Co-nominal pointing and quantifiers*

Amir Anvari (MIT)

Abstract

In this paper, I zoom in on the interpretation of 'co-nominal pointing', i.e., those pointing gestures that accompany quantified noun phrases. I argue that co-nominal pointing 'exemplifies' plural discourse referents that are made salient by quantifiers for subsequent anaphoric pick-up (Nouwen 2003 a.o.). On this line of thinking, a direct paralleism is predicted between the interpretation of co-nominal pointing and the anaphoric potential of various determiners. In the paper, I provide evidence that this prediction is born out.

keywords: pointing, quantifiction, anaphora, complement anaphora

1 Introduction

On an abstract level of analysis, the two sentences in (1) below both tend to convey the information, namely, that some but not all students failed.

(1) The exam was very difficult . . .
   a. . . . and some students failed.
   b. . . . yet, not all students failed.

It is, therefore, surprising that if a pointing gesture toward an individual, say, John, accompanies the quantificational noun phrase of (1a), as in (2a) below, the result is an inference that is partially different form the inference generated by having the same gesture accompany the quantificational noun phrase of (1b), as in (2b) below.[1] On the one hand, both utterances in (2) trigger the inference that the 'pointing target', i.e., John, is one of the students. On the other hand, (1a) triggers the inference that John failed the exam while (2b) triggers the opposite inference.

(2) The exam was very difficult . . .

**acknowledgements to be added*

[1]Throughout this paper, the symbol 'ix' (standing for 'index') is used to represent an occurrence of a pointing gesture. Overlining is used to give an upper bound on the time slot in which pointing can felicitously occur with the intended interpretation.(Thanks to Jeremy Kuhn for suggesting this notation.) These notational devices are both adopted from sign language research, yet while my use of the former follows convention, the latter might be slightly misleading since in sign language literature overlines are typically associated with non-manual signs, such as eye-gaze. Regardless of any potential similarity between eye-gaze in sign language and pointing in speech, no substantial *assumption* is intended by this notation here (although the hint for possible future research very much is). In particular, I will consistently ignore the potential role of eye-gaze in this study.

a. . . . and $\overline{\text{some students}}^{\text{IX}}$ failed. (IX to John)
   ⇝ *John is one of the students and he failed the exam*

b. . . . yet, $\overline{\text{not all students}}^{\text{IX}}$ failed. (IX to John)
   ⇝ *John is one of the students and he did not fail the exam*

1.1 Claims of the paper

This paper is about the interpretive process that underlies such cases of 'co-nominal pointing'. Specifically, I will focus on the interpretation of those pointing gestures that are temporally aligned with (i) *quantificational* (ii) *noun phrases*, as opposed to referential noun phrases or predicates. In such configurations, pointing generates a rich inferential pattern that depends, crucially, on the determiner, as seen already in the contrast between (2a) and (2b), and also the logical structure of environment that surrounds the gesturally modified noun phrase, as we will see later on. Examining this pattern forms the empirical side of this paper.[2]

On the theoretical side, the question pertaining to the interpretation of co-nominal pointing can be split into two parts. The first task is to analyze the *content* of the co-nominal pointing inference in abstraction from how this inference projects, i.e., interacts with logical operators. Second, the projection facts need to be brought into the picture and accounted for. As to the former, I will propose that the function of co-nominal pointing is to 'exemplify' the set of individuals that is made salient by the quantifier for subsequent anaphoric pick-up ('plural anaphora', Nouwen 2003 a.o.). More specifically,

(3) **The exemplification hypothesis.** ***(to be slightly revised below)*** If a pointing gesture IX toward individual T_{IX} accompanies a quantificational noun phrase α, it triggers the inference that $T_{IX} \in S_\alpha$, where S_α is a set of individuals (a 'discourse referent') that is made salient by α for anaphoric uptake.

The exemplification hypothesis immediately predicts that there should be a parallelism, on a case by case basis, between the co-nominal pointing inferences that are triggered if pointing modifies the quantificational noun phrase α and the anaphoric potential of α in discourse, as exposed by the referential possibilities of pronouns that are anteceded by α. Formulated in strongest possible sense (possibly too strong), the prediction, here termed 'the isomorphy prediction' is (4).

[2] One case that, abstractly speaking, falls in the same category but is not discussed in this paper is the effect of having pointing gestures with *wh*-words. In particular, Alexandre Cremers (p.c.) points out the following data point (the inference, particularly as it pertains to John's beliefs *vis-à-vis* whether x is a student or not, is not entirely clear to me; more work is required to determine the content of this inference adequately).

