

## SHORT REPORT

### A quantitative investigation of the imperative-and-declarative construction in English

GREGORY SCONTRAS

*Harvard University*

EDWARD GIBSON

*Massachusetts Institute of Technology*

The imperative-and-declarative (IaD) construction in English (e.g. *Study hard and you will pass the class*) has two distinct readings: one that has the semantics of a conditional and additionally the meaning of an imperative, and one that has only the semantics of a conditional, with no imperative meaning. There are two general kinds of syntactic approaches in the literature for analyzing this construction: one that treats the two interpretations as underlyingly syntactically the same, and one that treats them as two distinct syntactic constructions. This short report presents the results of an acceptability-judgment experiment that was designed to inform the debate between the two kinds of approaches. The two types of IaDs were observed to behave differently with respect to two phenomena we evaluated, suggesting either that they should be treated as grammatically distinct, or that a theory that treats them as grammatically the same must give a pragmatic account of the differences. Furthermore, because the pattern of data that we observed was a statistical interaction between two factors—a pattern of data that is not detectable without quantitative measurements—the results provide compelling evidence for the need for quantitative evaluations of linguistic hypotheses.\*

*Keywords:* imperatives, conjunctions, grammatical interaction, linguistic methodology, psycholinguistics

**1. INTRODUCTION.** The imperative-and-declarative (henceforth IaD) construction consists of two clauses conjoined by *and*. The first clause includes a morphologically imperative verb, and the second clause is a declarative sentence containing a future-tense-marked verb. Pretheoretically, there are two distinct types of IaDs: one that appears to carry the meaning of an imperative in addition to the semantics of a conditional (1a), and one that has only the semantics of a conditional, with no imperative meaning (1b).

- (1) a. Study hard and you will pass the class.  
→ Study hard.
- b. Ignore your homework and you will fail the class.  
↔ Ignore your homework.

One paraphrase for 1a includes both an imperative and a conditional explaining the outcome of the desired action: *Study hard! If you study hard you will pass the class*. Assuming that failing a class is an undesirable outcome, 1b cannot be construed as a command to ignore homework. Instead, the meaning of 1b is a basic conditional: *If you ignore your homework you will fail the class*. There are thus two types of IaD interpretations: (i) the conditional interpretation, which does not include a directive, or command, and (ii) the imperative-conditional interpretation (available for desirable outcomes only), which receives a command interpretation together with the conditional interpretation. IaDs receive the readings that they do depending on the desirability of the consequences expressed in their second conjuncts; as demonstrated in 1, desirable-

\* We would like to thank Leon Bergen, Ev Fedorenko, Kai von Fintel, Peter Graff, Irene Heim, Sabine Iatridou, Steve Piantadosi, two anonymous referees, and audiences at TedLab and MIT's LingLunch for their comments on earlier drafts of this short report.

consequence IaDs receive imperative-conditional interpretations, whereas undesirable-consequence IaDs receive conditional ones.<sup>1</sup>

Linguists divide on whether they take the distinction between these two types of readings for IaDs—*IMPERATIVE-CONDITIONAL* and *CONDITIONAL*—to be a grammatical one (see von Stechow & Iatridou 2009 for discussion). In particular, under a *UNIFIED* analysis, the IaD constructions with different readings are analyzed as syntactically the same and differ only with respect to their content (i.e. with respect to whether the second clause talks about a desirable vs. an undesirable outcome). In contrast, under a *SPLIT* analysis, the distinction between the different readings for IaDs results from derivational differences between two distinct structures.

In the literature thus far, the evidence that has been used to decide between these two kinds of analyses has been in the form of intuitive judgments from a small set of speakers on a small set of materials. Some of these judgments have been contradictory, making it difficult to critically evaluate the analyses. This short report provides evidence collected from a large number of naive speakers and a large number of experimental materials, demonstrating that the two types of IaDs exhibit significant differences in behavior with respect to two grammatical phenomena.

In what follows, we first provide some background on IaDs, presenting the unified approach developed by Han (2000), and then the split approach from Russell (2007). We then present the design and results of an experiment that evaluates the claims made by these authors. We conclude with a general discussion of the results and their theoretical implications, and a discussion of the impact of the experimental methods like the ones used in the current study on the enterprise of theoretical linguistics.

## 2. TWO ANALYSES OF IADS: HAN 2000 AND RUSSELL 2007.

**2.1. HAN 2000.** Han (2000) gives a unified syntactic and semantic account of IaDs such that both IaD readings stem from a single IaD structure (see van der Auwera 1986 for another version of a unified approach). In her account, the first conjunct of an IaD becomes the antecedent of a conditional for interpretative purposes; the second conjunct becomes the consequent. Thus, the IaD in 2a becomes the conditional in 2b.

- (2) a. Study hard and you will pass the class. →  
 b. If you study hard you will pass the class.

Han's account assumes that the morphologically imperative verb in the first conjunct of IaDs is actually a defective imperative. Instead of possessing both of the syntactic features argued to be common to true imperatives—[irrealis] (encoding the sentence's modality) and [directive] (encoding the sentence's illocutionary force)—the imperatives in IaDs lack the feature [directive]. This is why IaDs are not true commands, not even when they contain desirable consequences. As for the conditional nature of the IaD construction, Han proposes that it arises from the fact that the second conjunct is in effect modally subordinated to the first. Thus, the second conjunct is evaluated with respect to the worlds in which the first is true, just as in conditionals where the consequent is evaluated with respect to the worlds in which the antecedent is true (Roberts 1989).

