Scalar Implicatures and Presupposition of Existence: Strawson-entailment and the Grammatical Theory

Aldair Díaz-Gómez

Universidad Industrial de Santander

Abstract

Two strong contenders for scalar implicature (SI) computation are the pragmatic and the grammatical theories. While the former sustains that context plays a major role, the latter suggests context is required but is lexically and monotonically constrained (Chierchia 2012). In particular, this paper discusses a processing account for SIs that is dependent on the satisfaction of the Strawsonian presupposition of existence, necessary for the realization of the asymmetric entailment pattern among relevant alternatives. This observation complies with the principles of the grammatical view, for it predicts SIs in the presence of contextually empty domains, unlike the pragmatic account whose necessary access to contextual information will cause propositions with empty domains to always return a truth value false, hence blocking any inference. I present online experimental evidence of an acceptability judgment task and recorded response times of both existential and universal sentences containing entities of three kinds: existent (type-a), non-existent but conceivable (type-b), and non-existent and inconceivable (type-c). The data of 25 Colombian Spanish speaking participants were collected using PsychoPy, powered by Pavlovia. The results suggest SIs are computed in types a and b but relatively unsuccessful in type-c. I conclude that the relevant entailment pattern for implicature computation is the Strawson-entailment relation which, combined with the grammatical account, correctly predicts SIs with non-existent but conceivable entities but avoids inference with inconceivable terms.

Keywords: Scalar implicatures, Strawson-entailment, Grammatical theory, Conceivability.

1. Introduction

This paper intends to answer the following research questions: (i) Under which condition is the entailment pattern among alternatives possible? (ii) Can inferences be derived in the presence of contextually empty domains? Regarding (i), I will discuss the idea of a processing account for scalar implicature computation that is dependent on the satisfaction of the Strawsonian presupposition of

existence, necessary for the relevant asymmetric entailment[1] relation among relevant alternatives which is part of the grammatical theory pursued by Chierchia (2004) and Chierchia et al. (2012). As far as (ii) is concerned, my hypothesis is that SIs are computed in existential sentences featuring empty-conceivable terms but not necessarily computed with empty-inconceivable elements due to a conceivability restraint. First, section 2 introduces the theoretical discussion revolving around the case of scalar implicatures. Then, section 3 presents theoretical instances involving context sensitivity in implicature processing in relation with presupposition satisfaction and entailment patterns. Section 4 outlines the hypothesis of a refined theory of entailment based on Strawson-entailment (von Fintel 1999). Finally, section 5 reports experimental evidence that supports the addressed hypotheses. Section 6 closes this paper with some concluding remarks.

2. Scalar Implicatures

Observe the dialogue in (1):

(1) a. Arnold: Did you invite all of your friends?
b. Emily: I invited some of them.
⤳I did not invite all of them.

Sentence (1b) instantiates a case of scalar implicatures (SIs henceforth), a phenomenon observed when a sentence containing a term that is part of an ordered scale triggers the negation of stronger terms that also belongs to such scale, e.g., ⟨some, many, most, all⟩ (Horn 1972).[2] That negation is not precisely uttered by the speaker, but rather implicated by them, that means that it is the hearer who is expected to infer what the speaker has implicated. That sort of inference is known as SI. For more clarity, Emily's reply contains the term 'some' which is part of the scale shown between angle brackets above; in uttering it, Emily implicates that she did not invite all of her friends.

There are two main approaches that account for implicature computations, the pragmatic and the grammatical ones. Neo-Griceans (Horn 1972; Gazdar 1979; Hirschberg 1985; Russell 2006, and others) are responsible for the fortification of the context-driven pragmatics-based enterprise. Similarly, Chierchia (2004, 2006); Fox (2007); Chierchia et al. (2012) have formally submitted evidence for a grammatical theory; it has inspired additional work like that of Magri (2009, 2017), and it has been strongly supported by linguists such as Crnic et al. (2015) and most recently Del Pinal (2021). Both theories agree that implicatures are triggered via exhaustification as justified by van Rooij and Schulz (2004) of a sentence *against* the set of alternatives (or scales) induced by it, so a theory of alternatives is imperative in both approaches. Nevertheless, they differ in that the strengthened meaning of a sentence is a result of different cognitive systems. In

---

[1] Fox (2007) refines the notation of the set of excludable alternatives as one that excludes alternatives that, if negated, lead to a contradiction, such that only non-weaker (instead of stronger) alternatives are negated. Hence, entailment relations are not purely logical. Magri (2009) presents further examples for the motivation of this move.

[2] Other examples of so-called Horn-scales are:

⟨sometimes, often, usually, always⟩
⟨or, R, L, and⟩   (Sauerland 2004)
⟨possible, likely, certain⟩
⟨can/may, should/ought to, must⟩

the pragmatic system it is "derived from principles of rational cooperation" (Chemla and Singh 2014) while in the grammatical system a sentence is strengthened thanks to compositionality principles of a given linguistic system.