(i) John knows $\overline{\text{which students}}^{\text{IX}}$ failed the exam.
   ⇝ *The person pointed to x is one of the students and John correctly believes that x failed the exam*

Notice that, as is well known, *wh*-phrases license anaphoric dependencies much like run-of-mill quantificational indefinites (Haida 2007, a.o.). As the exemplification hypothesis, introduced just below, accounts for the interpretation of co-nominal pointing on the basis of their anaphoric potentials, it seems reasonable to assume that it applies to these cases as well. I have to leave a detailed discussion to future work.

(4) **The isomorphy prediction** If a pointing gesture IX toward individual T_{IX} accompanies a quantificational noun phrase α then the inference is triggered that $T_{IX} \in S$ if and only if the set S can be referred back to by a (plural) pronoun that is referentially dependent on α.

That there is some *prima facie* plausibility to this prediction is established by the following pair of examples.

(5) a. $\overline{\text{Some students}}^{\text{IX}}$ failed the exam.
$\rightsquigarrow$ *T_{IX} is one of* ***the students who failed the exam***
b. Some^i students failed the exam. They$_i$ are upset.
$\rightsquigarrow$ ***The students who failed the exam*** *are upset*

Indeed, the exemplification analysis builds on the intuition that the interpretive effect of pointing in, e.g., (2a) can be quite transparently paraphrased as in (6).

(6) Some^i students failed, and John is one of them$_i$.

In Section 2, the exemplification hypothesis, and the prediction in (4) in particular, are discussed in detail in connection to the anaphoric potential of various determiners. Interestingly, there is a *prima facie* problem for the exemplification hypothesis when it comes to the universal determiners *every* and *no* (and their variants). These determiners seem to trigger inferences of a *scalar* nature (cf. the paraphrase in (7b)) when modified by co-nominal pointing.

(7) a. $\overline{\text{Every student}}^{\text{IX}}$ passed the exam.[3,4] (IX to John)
$\rightsquigarrow$ *John is one of the students and he was unlikely to pass the exam*
b. Every student passed the exam, even John!

In Section 3, the relevant facts pertaining to *every* and *no* are briefly summarized for subsequent reference. Putting these problematic cases temporarily aside, in Section 4, I turn to the projection problem of co-nominal pointing inferences. I will argue that these inferences are *presuppositional*, in a standard sense, but this claim requires a stipulative modification of the exemplification hypothesis. According to this modification, pointing exemplifies the discourse referent made salient by the determiner *on the condition that this set is not empty*.

(8) **The exemplification hypothesis.** ***(final version)*** If a pointing gesture IX toward individual T_{IX} accompanies a quantificational noun phrase α, it triggers the *presupposition* that $S_\alpha \neq \emptyset \Rightarrow T_{IX} \in S_\alpha$.

In the last analysis, then, co-nominal pointing inferences are conditional presuppositions. This makes the present analysis look very similar to Schlenker's (2018) 'cosuppositional' analysis of *iconic* gestures that modify predicates; according to Schlenker's analysis, the iconic gesture SLAP in an utterance of *John [punished his son]$_{SLAP}$* triggers the presupposition that *if John punished his son*, he did so by slapping him. This parallelism is discussed in Section 6, where it is also noted that co-nominal pointing inferences share the same behavior as their iconic brethren in non-monotonic environments and environments involving el-

[3]Some consultants report that this utterance improves significantly with a sharp focus on the determiner. It is my impression that this intonation is not essential, however.

[4]Some consultants prefer to paraphrase the inference in less than polite terms, as in *the person pointed at is the most stupid of the relevant students (or is plainly stupid)*.

lipsis and focus-sensitive operators. Before that, however, in Section 5, I will have a second look at the problem raised by *every* and *no*. I will argue that once we are equipped with the final version of the exemplification hypothesis in (8), the problem with universal determiners is automatically solved *if* we are open to make certain assumptions regarding the anaphoric potential of these determiners that are somewhat non-orthodox, in the sense that they cannot be directly verified using pronouns; specifically, one assumption would have to be that *no* triggers a discourse referent for the set that consists of the intersection of the set denoted by its restrictor and scope (i.e., the REFERENCE SET, see Section 2 for the terminology) and, more surprisingly, *every* triggers a discourse referent for the set that consists of the intersection of the set denoted by its restrictor and the *complement* of its scope (i.e., the infamous COMPLEMENT SET). Some remarks in support of these assumptions are provided in that section as well. Section 7 concludes the paper by sketching certain facts pertaining to co-nominal *iconic* gestures.

1.2 Limitations

Some preliminary remarks pertaining to the limitations of this study are best stated at the outset. First, the main language studied in this paper is English. Every judgment reported has been checked against the intuitions of at least three native English speakers, including two non-linguists. Whenever comparable constructions existed, the judgments have been replicated in Farsi (based on my own intuitions and one non-linguist consultant) and French (one linguist). As of yet, I have not found any cross-linguistic variation.