Han reaches her conclusion that the morphologically imperative verbs in IaDs are not true imperatives by pointing to putative differences in acceptability between IaDs and imperatives with respect to two syntactic phenomena. First, she claims that unlike im-

<sup>1</sup> Desirable-consequence IaDs may optionally be given simple conditional interpretations. See von Stechow & Iatridou 2009 and references therein for discussion.

peratives, IaDs cannot have *do* for emphasis, as in 3 (from Han's examples 294 and 295, where the judgments are Han's).

- (3) a. \*Do put on the light and you'll see better. (desirable-consequence)  
 b. \*Do come one step closer and I'll shoot. (undesirable-consequence)  
 c. Do put on the light! (imperative)

And second, she claims that IaDs do not allow quantificational subjects such as *nobody*, *everybody*, and *somebody*, whereas imperatives do, as in 4 (Han's examples 303 and 304).

- (4) a. \*Everybody come to the party and she will be happy. (desirable-consequence)  
 b. \*Nobody help her and she will fail. (undesirable-consequence)  
 c. Everybody come to the party! (imperative)

Crucially, Han judges that there is no difference between desirable- and undesirable-consequence IaDs with respect to these two grammatical phenomena; her judgments suggest that the two types of IaDs pattern together, and differently from regular imperatives.

**2.2. RUSSELL 2007.** In contrast to Han, Russell (2007) provides a split analysis of IaDs (see Clark 1993, Franke 2005, and Schwager 2006 for other split analyses), in which desirable- and undesirable-consequence IaDs correspond to imperative-conditional and conditional structures, respectively. For Russell, the verb in the first conjunct of a desirable-consequence IaD is an imperative; the verb in the first conjunct of an undesirable-consequence IaD is not—instead, it is some kind of infinitival form. In desirable-consequence IaDs, the second conjunct is modally subordinated to the first, similar to Han's proposal. For the details of his account of undesirable-consequence IaDs, Russell refers the reader to Culicover and Jackendoff's (1997) account of a special type of conjunction called 'left-subordinating' *and*, which he suggests is present in these constructions.<sup>2</sup>

At this point we should make clear our use of terminology. Under a split approach, all IaDs are ambiguous: regardless of the desirability of the second conjunct, an IaD can be parsed as either imperative-conditional or conditional and receive the respective interpretation. Desirable-consequence IaDs may receive command interpretations (i.e. be parsed with the imperative-conditional structure), whereas undesirable-consequence IaDs may not (and so should be parsed with the conditional structure). Undesirable consequences are incompatible with a command interpretation, presumably due to the pragmatic oddness of giving someone a command and following up with the negative consequences that will ensue. For our purposes, we use the terms 'desirable-consequence' and 'imperative-conditional', and 'undesirable-consequence' and 'conditional' interchangeably to refer to the relevant IaD constructions/interpretations.

Russell motivates the grammatical distinction between desirable- and undesirable-consequence IaDs on the basis of putative acceptability differences between the two

<sup>2</sup> Another possible split approach (see Franke 2005, Schwager 2006) attributes the different IaD readings to derivational differences between two structures, as in Russell's approach, but assumes that the morphologically imperative verb in both types is a true imperative. The differences between desirable- and undesirable-consequence IaDs would thus result not from the nature of the first conjunct of the IaD, but rather from the way in which the two clauses are conjoined. Desirable-consequence IaDs would be conjoined by speech act conjunction, while undesirable-consequence IaDs would be conjoined using left-subordinating *and*. That is, desirable-consequence IaDs contain two speech acts, a command and an assertion, whereas undesirable-consequence IaDs contain just an assertion. The reason why undesirable-consequence IaDs are incompatible with an imperative-conditional interpretation follows from actually issuing the command in the first conjunct, rather than just asserting a conditionalized statement.

types with respect to emphatic *do* and quantificational subjects. First, Russell claims—contra Han—that like imperatives, desirable-consequence IaDs can contain emphatic *do*; undesirable-consequence IaDs cannot (from Russell's examples 15 and 16, where the judgments are Russell's).

- (5) a. Do tithe and you'll go to heaven. (desirable-consequence)  
 b. #Do steal from the church and you'll go to hell. (undesirable-consequence)  
 c. Do tithe! (imperative)

Recall that Han argues that no IaD can contain emphatic *do*. Thus, Russell's judgments contradict Han's.

Russell further claims that desirable-consequence IaDs allow overt subjects, while undesirable-consequence IaDs do not, again patterning desirable-consequence IaDs with imperatives (Russell's examples 15 and 16).

- (6) a. Nobody steal and you'll all go to heaven. (desirable-consequence)  
 b. #Nobody tithe and you'll all go to hell. (undesirable-consequence)  
 c. Nobody steal! (imperative)

As with the emphatic *do*, Russell's judgments conflict with those reported by Han; according to Han, no IaD can have an overt subject.