2.1. Pragmatic Theory

The pragmatic program relies on speech acts analysis; the hearer reasons upon the speaker's intentions to utter a sentence. This process develops freely when participants of a conversation are assumed to be cooperative.[3] When a speaker S utters some x is p (sentence), a hearer H's reasoning infers that S believes that not all x is p (SI) because, as mandated by the maxim of quality, S lacks evidence that all x is p—an alternative statement—and, since S observes the maxim of quantity too, S does not say all x is p because S is entitled to the belief that what they are saying is as informative as required. Saying all x is p would be much of an over-informative statement. As an example, imagine S utters sentence (2a) which is under-informative given the contextual piece of information that all elephants are mammals, hence the strengthened meaning of the sentence in (2d).

(2) a. Sentence: Some elephants are mammals (Bott and Noveck 2004).
  b. Alternative: All elephants are mammals.
  c. SI: Not all elephants are mammals.
  d. Strengthened meaning: Some but not all elephants are mammals.

In cases like (3), for instance, because it functions at the level of speaker's intentions, the pragmatic view dictates that (3b) is not a relevant alternative given contextual information. Plus, since it applies to global contexts, by definition, a SI is not predicted in embedded contexts as shown in the subordinate clause of (3a).

(3) a. If some of Judy's students passed the test, she will be pleased.
  b. If all of Judy's students passed the test, she will be pleased.

Therefore, this theory fails to account for certain anomalies present in natural language. One example involves Hurford's constraint[4] (HC) (Hurford 1974); compare sentence (4a), which is infelicitous by virtue of HC, with sentence (4b), where HC does not apply; however, this is a question that cannot be answered in pragmatic terms. Similarly, there are sentences with possible strengthened meanings that emerge from two logically independent alternatives such as sentences in (5). Once again, SI calculation, in this case, remains unaccounted for by the pragmatic enterprise due to the fact that while both (5a) and (5b) can be true independently of each other's truth value in a given situation, (5a) still triggers a SI that involves the negation of (5b).

(4) a. # John ate an apple or a fruit
  b. Some of Mary's students got an A or all of them did.
(5) a. Exactly one kid ate some of his cookies.
  b. Exactly one kid ate all of his cookies.

The above observation escapes neo-Gricean reasoning granted that the Gricean maxim of quantity does not require that one utter (5b) rather than (5a) "even when both are believed to be true and relevant" (Chierchia et al. 2012: 2325). As

---

[3] A speaker is said to be cooperative if they observe Grice's four maxims of conversation: quality, quantity, manner, and relation (Grice 1989).
[4] HC: A disjunctive sentence is infelicitous if their disjuncts entail one another.

seemingly expected, these cracks of the pragmatic view can be accounted for by the grammatical view by virtue of an invisible operator that can be parsed through syntactic processes.

2.2. Grammatical Theory

While the pragmatic program appeals to a theory of speech acts that require the hearer to pull off reasoning strategies to cast light on SI derivation based on contextually relevant information, the grammatical theory is motivated by the insertion of a silent operator akin to only. This operator is often written as Exh which denotes Exhaustification.[5] To exhaustify a sentence is to factor in activated scalar alternatives as part of its strengthened meaning. Exh happens at a compositional level of sentence meaning which grants it the power to occur freely at any embedded level as well as globally. Furthermore, it is part of the sentence logical form given that SIs are logical entailment patterns after all. For those reasons, Exh is a grammatical operator that, unlike neo-Gricean reasoning, is able to justify both local and global implicatures. It should be noted, however, that computation of local implicatures is possible in Levinson's lexical approach (2000); in a sentence like "if you ate some of the cookies and no one else ate any, then there must still be some left", 'some' is understood as 'some but not all'; nevertheless, Levinson's account faces problems in deriving indirect implicatures found in sentences like "Mika doesn't like all of Beethoven's symphonies" where Mika clearly likes only some of Beethoven's symphonies (see Sauerland 2012 for this discussion).

For example, the oddness present in (4a) is indeed explained via HC. However, the same predicted oddness in cases like (4b) disappear thanks to Exh because, when inserted in the first disjunct, the entailment relation that leads to infelicity disappear, so the strengthened meaning of (4b) is shown in (6):

(6) Exh(Exh(Some of Mary's students got an A) or all of them did).

The resulting reading is comparable to an exclusive disjunction. The first embedding of Exh yields some (but not all) of Mary's students got an A, and the second allows for a reading like some (but not all) of Mary's students got an A or all of them did, leaving HC out of question since the entailment relation between the two disjuncts will not hold anymore; this move is unknown to the pragmatic program.

Concerning the second crack of the neo-Gricean opponent, applying Exh to (5a) does trigger a reading that implicates the negation of (5b) as shown in (7), again, unavailable to the pragmatic reasoning.