Second, the timing of the gesture matters. For my consultants, (9) below was either unacceptable or it triggered the inference that the person pointed to is a (heavy?) smoker. A possible paraphrase would be, *not every student here is a smoker like he is!*, with no indication of whether *he* refers to a student in the mentioned department. This is in clear distinction with the effect of pointing in (2b) above.

(9) Not every student in this department $\overline{\text{is a smoker}}^{\text{IX}}$.

I have to leave the question of how co-*nominal* pointing, as in (2a), relates to co-*predicative* pointing, as in (9), to future research. In the domain of co-nominal pointing, I am not aware of any effect depending on whether the gesture co-occurs with the determiner (e.g., *not every* in (2b)) or its argument (e.g., *students* in (2b)), therefore throughout I have over-lined the entire quantificational noun phrase. That said, the following data point suggests that the precise timing of the gesture *vis-à-vis* the internal make-up of the quantificational phrase can be quite important.

(10) a. $\overline{\text{Some}}^{\text{IX}}$ but not all students smoke.
⇝ *The person pointed to smokes.*

b. Some but $\overline{\text{not all}}^{\text{IX}}$ students smoke.
⇝ *The person pointed to does not smoke.*

c. ??Some but not all $\overline{\text{students}}^{\text{IX}}$ smoke.[5]

[5]This utterance improves if pointing is directed at multiple individuals, in which case the (possible?) inference is triggered that the plurality pointed to consists of students, with no implications pertaining

Third, the inferences studied in this paper are sometimes difficult to detect, let alone articulate or paraphrase. My response to this problem has been to focus primarily on cases where judgments are relatively clear and robust. As it happens, the paradigm in (2) is already rich enough to allow us explore and evaluate several interesting hypotheses. Needless to say, this line of inquiry can benefit greatly from controlled, quantitative studies. My hope is that the hypothesis advanced here and the generalizations upon which it is built will be of some value to prospective experimental works of this kind.

Fourth, there are two major omissions in this paper. One pertains to 'plural pointing', i.e., pointing to several individuals. I hope future work will address this omission. Another pertains to the shape of the pointing gesture. For present purposes, I rely on the observation that the link between the pointing shape and the inferences triggered in the relevant constructions *appears* to be fairly indirect. For example, the inferences reported in (2) remain stable if instead of pointing with extended index finger another pointing shape is used, such as pointing palm up with all fingers extended, side-ways pointing with the thumb, head-tilt or even a simple tap on the back. Evidently, all that matters is that a certain individual is made salient in an appropriate time-frame. But this issue needs to be investigated more thoroughly. See Kendon & Versante 2003 for some very interesting observations.

Fifth, even a superficial examination of the examples in (2), repeated below, suggests an analysis which slightly differs from the exemplification hypothesis.

(11) a. . . . and $\overline{\text{some students}}^{\text{IX}}$ failed.
⇝ *The person pointed at is one of the students who failed*

b. . . . yet, $\overline{\text{not all students}}^{\text{IX}}$ failed.
⇝ *The person pointed at is one of the students who did not fail*

Specifically, suppose we are equipped with an inferential engine that can 'catch' those inferences that are licensed by an utterance that are existential in nature. On the basis of this system, we can then postulate that all pointing does is that it 'witnesses' some of these existential statements, where a witness of an existential inference is defined roughly as follows.

(12) An individual a witnesses the existential inference $\exists x \phi(x)$ if and only if $\phi(x)$ is true relative to an assignment that maps x to a.

For example, consider (11b) (it is obvious how this would apply to (11a)). The asserted sentence (minus the gesture) triggers the existential inference that there is at least one student who did not fail. The idea is that pointing simply provides a witness to this existential statement: 'I guy I am pointing at' is a student who did not fail. Although this line of thinking is intuitively very appealing, I think it should be resisted. First of all, note that (as implied at the very outset), both sentences (11a) and (11b) normally trigger two existential inferences: that at least one student fail and that at least one student did not. The former inference is asserted by (11a) but is an (indirect) scalar implicature of (11b). The latter inference is a scalar implicature of (11a) but is asserted by (11b). Now, why is it that pointing witnesses only one of these existential inferences? The obvious answer would seem to be that pointing only witness inferences that are part of the 'at-issue' content of accompanying sentences. But, then, consider (13).

to their smoking habits.

(13) $\overline{\text{Only some students}}^{\text{IX}}$ failed.
⇝ The person pointed at is one of the students and he failed the exam

Interestingly *only some* patterns with *some*, rather than *not every*, despite the fact that the relevant existential inference in the case of (13), i.e., that there is at least one student who failed, is in fact presupposed by (13), i.e., is not at-issue. Note, on the other hand, that the exemplification hypothesis makes the correct prediction for (13):

(14) Only some students failed. . . they are French.
⇝ The students who failed are French
⇝̸ The students who did not fail are French

The should also note that the exemplification hypothesis, because it relies on plural anaphora, does come very close to the analysis just sketched; it is just different enough from it to make correct predictions in cases like (13).