These perceived differences lead Russell to conclude that the morphologically imperative verb is different across the two constructions. Crucially, his judgments pattern desirable-consequence IaDs with true imperatives, to the exclusion of undesirable-consequence IaDs.

**3. EXPERIMENT.** As documented by several researchers, there are many cases of intuitive judgments in the literature that, when evaluated quantitatively on naive experimental participants, do not hold (Schütze 1996, Cowart 1997, Wasow & Arnold 2005, Gibson & Fedorenko 2010, 2012). Gibson and Fedorenko (2010, 2012) argue that one source of judgments that are shown not to hold in a quantitative evaluation may be the researchers' unconscious confirmation bias supporting their own theoretical positions. Because the empirical claims in Han's and Russell's work have not been quantitatively evaluated, it is possible that confirmation bias was at play in one or both cases here also. Consequently, we conducted an acceptability-rating experiment using naive experimental participants to evaluate the reported judgments. We tested whether the two IaD types are acceptable when they contain emphatic *do*, and whether the two IaD types are acceptable when they contain overt subjects.

**3.1. PARTICIPANTS.** We posted surveys for 160 workers on Amazon.com's Mechanical Turk using the Turkolizer software from Gibson et al. 2011. All workers were paid for their participation. Subjects were asked to indicate their native language, but payment was not contingent on their responses.

**3.2. DESIGN AND MATERIALS.** The materials consisted of twenty-four sets of sentences appearing in supportive contexts making clear what consequences count as desirable. Each test item consisted of eight minimally differing conditions, in a  $2 \times 4$  design, crossing the desirability of the consequence (desirable, undesirable) and the construction type (IaD, IaD with emphatic *do*, IaD with overt subject, conditional control). The conditional controls were included as baselines: the plain IaD construction should be rated similar to its conditional control for each of the desirable- and undesirable-consequence conditions, because these pairs of sentences have similar meanings under either the unified or split analysis.

Each experimental item was associated with two simple yes/no comprehension questions: one questioning some aspect of the material in the context, and one questioning

some aspect of the material in the critical sentence. These comprehension questions were included to ensure that the participants read and understood both the context and the target sentence. Correct ‘yes’ and ‘no’ responses were balanced across items such that each list had equal numbers of ‘yes’ and ‘no’ answers.

A sample item with its associated comprehension questions is presented in 7.

- (7) Context: A nutritionist is talking to the family of one of his clients, who needs to lose weight. He tells them the following:
- a. Desirable-consequence IaD  
Encourage Mary and she will lose weight.
  - b. Desirable-consequence IaD with emphatic *do*  
Do encourage Mary and she will lose weight.
  - c. Desirable-consequence IaD with overt subject  
Everyone encourage Mary and she will lose weight.
  - d. Desirable-consequence conditional control  
If everyone encourages Mary she will lose weight.
  - e. Undesirable-consequence IaD  
Discourage Mary and she will gain weight.
  - f. Undesirable-consequence IaD with emphatic *do*  
Do discourage Mary and she will gain weight.
  - g. Undesirable-consequence IaD with overt subject  
Everyone discourages Mary and she will gain weight.
  - h. Undesirable-consequence conditional control  
If everyone discourages Mary she will gain weight.
- Question 1: Does the client need to lose weight? (Y)  
Question 2: Will Mary lose weight if her family encourages her? (Y), or  
Will Mary gain weight if her family discourages her? (Y)

The materials also included twenty-four filler items similar in style and difficulty to the critical items. Filler items were based on eight syntactic frames, with three items generated for each frame. Like the target items, all fillers appeared in supportive contexts and with comprehension questions based on the material in both the context and the target sentence.

Before we proceed to discuss the results of the critical study, we discuss two norming studies that we conducted in order to help us interpret the critical results.

**NORMING STUDY 1: PLAUSIBILITY OF DESIRABLE VS. UNDESIRABLE CONSEQUENCES.** Although we tried to make the materials as plausible as possible for each of the desirable and undesirable-consequence versions of each item, we did not match these completions for plausibility. In fact, in a separate norming study on the syntactic conditional controls in our materials (e.g. *If everyone encourages Mary she will lose weight* vs. *If everyone discourages Mary she will gain weight*, following the context in 7), sixty participants who did not take part in the critical study rated the desirable-consequence continuations as significantly more natural than the undesirable-consequence continuations (4.20 vs. 3.81 on a five-point scale of naturalness with 1 being ‘extremely unnatural’ and 5 being ‘extremely natural’). Thus, it seems that more desirable continuations are perceived as more plausible than less desirable ones, at least for our materials. There are at least two possible explanations for this difference: (i) people may typically talk about desirable consequences more often than undesirable ones; or (ii) people may prefer to consider desirable consequences over undesirable ones, independent of their frequency in the input. Critically, however, this baseline difference in the plausibility of the desirable and undesirable consequences is not important for the evaluation of the acceptabil-

ity of IaD constructions because each IaD construction is compared to its appropriate desirable/undesirable-consequence control.