---

[5] There are good reasons to believe that *Exh* is different from the overt use of *only*. Overt *only* is seen as part of the assertive content of the used sentence under the relevant conditions of the occurrence of the utterance. Compare, for example, the two sentences in (8), (8a) yields an oddness effect due to the inconsistency with the context whereas (8b) feels closer to the strengthened meaning, which includes *some but not all of her students*, and it is not deemed odd presumably because the content that overt *only* presupposes is indirectly asserted instead; it is instilling an immediate revision of the contextual information (Del Pinal 2021).

(8) *Context*: Every year, Sue assigns the same grade to all of her students.
　　a. # This year, Sue assigned an A to some of her students.
　　b. This year, Sue assigned an A to only some of her students. It was a peculiar year.

(7) Exactly one kid x ate some of x's cookies, x did not eat all of x's cookies, and for all other kids y, y did not eat any of y's cookies.

In sum, not only does the grammatical theory justify implicatures where the pragmatic theory does too, but it also, certainly, predicts implicatures where the pragmatic program fails to do so.

3. Existential Presupposition

Information that is presupposed is information that is taken for granted. During a conversation, a lot of information is assumed by the participants for the purpose of efficient communication. Presuppositions entered linguistics and philosophy realms as felicity conditions for utterances; they were initially regarded as part of the semantic component of sentences that, when satisfied, a definedness condition is said to be met. One of such presuppositions is the assumption that the domain of entities to which an expression refers must be non-empty in order for the expression to be defined, that presupposition is called existential presupposition (term originally used by P.F. Strawson in 1952). In Fregean tradition, empty names, however, have sense but lack reference; an empty term like Pegasus fails to refer, but it does express a way in which the object is presented, so it has sense, which is to be held accountable for its meaning. Although the term 'presupposition' was not explicitly used by Frege, he acknowledged that an assertion carries along a presupposition that the thing being talked about designates something, at least something capable of having a cognitive representation, so the name Pegasus would be awarded existence by virtue of the mere thought of it.

Nevertheless, in modern analysis of Aristotelian logic, categorical propositions constituted the problem of existential import. Modern logicians assumed universal propositions are not existentially loaded while the particular ones are. This is motivated by the assumption that when asserted, a universal proposition does not imply the existence of members of the subject term as it is understood as a conditional of the type $\forall x\ (Sx \rightarrow Px)$, whose truth value will always be vacuously true given the falsity of Sx in the presence of empty terms. However, this leads to the unbearable conclusion that the particulars—whose existential import is indeed implied—will be false and will not stand in any relation of entailment w.r.t. the universals.[6] Hence, to say that (9a) is true while (9b) is false is to agree that there is no relation of entailment between these two.

(9) a. All unicorns have a spiraling horn.
   b. Some unicorns have a spiraling horn.

In *On Referring* (Strawson 1950), P.F. Strawson defended a theory of truth-valuelessness that alludes to cases where a proposition fails to be defined. In other words, (9a) would lack truth value in case of failure to meet the existential presupposition for the set of unicorns. However, in later work (Strawson 1952), he salvaged this situation by appealing to what he termed "uniquely referring use" of an expression; that is, uttering a sentence is using it significantly and for communicative purposes given the conventions of regular conversation, along with it, a speaker should succeed in conveying meaning to a hearer no matter what the existential status of an expression is in the actual world so long as they use it to

---

[6] Recall the relation of subalternation that states that the truth of the universals entails the truth of the particulars, but when the particulars are true, the truth of the universal is undetermined, so technically speaking, the truth of (9a) should entail the truth of (9b).

refer to something. Therefore, ultimately, the question of the truth of a proposition becomes available once it has been successfully used with a referring purpose. This referring use is tantamount to the existence presupposition in that, once satisfied, an expression can be said to be true or false. With this argument, Strawson rescues the entailment patterns between universal and particular categorical proposition.

3.1. The Blindness Hypothesis

A formal representation of Exh is shown in (10), where φ is the uttered sentence and ψ an alternative of the set of excludable alternatives of φ (Excl(φ)) that are negated.

(10) Exh(φ) = $\varphi \wedge \neg\psi$

It should be noted that φ and ψ must stand in a relation of asymmetric entailment, i.e., ψ entails φ and not the other way around ($\psi \rightarrow \varphi$; $\varphi \nrightarrow \psi$). Suppose, (11) is uttered, then (12) entails (11) but not the other way around.

(11) # Some Italians come from a warm country = φ

⤳ Exh(φ) = $\varphi \wedge \neg\psi$ = Some but not all Italians come from a warm country.