Sixth, and finally, the reader should note that in advancing the exemplification hypothesis I am not claiming that exemplification is the only function that co-nominal pointing can perform; there may very well be some ambiguity in how co-nominal pointing is interpreted. Indeed, I am not even claiming that exemplification is all there is to the particular interpretation of co-nominal pointing that I will focus on in this paper. For instance, I suspect that the exemplification inference must be strengthened in certain cases so as to imply, not only that the pointing target belongs to the discourse referent that the determiner makes salient, but also that the fact that pointing target belong to this set yields (some form of) support for the assertive content of the sentence.

2 The exemplification hypothesis

Consider again the first version of the exemplification hypothesis, i.e., (3) and the isomorphy prediction connected to anaphora, both repeated below.

(15) **The exemplification hypothesis.** ***(to be revised)*** If a pointing gesture IX toward individual T_{IX} accompanies a quantificational noun phrase α, it triggers the inference that $T_{IX} \in S_\alpha$, where S_α is a set of individuals (a 'discourse referent') that is made salient by α for anaphoric uptake.

(16) **The isomorphy prediction** If a pointing gesture IX toward individual T_{IX} accompanies a quantificational noun phrase α then the inference is triggered that $T_{IX} \in S$ if and only if the set S can be referred back to by a (plural) pronoun that is referentially dependent on α.

This section is an extended attempt in verifying this prediction. I will go about this task by systematically comparing the anaphoric potential of various determiners with the inference that is generated when these inferences are modified by a pointing gesture to a single individual. Before I do so, it is helpful to lay down some terminology and a descriptive generalization pertaining to plural anaphora.

I will follow the literature in assuming that three sets in particular are the candidates for anaphoric salience and that different determiners differ in which of these sets they make available, both as a matter of their lexically determiner

logical meaning and contextual factors. These three sets are defined in (17)[6,7] and the two crucial generalizations pertaining to their availability is given in (18) (from Nouwen 2003, whose discussion I take to be the state of the art as far as the empirical picture is concerned).

(17) [[DETERMINER N] M]

a. $N \cap M$ = REFERENCE SET
b. $N \cap \overline{M}$ = COMPLEMENT SET
c. N = MAXIMAL SET

(18) Nouwen's (2003) generalizations:

a. Every determiner makes the REFERENCE SET available.
b. (i) The COMPLEMENT SET is only made available if its non-emptiness can be inferred. (ii) Even if the COMPLEMENT SET is made available, it cannot be referred to unless there is no other set available with higher salience which, if chosen as the antecedent, leads to a coherent interpretation.

To begin with, consider the upward-monotonic determiners *some*, (cardinal) *many* and *a few*. As shown in (19), all three determiners license anaphoric reference to the REFERENCE SET. As shown in (20), none of the three determiners license anaphoric reference to the COMPLEMENT SET, even if the property that is predicated of the members of that set requires this resolution at the pain of contextual incoherence. For example, to the extent that (20a) is felicitous at all, it can only mean either that, for some reason or other, the students who failed are happy (REFERENCE SET) or that the students are all happy (MAXIMAL SET), cf. (21).

(19) a. Some^i students failed the exam, they$_i$ are upset.
⇝ *The students who failed are upset*
b. Many^i students failed the exam, they$_i$ are upset.
⇝ *The students who failed are upset*
c. A few^i students failed the exam, they$_i$ are upset.
⇝ *The students who failed are upset*

(20) a. ??Some^i students failed the exam, they$_i$ are very happy.
⇏ *The students who did not fail the exam are very happy*
b. ??Many^i students failed the exam, they$_i$ are very happy.
⇏ *The students who did not fail the exam are very happy*
c. ??A few^i students failed the exam, they$_i$ are very happy.
⇏ *The students who did not fail the exam are very happy*

(21) Some^i students failed the exam, the rest$_i$ are very happy.
⇝ *The students who did not fail the exam are very happy*

Co-nominal pointing with these determiners generates a reading which essentially boils down to the exemplification of the REFERENCE SET. ('T_{IX}' is used as a short-hand for 'pointing target'.)

[6] I follow Nouwen's (2003) terminology. The reader should note that different researchers use these terms differently.

[7] In (17) I have ignored the form / denotation distinction for simplicity.