**NORMING STUDY 2: EMPHATIC *do* AND OVERT SUBJECTS IN IMPERATIVES.** Two variants of the IaD construction were included as critical conditions: the IaD with emphatic *do* and the IaD with overt subject. We evaluated the effect of adding emphatic *do* and overt subjects to imperatives independent of the IaD construction in a norming study on sixty participants who did not take part in the first norming study or in the critical study. We tested the first conjunct of each of the desirable-consequence IaD conditions following the contexts in 7 (e.g. *Encourage Mary*; *Do encourage Mary*; *Everyone encourage Mary*). Imperatives without emphatic *do* or overt subjects were rated the highest (4.39 on a five-point scale); imperatives with overt subjects were rated slightly and non-significantly less acceptable (4.15); and imperatives with *do* were rated as reliably less acceptable than either of the other two conditions (3.40).

Under Han's unified analysis whereby there is no underlying imperative in the first conjunct of the IaD construction (regardless of whether the second conjunct describes a desirable vs. an undesirable consequence), IaD constructions with emphatic *do* and with overt subjects should be rated as less acceptable than their plain IaD counterparts. In contrast, under Russell's split analysis, desirable-consequence IaDs contain a true imperative, and so an emphatic *do* or an overt subject should affect these IaD constructions in the same way that they affect simple imperatives. As norming study 2 showed, simple imperatives with emphatic *do* are rated as less acceptable than those with overt subjects or the plain versions of the imperatives, with the latter two being rated as similarly acceptable. Thus, Russell's account predicts a similar pattern for desirable-consequence IaDs. In contrast, undesirable-consequence IaDs should be more negatively affected by the presence of emphatic *do* or an overt subject.

**3.3. PROCEDURE.** Two sets of eight randomized questionnaires were created, with ten participants assigned to each questionnaire. Participants were given the following instructions.

(8) INSTRUCTIONS:

1. Read the context.
2. Read the target sentence.
3. Rate how natural the target sentence sounds following the context.
4. Answer the questions immediately following.

**Please note that there is a correct answer for each question.**

Because some Mechanical Turk users answer questions randomly, we will reject users with error rates of 25% or larger. Consequently, if you cannot answer 75% of the questions correctly, please do not fill out the survey.

Note: **Please read the sentences** before answering the question and giving the rating.

The context was preceded by the word 'CONTEXT:', and the target sentence was preceded by the words 'TARGET SENTENCE:'.

Participants were asked to provide a rating for the sentence in the context (preceded by the heading 'Rating of TARGET SENTENCE in CONTEXT') by clicking a radio button beside the appropriate rating. There were five choices for each sentence: 'extremely unnatural', 'somewhat unnatural', 'possible', 'somewhat natural', and 'extremely natural'. These responses were converted to numerical scores from 1 (extremely unnatural) to 5 (extremely natural) for the analyses. Each participant saw only one condition from each

item, and saw each condition three times; participants responded to a total of forty-eight sentences.

The experiment took approximately fifteen minutes to complete.

**3.4. RESULTS.** We considered data from native English speakers within the United States. Among the participants who met these criteria, data from those with less than a 75% accuracy rate for comprehension questions or less than a 90% answer rate, meaning they left more than 10% of the trials in the survey blank, were excluded; these exclusion criteria left data from 132 participants to be included in the analysis.

**3.5. ANALYSES.** Analyses reported here were conducted with the lme4 package (Bates et al. 2008) for the statistical language R (R Core Development Team 2008). Recent results have shown that including only random intercepts in linear mixed-effects regressions can be anticonservative, so we also include random slopes for participants in our model. Significance ( $p$ ) values were estimated from (i) the  $t$ -values that were obtained from the lmer function, and (ii) conservative estimates of the number of degrees of freedom in the model. The estimates of the number of degrees of freedom in the model consisted of the number of observations (3,152) minus the number of intercepts fit in the model (the number of participants + the number of items =  $132 + 24 = 156$ ) and the number of slopes being fit in the model ( $7 * \text{the number of participants} = 7 * 132 = 924$ ). (There are seven parameters for each slope because there are four main-effect terms plus three interaction terms in the  $2 \times 4$  experimental design.)

**3.6. COMPREHENSION QUESTION ACCURACY.** The critical dependent measure of interest was sentence rating. Comprehension questions were included in order to ensure that participants read and understood the sentences they were rating. Across all items, subjects had an average comprehension rate of 95%. The rates for each experimental condition are presented in Table 1. The only reliable between-condition difference in accuracy is between consequence desirability; constructions with negative consequences received lower comprehension rates. This pattern is consistent with the results from our norming study 1: people find continuations with undesirable consequences less plausible than continuations with desirable consequences, and they likely have more difficulty in answering comprehension questions about the less plausible versions.

	CONDITIONAL CONTROL	IaD	IaD + SUBJECT	IaD + <i>do</i>
desirable consequences	0.95	0.95	0.96	0.94
undesirable consequences	0.91	0.92	0.92	0.89

TABLE 1. Average comprehension rates across experimental conditions.

**3.7. RATINGS.** Average ratings by condition are plotted in Figure 1. Statistical analyses revealed the following results.

- Sentences with undesirable consequences were rated as less acceptable than sentences with desirable consequences (as we found in norming study 1).
- IaDs were rated no differently from their conditional controls.
- Desirable-consequence IaDs with overt subjects were rated no differently from baseline IaDs (we found the same lack of effect in norming study 2 for simple imperatives).
- Undesirable-consequence IaDs with overt subjects were rated as worse than the linear effects of undesirable consequences and overt subjects.