(12) All Italians come from a warm country = ψ

Magri (2009) argues (11) is odd because, when exhaustified, it generates a SI that conflicts with the piece of information that all Italians have the same origin. He goes on to say that this mechanism of generating implicatures operates in an automatic fashion and it works regardless of common knowledge which he calls Blindness. If it was not blind to common knowledge, then no implicature would arise, and oddness would not be felt. How does Magri back up his Blindness hypothesis? He argues against a notion of entailment given common knowledge and in favor of a logical notion of entailment as the relevant notion for the definition of Exh since "the strengthened meaning can never be a logical contradiction. This, of course, does not exclude the possibility of the strengthened meaning being a contradiction given common knowledge" if that is the case, then such mismatch results in oddness (Magri 2009: 258). This explains the preference for the SI algorithm to prefer a logical notion of entailment over entailment given common knowledge. In effect, if the latter were the preferred one, then the SI computation device would prevent (12) from being a scalar alternative of (11), hence avoiding any contextually contradictory interpretation.

As predictable, one could argue that sentences are not always strengthened; plus, it is not mandatory that alternatives be negated since it is known across the literature that implicatures do not always happen. Under those circumstances, Magri assumes a relevance assignment procedure, which the Blindness scheme also overlooks, that renders the application of Exh mandatory in matrix clauses such relevance procedure encloses the uttered sentence—also known as the prejacent—and any other contextually equivalent sentences. In so doing, all the relevant alternatives will be obligatorily negated.

To summarize, Margri's scheme dictates that SIs emerge blindly to contextual information, although constraint by the lexicon and monotonicity as pointed out by Chierchia (2012), and are the result of mandatory application of Exh that negates excluded alternatives—necessarily assigned relevance—and confronts the prejacent against its alternatives by means of logical characteristics (logical

entailment) rather than contextual force. This process may or may not yield oddness effects depending on whether the result is a contextual contradiction or not.

3.2. Contextually Empty Domains

In his paper, Pistoia-Reda (2017a) argues that establishing the asymmetric entailment pattern in the interpretation of existentially quantified sentences with a domain restrictor contextually known to be empty is indeed plausible. He argues that if such pattern is the relevant relation for SI computation, then it is realized with no need to access contextual information to check whether the relevant domain is empty, contrary to what Schlenker (2012) defends, that however the computation device works, it cannot be blind to the piece of information that domains are non-empty. His main empirical evidence relies on the interpretation and appropriateness of this pair of sentences:

(13) # Some Swedes come from a cold country.
(14) # Some Swedish matadors come from a cold country.

His main intuition is that if an existential sentence with contextually empty sets is odd in virtue of a SI generated, then no need to access is necessary for the realization of the entailment pattern, and this would suggest that universal quantifiers are existentially loaded. As a matter of fact, in a pilot experiment run with native speakers of English, he confronted the results of three types of existential propositions; basic non-empty subject terms with predicates producing contextual contradictions (13), contextually empty subject terms also with predicates leading to contextual contradictions (14), and contextually empty subject terms but this time not yielding contextual contradictions (15).

(15) Some Swedish matadors know Latin.

In the first two cases he noted that sentences like (13) and (14) received similar percentage of inappropriateness judgments that, when compared to (15) this latter did not show a significantly low acceptability. So, if inappropriateness is to be accounted for via SI computation conflicting with contextual information, then the implicature computation arises irrespective of the non-emptiness status of the relevant domain, i.e., no access to context is mandatory; case (15) provides evidence of high appropriateness potential that could be explained via SI generation not conflicting with contextual information. In other words, if the asymmetric entailment is maintained in order to account for mismatching inferences with empty domains, then universal sentences must carry an existence presupposition. If this is so, then this existence presupposition is satisfied without recourse to contextual knowledge when the universal sentence is counted as relevant alternative. Pistoia-Reda (2012) elaborates on a modified version of the relevance assignment procedure for the universal variable featuring non-existing entities, through a careful Meinongian analysis that takes into account the principle of unrestricted freedom of assumption, where predicated properties of entities are said to be possessed by them independently of their existential status. With this modification, entailments derived from predicated properties can explain the oddness in (14), namely that Swedish matadors, while not existing, come from a cold country.

Having this panorama into account, I find it only logical to contribute to this debate with the aim of elucidating the conditions for implicature computations, particularly in the interpretations of contextually empty domains. My predictions

are in line with Pistoia-Reda (2017a); according to the results I present, the SI mechanism overlooks contextual contradictions that result from the negation of relevant alternatives. However, there is certain level of context involved (though constrained) in the realization of the relevant entailment pattern, such involvement of context is the assumption that a presupposition of existence in Strawsonian terms is satisfied. However, failure of this results in a rejected sentence with no defined truth value.

4. Strawson-Entailment in Implicature Computation

Though slightly controversial, Magri's Blindness hypothesis make appropriate pre-dictions on SI behavior, hence the preference of the view that SIs are indeed computed at a compositional level via entailment patterns that allow for the exclusion of alternatives which are negated so that a SI is derived without any needed access to contextual information. Despite that, I propose a revised version that refines the entailment pattern required for the SI generation. I argue that the entailment relation in the Blindness formulation is restricted to the satisfaction of the definedness condition which, in turn, must be met by means of the Strawsonian presupposition of existence; otherwise, no entailment pattern will be realized resulting in SI failure. The main evidence for this is an extended analysis of observations concerning contextually empty terms (Pistoia-Reda 2017a, b; Pistoia-Reda and Sauerland 2021).