(22) a. $\overline{\text{Some students}}^{\text{IX}}$ failed the exam.
$\rightsquigarrow$ *T_{IX} is one of the students who failed the exam*
$\not\rightsquigarrow$ *T_{IX} is one of the students who did not failed the exam*

b. $\overline{\text{Many students}}^{\text{IX}}$ failed the exam.
$\rightsquigarrow$ *T_{IX} is one of the students who failed the exam*
$\not\rightsquigarrow$ *T_{IX} is one of the students who did not failed the exam*

c. $\overline{\text{A few students}}^{\text{IX}}$ failed the exam.
$\rightsquigarrow$ *T_{IX} is one of the students who failed the exam*
$\not\rightsquigarrow$ *T_{IX} is one of the students who did not failed the exam*

Next, consider the downward-monotonic determiners *few* and *less than n*. The first thing to note is that judgments in these cases are slightly less robust. Nevertheless, as shown in (23), these determiners allow reference to the Reference Set and, as established by the contrast between (24) and (25), these determiners allow reference to the Complement Set as well but, importantly, only if the meaning that results from the Reference Set is contextually incoherent.

(23) a. Few^i students failed the exam, they$_i$ are upset.
$\rightsquigarrow$ *The students who failed are upset*

b. Less than three^i students failed the exam, they$_i$ are upset.
$\rightsquigarrow$ *The students who failed are upset*

(24) a. Few^i students failed the exam, they$_i$ are French.[8]
$\rightsquigarrow$ *The students who failed are French* (possible reading)
$\overset{?}{\rightsquigarrow}$ *The students who did not fail are French*
(not easily accessible, if possible at all)

b. Less than three^i students failed the exam, they$_i$ are French.
$\rightsquigarrow$ *The students who failed are French* (possible reading)
$\overset{?}{\rightsquigarrow}$ *The students who did not fail are French*
(not easily accessible, if possible at all)

(25) a. Few^i students failed the exam, they$_i$ are happy.
$\rightsquigarrow$ *The students who did not fail are happy*

b. Less than three^i students failed the exam, they$_i$ are happy.
$\rightsquigarrow$ *The students who did not fail are happy*

Co-nominal pointing with *few* and *less than n* can certainly license exemplification of the Reference Set ; however, it is not at all clear whether the Complement Set can be exemplified as well. Of the five individuals that I have consulted, none was able to access the Complement Set reading easily, but two did not rule it out either.

(26) a. $\overline{\text{Few students}}^{\text{IX}}$ failed the exam.
$\rightsquigarrow$ *T_{IX} is one of the students who failed the exam*
$\overset{?}{\rightsquigarrow}$ *T_{IX} is one of the students who did not failed the exam*
(probably impossible)

b. $\overline{\text{Less than three students}}^{\text{IX}}$ failed the exam.
$\rightsquigarrow$ *T_{IX} is one of the students who failed the exam*

[8] Reference to the Maximal Set is also available for these cases, but I put these aside.

$\overset{?}{\rightsquigarrow}$ T_{IX} *is one of the students who did not failed the exam*
(probably impossible)

Notice that, even with pronominal anaphora, *few* and *less than n* do not allow unconditional access to the Complement Set, as pointed out above: explicit linguistic cues are required to make the Reference Set incoherent, leaving the Complement Set as the only possibility.[9] Thus, it could be argued that since such linguistic cues are not available with pointing, Reference Set can hardly be ruled out and, therefore, blocks Complement Set. That said, arguably contextual factors that perform the same function as linguistic cues. At least some of my consultants found the Complement Set reading easier to access in the following context; note the contrast between *few* and *some* (which, undeniably, never allows access to Complement Set).

(27) *Context: The conversation is taking place in a math teacher's office. At the moment, the teacher is tutoring several students. These students have struggled with the material during the whole semester. The dean walks in the room . . .*

a. **The dean:** You have to include some Algebra in the final exam.

b. **The teacher [*shocked*]:** But, then, $\overline{\text{(very) few students}}^{IX}$ will pass the exam!
$\rightsquigarrow$ T_{IX} *is one of the students who will not pass the exam*

c. #**The teacher [*shocked*]:** But, then, $\overline{\text{some students}}^{IX}$ will pass the exam!
$\rightsquigarrow$ T_{IX} *is one of the students who will pass the exam*
(the only available reading)

I conclude that not only is the parallelism between anaphora and pointing not threatened by these cases, but that in fact the downward-entailing determiners *few* and *less than n* provide support for it.

Next, consider the determiner *not all* (or *not every*, the distinction will not matter here), which is also downward-entailing but slightly differs from *few* and *less than n* in its anaphoric potential. On the one hand, it appears that anaphoric access to the Complement Set is possible with *not all* just as it is with *few*. To see this, compare (28) with (25) above; in both cases, the pronoun can access the Complement Set (i.e., the students who did *not* fail) with the help of linguistic cues (i.e., *are happy*). On the other hand, it appears that anaphoric access to the Reference Set of *not all*, while possible, is not quite as salient as anaphoric access to the Reference Set of *few*. To see this, compare (29) with (23). As shown in (29), referring to the Reference Set of *not all* is marked regardless of whether linguistic cues are present to introduce a bias for it (*are upset*) or not (*are French*). Indeed, several of my consultants could not access the Reference Set for the examples in (29) at all. This is contrast with *few* because, as shown in

[9] Nouwen suggests that the Maximal Set is made available by any determiner that presupposes the non-emptiness of its domain of quantification (i.e., its restrictor). These are the 'strong' determiners in the sense of Milsark (1974). Importantly, however, as Nouwen points out, specific constructions (such as existential-*there* sentences) aside, many weak determiners also have strong readings which are generally available. The prediction, then, is that reference to the Maximal Set should be generally available unless the determiner is weak and occurs in a construction which does not allow the strong interpretation. I will have a few words to say regarding the Maximal Set in Section 7, but I will ignore it until then.