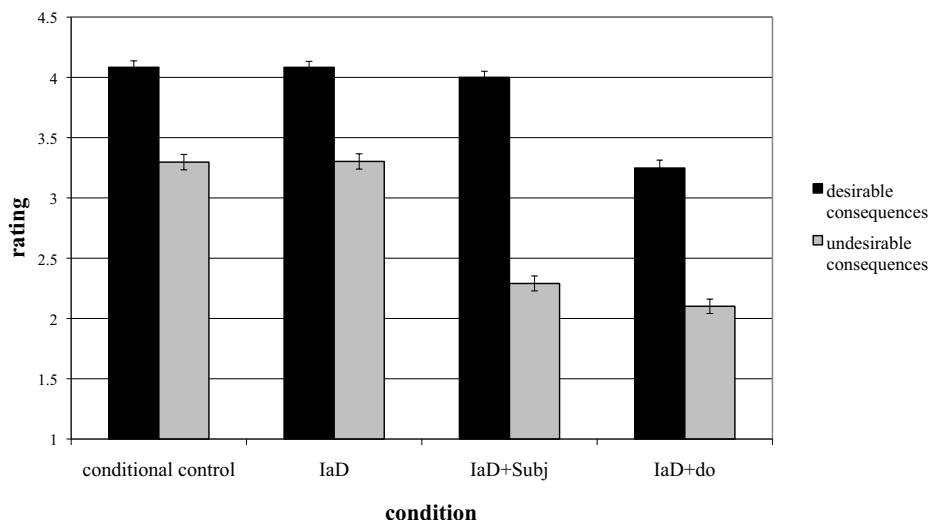


FIGURE 1. Mean acceptability ratings for the experiment: a  $2 \times 4$  design, crossing the desirability of the consequence (desirable, undesirable) and the construction type (IaD, IaD with emphatic *do*, IaD with overt subject, conditional control).

- IaDs with emphatic *do* were rated as less acceptable than baseline IaDs (this is the effect we found in norming study 2 for simple imperatives).
- Undesirable-consequence IaDs with emphatic *do* were rated as worse than the linear effects of undesirable consequences and emphatic *do*.

In particular, a linear mixed-effects model including the desirability of the consequence (desirable, undesirable) and the construction type (IaD, IaD with emphatic *do*, IaD with overt subject, conditional control) as dummy-coded factors, as well as random slopes and intercepts for each subject and random intercepts for each item, demonstrated these effects. Relative to the baseline condition of desirable-consequence IaDs, the model revealed a main effect of consequence-desirability type ( $\beta = -0.782$ ,  $t = -10.96$ ,  $p < 0.0001$ ); changing from desirable to undesirable consequences resulted in a 0.782 decrease in ratings. The model did not find a main effect of construction type when compared with the conditional control ( $\beta = 0.004$ ,  $t = 0.07$ ) or an interaction between construction type and consequence desirability ( $\beta = 0.004$ ,  $t = 0.04$ ). The model found a main effect of emphatic *do* ( $\beta = -0.818$ ,  $t = -8.87$ ,  $p < 0.0001$ ), showing that adding *do* to an IaD construction resulted in a 0.818 decrease in rating for IaDs with desirable consequences. The model did not find an effect of overt subject for desirable consequences ( $\beta = -0.089$ ,  $t = -1.39$ ). Most critically, the model found two significant interactions. First, there was a significant interaction between consequence desirability and emphatic *do* ( $\beta = -0.379$ ,  $t = -3.62$ ,  $p < 0.002$ ), such that the effect of emphatic *do* was 0.379 worse for undesirable-consequence IaDs. The model also found a significant interaction between consequence desirability and overt subjects ( $\beta = -0.921$ ,  $t = -9.23$ ,  $p < 0.0001$ ), such that the effect of overt subjects was 0.921 worse for undesirable-consequence IaDs. The results are summarized in Table 2. In addition, all results were replicated in two subsequent experiments independently testing six of the eight conditions: leaving out overt subjects in one study, and leaving out emphatic *do* in the other.



	ESTIMATE	STD ERROR	<i>t</i>
(intercept)	4.081	0.084	48.32
Desirability_undesirable	-0.782	0.071	-10.96
Structure_Conditional-control	0.004	0.065	0.07
Structure_IaD+subject	-0.089	0.064	-1.39
Structure_IaD+do	-0.818	0.092	-8.87
Desirability_undesirable:Structure_Conditional-control	0.004	0.095	0.04
Desirability_undesirable:Structure_IaD+subject	-0.921	0.100	-9.23
Desirability_undesirable:Structure_IaD+do	-0.379	0.105	-3.62

TABLE 2. Regression coefficients, standard errors, and *t*-values for a linear mixed-effects model including the desirability of the consequence (desirable, undesirable) and the construction type (IaD, IaD with emphatic *do*, IaD with overt subject, conditional control) as dummy-coded factors.

**3.8. DISCUSSION.** The findings in this experiment demonstrate that there are differences in behavior between IaD types both for overt subjects and for emphatic *do*. We discuss these effects below.