Let me take stock, assume scalar implicatures are the result of mandatory *Exh*, 1) alternative members are activated through a relevance assignment procedure, 2) non-weaker alternatives standing in an asymmetric entailment relation with the base form of the uttered sentence (the prejacent) enter the set of excludable alternatives (Fox 2007), 3) excludable alternatives, part of the entailment relation, are negated (SI), 4) if there is a mismatch between the SI just generated and the information contained in the common ground, the outcome will be an odd sentence.

Now, let us focus on the entailment relation mentioned in step 2. Since entailment relations are contingent to presupposition satisfaction, there is a restriction that should be present for the entailment pattern to be computed successfully and prevent the sentences from lacking truth value; it is that the expressions for which the entailment pattern had ensued must be defined following the definedness condition. If the expressions are undefined, they provoke truth-valuelessness; hence, it is expected that no entailment relation arises. The particular case of seemingly empty terms is salvaged by virtue of Strawson-entailment (von Fintel, 1999) for it presupposes existence of entities under the assumption that speakers take for granted that utterances carry truth values and are logical.

However, this treatment is *restrained by conceivability* because committing to the presupposition of existence of an entity used in common conversation is dependent on our epistemic status as well as our ability to conceive of objects, including those that are not contextually known to exist on account of our linguistic knowledge, feature which equates to context retrieval. This move is pivotal for the reconciliation between context and grammar, our SI derivation device is intrinsically endowed with the inherent definedness of the domain of entities, this, of course, does not contradict the Blindness filter, in fact, this reconciliation ratifies that scalar implicatures are not derived because of context but in spite of

context; and it is only under the Blindness hypothesis that oddness is explained via SI, if it were not, access to context would prevent any inferences given that contradictions ought to be avoided.

With that modification to the relevant entailment relation in implicature computation, we are now in a position to explicate possible scalar inferences triggered in quantified propositions containing contextually empty terms, adding to the discussion the plausible explanation founded in the inclusion of a tacit premise that the relevant domain of discourse is assumed to be non-empty. In spite of that, Pistoia-Reda (2017b) predicts presupposition failure in propositions containing inconceivable entities such as *round squares*; even though they also intend to denote empty terms, they fail to be defined. However, in his current analysis, through the same Meinongian modification introduced before (Pistoia-Reda, 2022), he predicts an oddness effect due to relevance assigned to propositions containing empty domains. As I see it, propositions containing *round squares* are not necessarily always undefined, for the likelihood to assign a truth value to it by virtue of interpretation strategies applied by the speaker is not null. A round square could be understood to be a square with round corners, or even a circle inside a square. Though not understood logically, there are different ways speakers can make sense of it at the cost of significantly high cognitive processing time. This latter observation is approached more in detailed in Del Pinal (2021) and Pistoia-Reda and Sauerland (2021) amidst discussions on logicality of language. However, I sustain that definedness is restrained by conceivability which may either block interpretations or take significantly long times for acceptance. On a par with this theoretical postulation, I will present experimental evidence that supports it. Next section presents a sentence reading experiment with acceptability judgments that offers empirical support in the case of Colombian Spanish.

5. Experiment

5.1. Methods

The experiment consisted of a self-pace reading task that elicited acceptability judgements and recorded reaction times carried out with 25 Colombian Spanish-speaking undergraduate students of academic backgrounds different from linguistics, whose ages ranged between 18 and 30 years old. The participants were presented a number of Spanish sentences[7] split into 4 chunks, and they had to rate them following a Likert scale of 1 to 7 (Likert 1932) basing their decisions on their interpretative intuitions. This is a 3 X 2 factorial design. The first factor includes the degree of compatibility of the NPs with the actual world, it involves three levels: existing entities (*type-a*), non-existent but conceivable entities (*type-b*), and non-existent and inconceivable entities (*type-c*). In addition, the second factor holds two inference levels: universal sentences with no inference triggers, and existential sentences with inference triggers (see Table 1 for a clearer picture of each sentence kind. Their English equivalent is shown in (16) respectively).

---

[7] 16 sentences for each compatibility level (8 for each inference level) for a total of 48 sentences of the critical condition.

Table 1. Experimental conditions

Compatibility	Inference (+/−)
(1) Existent entities	(−) Todas las <u>rosas rojas</u> son flores. (+) Algunas <u>rosas rojas</u> son flores.
(2) Non-existent but conceivable entities	(−) Todos los príncipes colombianos son latinoamericanos. (+) Algunos príncipes colombianos son latinoamericanos.
(3) Non-existent and inconceivable entities	(−) Todos los triángulos de cuatro lados son polígonos. (+) Algunos triángulos de cuatro lados son polígonos.