(23), referring to the REFERENCE SET of *few* appears to be the unmarked option.

(28) a. Not all^i students failed the exam, they$_i$ are happy.
⇝ The students who did not fail the exam are happy
b. John didn't fail all^i of his students, they$_i$ are happy.
⇝ The students who did not fail the exam are happy

(29) a. Not all^i students failed the exam, they$_i$ are upset / French.
$\overset{?}{⇝}$ The students who failed the exam are upset / French
b. John didn't fail all^i of his students, they$_i$ are upset / French.
$\overset{?}{⇝}$ The students who failed the exam are upset / French

As expected, the bias that *not all* introduces in favor of the COMPLEMENT SET is mimicked by the co-nominal pointing facts. Indeed, as far as I can tell, co-nominal pointing with *not all* can *only* exemplify the COMPLEMENT SET.

(30) a. $\overline{\text{Not all students}}^{\text{IX}}$ failed the exam.
⇝ T_{IX} is one of the students who did not fail the exam
↛ T_{IX} is one of the students who failed the exam
b. John didn't fail $\overline{\text{all of his students}}^{\text{IX}}$.
⇝ T_{IX} is one of the students who did not fail the exam
↛ T_{IX} is one of the students who failed the exam
c. It is not the case that John failed $\overline{\text{all of his students}}^{\text{IX}}$.
⇝ T_{IX} is one of the students who did not fail the exam
↛ T_{IX} is one of the students who failed the exam

As pointed out at the beginning of this section, the exemplification hypothesis predicts that the interpretation of both co-nominal pointing and plural pronouns with quantificational antecedents rely on the anaphoric potential of the determiner in question. As discussed above, there is a fair amount of evidence in favor of this prediction.

3 The problem with *every* and *no*

Universal determiners *every* and *no* generate interesting inference when modified by pointing gestures. As pointed out in Section 1, co-nominal pointing with *every* triggers a scalar inference which can be paraphrased with an appositive *even*.

(31) a. $\overline{\text{Every student}}^{\text{IX}}$ passed the exam.
⇝ T_{IX} is one of the students and he was unlikely to pass the exam
b. Every student failed the exam, even $\overline{\text{him}}^{\text{IX}}$
⇝ T_{IX} is one of the students and he was unlikely to pass the exam

The case of *no* is entirely symmetric to that of *every*: the inference is again scalar, but it is 'flipped'.

(32) $\overline{\text{No student}}^{\text{IX}}$ passed the exam.
⇝ T_{IX} is one of the students and he was likely to pass the exam

Even without looking at the details, it is clear that the exemplification hypothesis falls short here as on the basis the exemplification hypothesis, the part of these two inferences pertaining to likelihood is entirely unaccounted for. Indeed, there is *prima facie* good reason to think that the likelihood inference might be pragmatic in nature. Consider the case of *every* for example. Evidently, this determiner makes the Reference Set available for anaphoric uptake (I will re-analyze this example in Section 5 as involving anaphoric reference to the Maximal Set).

(33) Every^i student failed the exam, they$_i$ are upset.
⇝ *The students who failed the exam are upset*

On this basis, the exemplification hypothesis predicts that if a quantificational noun phrase headed by *every* is modified by pointing, the inference should be triggered that the pointing target belongs to the Reference Set. For example (31a), this amounts to the inference that the pointing target is a student who passed. Importantly, note that the assertive content of the sentence entails that for any x, if x is a student then x passed. Thus, the pointing inference, to the extend that it is informative at all, can only convey the information that the pointing target is one of the students; the rest follows from the meaning of the sentence. One might then suspect that this is the reason why the likelihood inference is generated. Intuitively, the hearer reasons that presumably there is a reason why the speaker took the trouble of singling out that particular individual. The information that that individual is a student is not relevant; rather the question under discussion (presumably) pertains to the proportion of students who passed the exam (e.g., none, some, most, all, etc). A possible conclusion, then, could be that the speaker took the trouble of making that individual salient because he or she finds its remarkable that that particular student also passed the exam. (Analogous reasoning should presumably be applied to (32).)