First, the two types of IaDs do not behave the same with respect to their ability to contain emphatic *do*: there is something specific to undesirable-consequence IaDs that makes *do* worse. It is plausible that what Han reports when she gives unacceptable judgments for both types of IaDs with emphatic *do* in 3a,b, repeated below in 9, is the main effect of emphatic *do*; IaDs with *do* are degraded across the board, relative to baseline IaDs.

- (9) a. \*Do put on the light and you'll see better. (desirable-consequence)  
 b. \*Do come one step closer and I'll shoot. (undesirable-consequence)

Although both IaD types are degraded by *do*, the effect of emphatic *do* is significantly larger for the undesirable-consequence IaDs, demonstrating that the two types do not behave the same with respect to the presence of emphatic *do*. This result is compatible with the judgments reported by Russell, but not with those reported by Han.

Second, we find that overt subjects did not have an effect on desirable-consequence IaDs, similar to what we observed in norming study 2 with simple imperatives. Thus, we conclude that desirable-consequence IaDs are acceptable with overt subjects, whereas undesirable-consequence IaDs are not. Again, this pattern is consistent with the judgments reported by Russell but not by Han.

These findings are compatible with a split approach to IaD constructions wherein desirable-consequence and undesirable-consequence IaDs stem from distinct structures, and so pattern differently with respect to grammatical phenomena. Han's (2000) account of IaDs, or any unified account in which the grammatical properties of the two types are identical, predicts no interaction between IaD type and emphatic *do* or overt subjects. Such accounts would need to be enriched with a pragmatic account of the differences, wherein negative consequences and the emphasis introduced by *do* or overt subjects conspire to degrade the construction.

**4. GENERAL DISCUSSION.** Our results revealed a significant difference in the behavior of the two IaD types when emphatic *do* was included: undesirable-consequence IaDs are degraded more by the presence of emphatic *do* than desirable-consequence IaDs. The results demonstrate a similar effect for the presence of overt subjects in IaD constructions: undesirable-consequence IaDs are significantly degraded by the presence of an overt subject, whereas desirable-consequence IaDs are not affected. Taken together, these findings show that there are systematic differences between the two IaD types, which are consistent with a split account of IaD constructions. Although these results do

not resolve the debate between split and unified accounts, they suggest that judgments according to which there is no difference between the two IaD types with respect to *do* and overt subjects are not valid. Further, if one chooses to pursue a unified approach to IaDs, such an approach must account for the interactions we observe between IaD type and grammatical phenomena, most likely by relying on interplay between pragmatic factors such that negative consequences with the emphasis added by overt subjects or *do* are ruled out in IaD constructions.

In addition to the theoretical contribution of this work, the project provides another example of a quantitative evaluation of judgments from the theoretical literature in which the results do not match some reported intuitive judgments (Schütze 1996, Wasow & Arnold 2005, Gibson & Fedorenko 2010, 2012). In particular, Han (2000) reported that desirable- and undesirable-consequence IaD constructions are equally unacceptable when emphatic *do* is included. The results of our experiments show that the presence of emphatic *do* degrades both IaD types, but critically, the effect is stronger for undesirable-consequence IaDs, an observation that was not reflected in Han's reported intuitions. In addition, Han (2000) reported that both desirable- and undesirable-consequence IaD readings are equally unacceptable when a subject is added. The results of our experiments show that the presence of a subject degrades undesirable-consequence IaDs, but has no measurable effect on desirable-consequence IaDs, contrary to Han's reported intuitions. Overall, the pattern of results does not match with Han's reported intuitions.<sup>3</sup>

Finally, the pattern of data with respect to the presence of emphatic *do* in the IaD construction provides compelling evidence for the need for quantitative evaluations of linguistic hypotheses. In the investigation of emphatic *do*, two factors were manipulated: (i) the construction type (IaD with emphatic *do*, IaD without emphatic *do*, or a conditional control structure), and (ii) desirable vs. undesirable consequences. It turns out that BOTH of these factors reliably reduced acceptability. First, the presence of emphatic *do* reliably reduced acceptability of structures for both desirable and undesirable consequences. And second, structures with undesirable consequences are less acceptable across the board than structures with desirable consequences. In order to detect whether the consequence type affects the acceptability of different constructions, an experimental participant would need to evaluate whether (i) the difference between the acceptability effects for a plain IaD construction relative to an IaD construction with emphatic *do* is equal across desirable vs. undesirable consequences, or (ii) the difference is greater for undesirable consequences compared to desirable consequences. This is a complex and subtle judgment, to which the notation '\*', '?' cannot do justice. More generally, intuitions alone will not be able to tease apart the additive or interactive effects of degradedness. When more than one factor is at work (which is likely to be the case in many phenomena), we may incorrectly conclude, as was done with IaDs, that just one of these factors makes a construction unacceptable, which would consequently lead to misguided theorizing. A quantitative evaluation with multiple items and multiple naive participants is the simple solution.

<sup>3</sup> It is possible that there are two dialects with respect to the IaD construction. If Han's judgments are representative of a second dialect, then we might expect to see a bimodal distribution of acceptability ratings for those conditions where Han's judgments differ from our results. An examination of both raw ratings and normalized z-scores revealed no such bimodality.