(16) a. All/Some <u>red roses</u> are flowers.
     b. All/Some <u>Colombian princes</u> come from Latin America.
     c. All/Some <u>four-sided triangles</u> are polygons.

Since this is a sentence reading task with acceptability judgments and reaction times, the dependent factors will be both on-line and off-line measures. The former are the reaction times before pushing the judgment button, and the latter are the acceptability judgements themselves. Every sentence belonging to the crucial conditions have the form '*some S are P*' and '*all S are P*' as shown in (16). The predicate in the existential one induces a mismatch that allows for two readings of the sentence, a logical one that yields a positive truth value and a contextual one that yields a negative one because of the inference inconsistent with common knowledge. This is due to the fact that when an inference is made, the sentence meaning gets strengthened and this is what clashes with the common ground information. Hence, higher response time with low acceptability in the condition with 'some' (*some*-sentence henceforth) is expected, compared to the condition with 'all' (*all*-sentence henceforth) which carries no inference trigger and whose meaning does not conflict with contextually known information.

5.2. Procedure

The task was run using PsychoPy (Peirce et al. 2019), powered by Pavlovia to be run online; participants were made to use a computer since the task was not available in another device. As soon as they started the exercise, they were warned that they would be presented sentences divided in four chunks which they would read progressively, and soon after, rate on an acceptability scale of 1 to 7. The software recorded reaction times before participants response (RTs) and, of course, participants' acceptability judgments (AJs).

5.3. Results

Fig. 1 summarizes AJs of types a, b and c. It shows the contrast between non-inferential *all*-sentences and inferential *some*-sentences. The results for type-a concur with the predictions, high ratings for non-inferential items against low ratings for inferential ones due to oddness effects. Even though in types b, and c the

difference between inferential and non-inferential sentences was not salient, type-b sentences did receive higher levels of appropriateness.
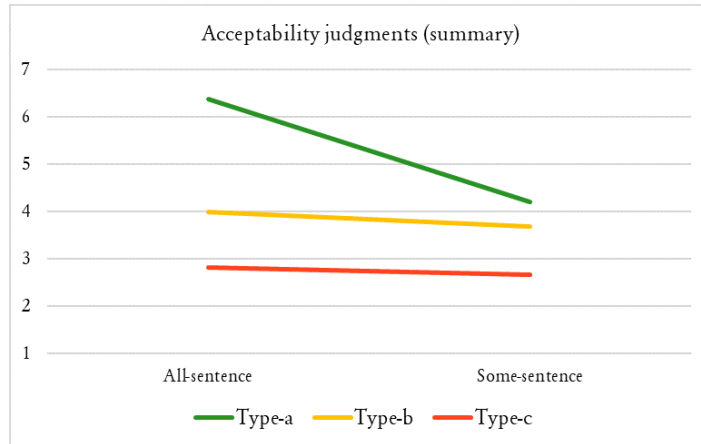

Fig. 1. Acceptability judgments.

Fig. 2, on the other hand, reports higher RTs in the inference conditions for type-a. This is explained by virtue of the cost of SI computation; the moment the sentence was found to be odd, it received low AJs as reported above. For type-b, RTs were higher in the inference condition compared to the non-inference trigger sentences. This points to similar reasons to those of type-a. Finally, for type-c, a closer behavior to type-b is reported, however, the crucial difference is that inferential sentences of this type took less amount to be rated, that is, to be rejected considering the low AJs reported in Fig. 1.
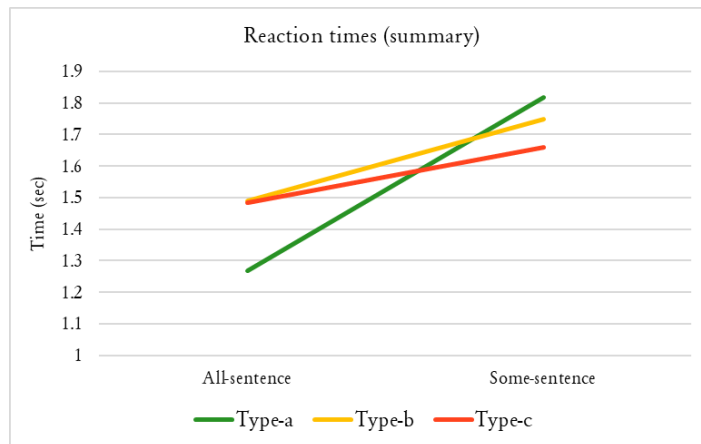

Fig. 2. Reaction times.

5.4. Discussion

Overall, type-a items behave according to previous research conducted by Bott and Noveck (2004); rejections are due to SI computation conflicting with

contextual knowledge which renders the *some*-sentence odd. Besides, a SI is said to occur owing to the higher RTs reported in the inference condition.