Some form of pragmatic reasoning based on relevance might indeed account for the scalar inferences in (31a) and (32). However, as I will discuss in Section 5, once a certain modification is made to the exemplification hypothesis to make it suitable to be coupled with a presuppositional analysis for projection, the puzzling scalar inferences of *every* and *no* follow immediately, *on certain assumptions about the anaphoric potential of these determiners* which can be to some degree motivated on conceptual and empirical grounds.

4 A projection recipe for the exemplification hypothesis

My claim in this section is that, to account for co-nominal pointing inferences, no new mechanism of 'projection' is required. More specifically, the claim is that co-nominal pointing inferences interact with logical operators in their environment *in the same way that presuppositions do*. To establish this claim, I will rely on one particularly strong piece of evidence. To setup the background, consider the factive predicate *know* which triggers the presupposition that its complement clause is true.

(34) John knows that Mary failed the exam.
⇝ *Mary failed the exam*

It is well-known that presuppositions (i) project from polar questions, (35a), and (ii) can give raise to conditional inferences when embedded in the consequent of conditionals, (35b). Indeed, these two tests can be combined. Thus in (35c), the factive presupposition first projects from the embedded polar question and then is filtered through the antecedent, giving rise to the conditional presupposition at root.

(35) a. Does John know that Mary failed the exam?
⇝ Mary failed the exam
b. If the exam involved math, then John knows that Mary failed.
⇝ If the exam involved math, then Mary failed
c. If the exam involved math, does John know that Mary failed?
⇝ If the exam involved math, then Mary failed

With this in mind, let us consider a case of co-nominal pointing with the determiner *many* as a case study.

(36) *Context: The person pointed at is John, we know that John is one of the students.*
$\overline{\text{Many students}}^{\text{IX}}$ failed the exam.
⇝ John is one of the students who failed the exam

In (37), (36) is embedded in a polar question in the consequent of a conditional, analogous to (35c).

(37) If the exam involved math, did $\overline{\text{many students}}^{\text{IX}}$ fail the exam?

If we supplement the exemplification hypothesis, as given in Section 2, with the assumption that the exemplification inference is presuppositional, then, on analogy with (35c), we except the inference to be generated at root that if the exam involved math, then John is a student who failed. This prediction is almost correct, intuitively, but it is a bit too strong. Specifically, none of my consultants inferred from (37) that if the exam involves math then at least one student failed; that is, in their judgment the utterance allows for every student passing the exam, even if the exam involved math. But our prediction is that precisely this inference should be triggered: if every worlds compatible with the exam having involved math is one in which John is a student who failed, then it follows that if the exam involved math then at least one student failed.

My suggestion is to weaken the exemplification hypothesis. Specifically, the idea is that exemplification, as involved in co-nominal pointing, is predicated on the non-emptiness of the set being exemplified: the inference is that *if that set is not empty* then the pointing target belongs to it. This, coupled with the claim that the pointing inference is presuppositional, is made explicit below (repeated from (8) in Section 1).

(38) **The exemplification hypothesis.** ***(final version)*** If a pointing gesture IX toward individual T_{IX} accompanies a quantificational noun phrase α, it triggers the *presupposition* that $S_\alpha \neq \varnothing \Rightarrow \text{T}_{\text{IX}} \in S_\alpha$.

The effect of this modification is precisely that it removes the extra piece of information pointed out above. What we now predict for the case of (37) is the inference that if the exam involved math, then either no student failed or John is one of the students who failed. This inference seems to match the intuitive

judgments pertaining to (37). Indeed, with this in place, we can look at the simpler cases below.

(39) a. Did $\overline{\text{many students}}^{\text{IX}}$ fail the exam?

b. If the exam involved math, then $\overline{\text{many students}}^{\text{IX}}$ failed the exam.

The inference predicted for (39a), on the basis of (38), is that either no student failed the exam, or John is a student who failed, and the inference predicted for (39b) is the same as that of (37) above. Both of these predictions seem to be on the right track, according to the judgments that I have been able to obtain, with one proviso. Intuitively, the inference that John is a student seem to project to root without getting 'conditionalized' by the antecedent of the conditions in (37) and (39b). I will return to this point in Section 7.

5 Another look at *every* and *no*

If the discussion in the previous section is on the right track, then the predicted inference for (40a) is (40b). That this predicted inference should surface as the attested inference in (40c) is not particularly mysterious, as the assertive content of the sentence entails that at least one student failed.

(40) a. $\overline{\text{Many students}}^{\text{IX}}$ failed the exam.

b. *Either no student failed or John is a student who failed*

c. *John is a student who failed*

But notice what the predicted inference (40b) amounts to in isolation. One way to read this inference in common sensical terms, on the assumption that John is one of the students, is that John is very likely to fail. This is because this inference rules out the possibility of there being some students who failed but John having passed: if there is student who failed, it is John. Indeed, some of my consultants' reaction to one of the crucial examples of the previous section, repeated below, was precisely to report the inference that John is likely to have failed the exam, and that is why he is singled out by the speaker via a pointing gesture.