## APPENDIX: EXPERIMENTAL ITEMS

All experimental items are given below. As exemplified in A1, emphatic-*do* conditions were formed by adding *do* to the beginning of the bare IaD conditions. Similarly, overt-subject conditions were formed by adding *everyone* to the beginning of the bare IaD conditions. Conditional controls were formed by using the first conjunct of the overt-subject condition in the antecedent of a conditional, and using the second conjunct as its consequent. Where the possessive pronoun is *your* in the IaD conditions, it appears as *their* in the conditional controls.

- (A1) Context: A school is in danger of losing its state accreditation, and nobody wants this. The school's administration gives a message to the students:
- |   |  |
|---|--|
| Study hard and the school will stay open.           | (desirable IaD)                            |
| Do study hard and the school will stay open.        | (desirable IaD with emphatic <i>do</i> )   |
| Everyone study hard and the school will stay open.  | (desirable IaD with overt subject)         |
| If everyone studies hard the school will stay open. | (desirable conditional)                    |
| Goof off and the school will be closed.             | (undesirable IaD)                          |
| Do goof off and the school will be closed.          | (undesirable IaD with emphatic <i>do</i> ) |
| Everyone goof off and the school will be closed.    | (undesirable IaD with overt subject)       |
| If everyone goofs off the school will be closed.    | (undesirable conditional)                  |
- (A2) Context: A nutritionist is talking to the family of one of his clients, who needs to lose weight. He tells them the following:
- |   |                   |
|---|-------------------|
| Encourage Mary and she will lose weight.  | (desirable IaD)   |
| Discourage Mary and she will gain weight. | (undesirable IaD) |
- (A3) Context: A class is trying to catch up a student on material he has missed while he was out sick. The teacher tells the class the following:
- |                                |                   |
|--------------------------------|-------------------|
| Help Tim and he will pass.     | (desirable IaD)   |
| Overlook Tim and he will fail. | (undesirable IaD) |
- (A4) Context: A company is planning to have a meeting in the morning. A day before the meeting, the boss tells her employees the following:
- |  |                   |
|--|-------------------|
| Arrive early and the meeting will start on time. | (desirable IaD)   |
| Arrive late and the meeting will be delayed.     | (undesirable IaD) |
- (A5) Context: You are in a train station and you hear the following announcement about how to stay vigilant:
- |  |                   |
|--|-------------------|
| Report suspicious behavior and we will be safe.      | (desirable IaD)   |
| Ignore suspicious behavior and we will be in danger. | (undesirable IaD) |
- (A6) Context: Children are getting ready for recess on a snowy day. The teacher tells the students the following:
- |   |                   |
|---|-------------------|
| Zip up your coat and our class will stay healthy.     | (desirable IaD)   |
| Leave your coat unzipped and our class will get sick. | (undesirable IaD) |
- (A7) Context: A family is about to go out to a fancy dinner with new friends. The mother tells the family the following:
- |   |                   |
|---|-------------------|
| Chew with your mouth closed and we will make a good impression. | (desirable IaD)   |
| Talk with your mouth full and we will make a bad impression.    | (undesirable IaD) |
- (A8) Context: A group of people are trying to win a contract at a big firm. Their friend at the firm tells them the following:
- |   |                   |
|---|-------------------|
| Give a good presentation and they will give you the contract.         | (desirable IaD)   |
| Give a bad presentation and they will give someone else the contract. | (undesirable IaD) |
- (A9) Context: An officer is questioning a gang about their involvement in a crime. He tells them the following:
- |   |                   |
|---|-------------------|
| Tell the truth and we will give you a reward. | (desirable IaD)   |
| Tell a lie and we will arrest you.            | (undesirable IaD) |
- (A10) Context: A group is working on a project together. The group leader tells the members the following:
- |   |                   |
|---|-------------------|
| Contribute to the project and it will be a success. | (desirable IaD)   |
| Neglect the project and it will be a failure.       | (undesirable IaD) |
- (A11) Context: Students are graduating from college. Their advisor gives them the following advice:
- |                                     |                   |
|-------------------------------------|-------------------|
| Work hard and I will be proud.      | (desirable IaD)   |
| Give up and I will be disappointed. | (undesirable IaD) |
- (A12) Context: A man is about to introduce his friends to his girlfriend. He tells his friends the following:
- |                                |                   |
|--------------------------------|-------------------|
| Be nice and she will like you. | (desirable IaD)   |
| Be mean and she will hate you. | (undesirable IaD) |