Although AJs in type-b sentences were not noticeably different across conditions, the pattern of higher RTs in the presence of inference triggers is indeed observed, which marks SI computation effort that results in a moderately acceptable sentence, certainly less acceptable than non-inferential sentences. However, the fact that type-b sentences are not prominently accepted across conditions does not render them utterly unacceptable. One could argue that there is a possible domain of discourse where 'Colombian princes' exist; this interpretative component might as well be what is preventing the judgment from plummeting in the Likert scale. This AJ difference becomes more relevant when we acknowledge they are rescued from utter unacceptability by their being conceivable, unlike type-c sentences which are lying at the bottom of the scale, so under these circumstances, the *some*-sentence appears odd because of its possible incongruity found at the intersection between the subject and the predicate terms (equivalent to SI), and its appropriateness should not be much higher than the universal sentence; hence, their higher RTs compared to *all*-sentences.

If we look at the RTs of *all*-sentences of types a and b, they are higher in the latter than in the former, and this may be due to a verification process aimed at finding elements of the crucial kind in our epistemic world construal which requires significantly more time than in type-a sentences with no reference failure. Likewise, this process is equivalent to effort for presupposition satisfaction, which is rather restrained in type-c elements but achieved more freely in type-b items given they both have the same RTs for non-inferential conditions, but different ones for the elements with inference triggers where type-b sentences showcase higher AJs. In fact, such low acceptability for type-c *some*-sentences may be due to their being highly hindered by conceivability, namely, the presupposition of existence is hard—if not impossible—to be achieved, leading to definedness failure.

Be that as it may, type-c results raise the following questions: 1) why did participants give, on average, a rating between 2.0-3.0 to these items and not a straight up 1.0? 2) Why can we still perceive a tendency for rejection in the inference sentences?

The most reasonable answer is the availability of interpretation strategies undertaken by the participant who, presumably, attempts to verify the existence of possible elements within the cardinality of the subject term. 1) It may have been the case that a small subset of the participants did figure out a way to make some loose sense of at least some type-c sentences, or every participant found some items of the same condition less infelicitous than others, and based on this, they judged the sentence with the inference trigger a tiny bit less acceptable than the non-inference condition. 2) This move will result in higher cognitive effort evidenced in the reaction times, though not as high as in type-b, most probably due to presuppositions failure which actually leads to rejection.

An interesting recent approximation to this observation appears in Pistoia-Reda and Sauerland (2021) who investigate a pragmatic repair strategy discussed in Del Pinal (2019). In their analysis, Pistoia-Reda and Sauerland envisage the infelicity of sentences belonging to this kind but rescues them via application of a pragmatic operator that modifies and weakens the meaning of the crucial terms. To my view, it could actually be the case that a sentence recovers from infelicity via application of a "silent RESCALE operator" that strengthens interpretation and modulates meaning "via exclusion of logically available interpretations" (Del

Pinal 2019: 4); as a matter of fact, this agrees with the process of linguistic retrieval for meeting the definedness condition, but then again, the results suggest high infelicity effects.

6. Conclusion

In sum, the results of this experiment corroborate the data presented by previous research that dictates higher cognitive effort for conventional sentence interpretation with no referential failure carrying scalar implicatures (type-a). In addition, the critical data illustrate that propositions containing elements with referential failure but which are conceivable (type-b) are judged more felicitous than sentences containing elements that, from a logical perspective, fail to be conceived in the speaker's mind (type-c).

Regarding scalar implicature calculation, in type-b conditions, SIs are triggered and arguably achieved by virtue of successful definedness condition satisfaction in the spirit of Strawson, who assumes commitment to the non-emptiness status of the domain of discourse. A diverse prediction is forecast in the type-c conditions featuring inconceivable entities, for the data offers the interpretation of possible accommodation of the target definedness condition but low likelihood for scalar inference derivation given its infelicity and lower RTs compared to type-b items.

These results are in keeping with the grammatical account in that they suggest strong likelihood for computation of SIs in contextually empty domains, which is at odds with the pragmatic account. To recall, SI computation in contextually empty domains is not predicted by the pragmatic account, for if free access to contextual information is essential, expressions such as "Colombian princess" are said to always return a value false given today's actuality; hence, no inference of any kind is predicted.

Moreover, there is a conceivability restraint, which I alluded to in section 4, that represents a huge obstacle for SI processing in type-c elements since it hinders presupposition satisfaction in logically inconceivable empty terms; therefore, it does not allow for the realization of the Strawson-entailment pattern, that requires the definedness condition for it to be achieved. On the other hand, the possibility of pragmatic repair mechanisms applied by the speaker, via a weakening device applied to non-logical elements in order to make sense of an utterance (Pistoia-Reda and Sauerland 2021), cannot be cancelled at all. At the same time, I suggest a contrast between my results and their theoretical observations. They allow room for the acceptable interpretation of inconceivable entities, while my results suggest otherwise.