- (A13) Context: A small group of people are painting in a stuffy studio. Someone says the following:  
 Use acrylic paint and we will breathe better. (desirable 1aD)  
 Use oil paint and we will suffocate. (undesirable 1aD)
- (A14) Context: A church is in the middle of a financial crisis. As the collection basket is being passed around the congregation, the priest says the following:  
 Donate and the church will be saved. (desirable 1aD)  
 Steal and the church will be closed. (undesirable 1aD)
- (A15) Context: Workers are about to present a proposal that needs approval to their boss. One of the workers says the following:  
 Stick to the point and she will accept the proposal. (desirable 1aD)  
 Get sidetracked and she will reject the proposal. (undesirable 1aD)
- (A16) Context: Students want to get extra credit on an exam. Their teacher tells them the following:  
 Watch the debate tonight and I will raise the class average. (desirable 1aD)  
 Skip the debate tonight and I won't give any extra points. (undesirable 1aD)
- (A17) Context: Soldiers are involved in a firefight. Their commander tells them the following:  
 Stay in position and we will win this battle. (desirable 1aD)  
 Retreat and we will lose this battle. (undesirable 1aD)
- (A18) Context: A choir is practicing for their holiday concert. The conductor gives the following direction:  
 Sing louder and we will sound better. (desirable 1aD)  
 Sing softer and we will sound worse. (undesirable 1aD)
- (A19) Context: Some lawyers are meeting to prepare for a trial. One of them says the following:  
 Read the brief and we will win this case. (desirable 1aD)  
 Disregard the brief and we will lose this case. (undesirable 1aD)
- (A20) Context: Residents of a dorm are getting ready for a room inspection. Their RA tells them the following:  
 Remember to clean your room and our dorm will pass. (desirable 1aD)  
 Forget to clean your room and our dorm will fail. (undesirable 1aD)
- (A21) Context: An environmentalist is addressing a crowd. He tells them the following:  
 Plant a tree and the environment will benefit. (desirable 1aD)  
 Cut down a tree and the environment will deteriorate. (undesirable 1aD)
- (A22) Context: A senator is addressing a session in Congress. He says the following:  
 Promote the bill and crime will decrease. (desirable 1aD)  
 Reject the bill and crime will increase. (undesirable 1aD)
- (A23) Context: A public service announcement against drugs appears on television. It says the following:  
 Stop using drugs and the world will be a better place. (desirable 1aD)  
 Keep using drugs and the world will continue to suffer. (undesirable 1aD)
- (A24) Context: A consultant is telling the staff of a company how to improve their business. She says the following:  
 Start acting professionally and this business will prosper. (desirable 1aD)  
 Keep acting unprofessionally and this business will fail. (undesirable 1aD)

## REFERENCES

- BATES, DOUGLAS; MARTIN MAECHLER; and BIN DAI. 2008. lme4: Linear mixed-effects models using S4 classes. R package version 0.999375-27. Online: <http://lme4.r-forge.r-project.org/>.
- CLARK, BILLY. 1993. Relevance and 'pseudo-imperatives'. *Linguistics and Philosophy* 16.79–121.
- COWART, WAYNE. 1997. *Experimental syntax: Applying objective methods to sentence judgments*. Thousand Oaks, CA: Sage.
- CULICOVER, PETER, and RAY JACKENDOFF. 1997. Semantic subordination despite syntactic coordination. *Linguistic Inquiry* 28.2.195–217.
- FRANKE, MICHAEL. 2005. Pseudo-imperatives. Amsterdam: Institute for Logic, Language and Computation, University of Amsterdam, masters thesis.
- GIBSON, EDWARD, and EVELINA FEDORENKO. 2010. Weak quantitative standards in linguistics research. *Trends in Cognitive Science* 14.6.233–34.
- GIBSON, EDWARD, and EVELINA FEDORENKO. 2012. The need for quantitative methods in syntax and semantics research. *Language and Cognitive Processes*, to appear.

- GIBSON, EDWARD; STEVEN T. PIANTADOSI; and KRISTINA FEDORENKO. 2011. Using Mechanical Turk to obtain and analyze English acceptability judgments. *Language and Linguistics Compass*, to appear.
- HAN, CHUNG-HYE. 2000. *The structure and interpretation of imperatives: Mood and force in universal grammar*. (Outstanding dissertations in linguistics.) New York: Garland.
- R CORE DEVELOPMENT TEAM. 2008. R: A language and environment for statistical computing. Version 2.70. Vienna: R Foundation for Statistical Computing. Online: <http://cran.R-project.org>.
- ROBERTS, CRAIGE. 1989. Modal subordination and pronominal anaphora in discourse. *Linguistics and Philosophy* 12.683–721.
- RUSSELL, BENJAMIN. 2007. Imperatives in conditional conjunction. *Natural Language Semantics* 15.2.131–66.
- SCHÜTZE, CARSON. 1996. *The empirical base of linguistics: Grammaticality judgments and linguistic methodology*. Chicago: University of Chicago Press.
- SCHWAGER, MAGDALENA. 2006. *Interpreting imperatives*. Frankfurt: University of Frankfurt dissertation.
- VAN DER AUWERA, JOHAN. 1986. Conditionals and speech acts. *On conditionals*, ed. by Elizabeth Closs Traugott, Alice ter Meulen, Judith Snitzer Reilly, and Charles A. Ferguson, 197–214. Cambridge: Cambridge University Press.
- VON FINTEL, KAI, and SABINE IATRIDOU. 2009. Morphology, syntax, and semantics of modals. Lecture notes for 2009 LSA Institute class.
- WASOW, THOMAS, and JENNIFER ARNOLD. 2005. Intuitions in linguistic argumentation. *Lingua* 115.1481–96.

Scontras  
Department of Linguistics  
Harvard University  
Boylston Hall, Third Floor  
Cambridge, MA 02138  
[[scontras@fas.harvard.edu](mailto:scontras@fas.harvard.edu)]  
[[egibson@mit.edu](mailto:egibson@mit.edu)]

[Received 24 July 2010;  
revision invited 20 January 2011;  
revision received 15 February 2011;  
accepted 28 March 2011]