In the light of Magri's standard cases, infelicity in type-c is explicated by dint of propositions not meeting the definedness condition, and not through a contextual clash via mandatory SI computation, yet Magri does not deal, to a deeper extent, with inconceivable objects. Nonetheless, my intuition is that this may well be attained but only at the cost of heavy cognitive exercise. After all, natural language understanding is as subjective as it is flexible, but this does not mean that anything can be said that is meaningful.

References

Bott, L. and Noveck, I.A. 2004, "Some Utterances are Underinformative: The Onset and Time Course of Scalar Inferences", *Journal of Memory and Language*, 51, 3, 437-57.

Chemla, E. and Singh, R. 2014, "Remarks on the Experimental Turn in the Study of Scalar Implicature, Part 1", *Language and Linguistics Compass*, 8, 9, 373-86.

Chierchia, G. 2004, "Scalar Implicatures, Polarity Phenomena and the Syntax/Pragmatics Interface", in Belletti, A. (ed.), *Structures and Beyond*, Oxford: Oxford University Press, 39-103.

Chierchia, G. 2006, "Broaden Your Views: Implicatures of Domain Widening and the 'Logicality' of Language", *Linguistic Inquiry*, 37, 535-90.

Chierchia, G., Fox, D., and Spector, B. 2012, "Scalar Implicature as a Grammatical Phenomenon", in von Heusinger, K., Maienborn, C., and Portner, P. (eds.), *Semantics: An International Handbook of Natural Language Meaning*, vol. 3, Berlin: Mouton de Gruyter, 2297-2331.

Crnic, L., Chemla, E., and Fox, D. 2015, "Scalar Implicatures of Embedded Disjunction", *Natural Language Semantics*, 23, 271-305.

Del Pinal, G. 2019, "The Logicality of Language: A New Take on Triviality, 'Ungrammaticality', and Logical Form", *Noûs*, 53, 4, 785-818.

Del Pinal, G. 2021, "Oddness, Modularity, and Exhaustification", *Natural Language Semantics*, 29 (1), 115-58.

Fox, D. and Hackl, M. 2006, "The Universal Density of Measurement", *Linguistics and Philosophy*, 29, 537-86.

Frazier, L. 2009, "Computing Scalar Implicatures", in Friedman, T., and Ito, S. (eds.), *SALT XVIII Proceedings*, Cornell University: Linguistic Society of America, 319-39.

Gazdar, G. 1979, *Pragmatics: Implicature, Presupposition and Logical Form*, New York: Academic Press.

Grice, H.P. 1989, *Studies in the Way of Words*, Cambridge, MA: Harvard University Press.

Hirschberg, J.L.B. 1985, *A Theory of Scalar Implicature*, Garland: University of Pennsylvania.

Horn, L.R. 1972, *On the Semantic Properties of Logical Operators in English*, Ann Arbor: University Microfilms.

Hurford, J.R. 1974, "Exclusive or Inclusive Disjunction", *Foundations of Language*, 11, 3, 409-11.

Likert, R. 1932, "A Technique for the Measurement of Attitudes", *Archives of Psychology*, 140, 1-55.

Magri, G. 2009, "A Theory of Individual-Level Predicates Based on Blind Mandatory Scalar Implicatures", *Natural Language Semantics*, 17, 245-97.

Peirce, J., Gray, J.R., Simpson, S., MacAskill, M., Höchenberger, R., Sogo, H., Kastman, E., and Lindeløv, J.K. ,2019, "PsychoPy2: Experiments in Behavior Made Easy", *Behavior Research Methods*, 51, 1, 195-203.

Pistoia-Reda, S. 2017a, "Contextual Blindness in Implicature Computation", *Natural Language Semantics*, 25, 2, 109-24.

Pistoia-Reda S. 2017b, "On Conceivability and Existence in Linguistic Interpretation", in Brézillon, P., Turner R., and Penco, C. (eds), *Modeling and Using Context. CONTEXT 2017: Lecture Notes in Computer Science*, Vol. 10257, New York: Springer, 203-12.

Pistoia-Reda, S. 2022, "Relevance Without Existence: Empty Domains in Blind Exhaustification", forthcoming in *Synthese*.

Pistoia-Reda, S. and Sauerland, U. 2021, "Analyticity and Modulation: Broadening the Rescale Perspective on Lan-Guage Logicality", *International Review of Pragmatics*, 13, 1, 1-13.

Russell, B. 2006, "Against Grammatical Computation of Scalar Implicatures", *Journal of Semantics*, 23, 4, 361-82.

Sauerland, U. 2004, "Scalar Implicatures in Complex Sentences", *Linguistics and Philosophy*, 27, 3, 367-91.

Strawson, P.F. 1952, *Introduction to Logical Theory*, London: Routledge.

Van Rooij, R. and Schulz, K. 2004, "Exhaustive Interpretation of Complex Sentences", *Journal of Logic, Language and Information*, 13, 4, 491-519.

von Fintel, K. 1999, "NPI Licensing, Strawson Entailment, and Context Dependency", *Journal of Semantics*, 16, 97-148.