(41) Did $\overline{\text{many students}}^{\text{IX}}$ fail the exam? (IX toward John)

⇝ *John is one of the students and he is considered likely to fail*

I submit that the puzzling scalar inference that was discussed for the universal determiners *all* and *no* can, in principle, be accounted for using the same reasoning. Specifically, consider the case of *all*.

(42) $\overline{\text{All students}}^{\text{IX}}$ failed the exam. (IX toward John)

⇝ *John is one of the students and he was considered unlikely to fail*

If this scalar inference is to be accounted for based on the discussion above about (41), then it must be the case that *all* makes the Complement Set available for anaphoric reference; i.e., it must be the case that the set that is exemplified by pointing is the Complement Set.

(43) If there is any student who did *not* fail the exam, then John is one of the

students who did not fail the exam. [In common sensical terms, John was very likely *pass* or very *un*likely to fail.]

But notice that the Complement Set of *all* cannot be referred to using a pronoun. This is entirely predicted, however, on the assumption that plural pronouns carry the presupposition that they refer to a non-empty set and given that the assertive content of *all* entails that the Complement Set is empty.

There is also indirect evidence for the claim that *all* makes the Complement Set salient, coming from negation. As noted in Section 2, *not all* allows access to the Complement Set. This claim is supported both by facts pertaining to anaphora and facts pertaining to co-nominal pointing, as discussed there. The situation with *all* embedded under sentential negation is exactly the same as *not all*. There are two possibilities pertaining to how negation 'projects' the discourse referents that are triggered in its scope (if this process is compositional at all, which I assume it is). Either negation prevents such discourse referents from projecting (this seems to be the common assumption) or, similar to the case of presuppositions, it allows them to project unmodified. There two problems with the former possibility. First, if negation completely blocks discourse referents, then double negation should to the same (i.e., the second occurrence of negation would not be able to 'recover' the discourse referents). Evidence against this comes from examples of the following kind. (See Schlenker 2011 for evidence from ASL and LSF that point in the same direction.)

(44) a. It is not true that John failed none^i of his students, they$_i$ are waiting outside of his office.
b. It is not true that Sam doesn't have an^i umbrella, it$_i$ is upstairs in his room.

Furthermore, and more to the point, if merely blocks discourse referents, it is entirely puzzling why *not all* should allow reference to the Complement Set. If, on the other hand, negation is thought of as a 'hole' for anaphora (much like it is a 'hole' for presuppositions), the facts start making more sense: *all* makes the Complement Set available for reference, but pronouns cannot refer to this discourse referent due to their existential presuppositions. Co-nominal pointing, on the other hand, does not carry an existential presupposition. Indeed, according to the modification proposed in the last section, exemplification is designed to deal with the emptiness of a given set.

6 Co-nominal pointing gestures and co-predicative iconic gestures

Consider the following example from Schlenker 2018.

(45) John [punished his son]$_{\text{SLAP}}$.
⇝ *John punished his son by slapping him*

This example involves (i) an iconic, slapping gesture, which (ii) is temporally aligned with the predicate of the sentence. Consequently, I will refer to such cases as iconic co-predicative gestures. Schlenker's (2018) analysis of iconic co-predicative gestures is summarized below.

(46) If an iconic gesture G modifies the predicate α of a simplex sentence of

the form [x α], where x is a referential expression, the presupposition is triggered that if x satisfies the property denoted by α then x satisfies the property denoted by α as conjunctively modified by G.

To be concrete, then, on Schlenker's analysis, (45) asserts that John punished his son and presupposes that if John punished his son he punished his son by slapping him. Note that, on this analysis, the attested inference of (45) is derived in the sense that the utterance in (45) is predicted to be *true* if and only if John punished his son (assertion) and if he punished his son, he did so by slapping (presupposition), which amounts to John punished his son by slapping him. According to Schlenker, this conditional inference becomes visible when (45) is embedded under negation (see Tieu et al. 2017, 2018 for two experimental investigations on this point).

(47) It is not the case that John [punished his son]$_{\text{SLAP}}$.
⇝ *If John had punished his son he would have done so by slapping him*

It should be clear at this point that Schlenker's 'cosuppositional' analysis of iconic co-predicative gestures bears a resemblance to the final version of the exemplification-based analysis of co-nominal pointing. More specifically, on both analyses the gestural inference is presuppositional and on both analyses the gestural inference is conditional. The crucial difference between the analyses pertains to the antecedent of the putative inferences. Specifically, according to Schlenker, the inference generated by iconic co-predicative inferences is 'conditionalized' on the assertive content of the sentence. In contrast, according to the exemplification-based analysis of co-nominal pointing, the inference generated by these gestures is conditionalized on the non-emptiness of the discourse referent that is being exemplified.

This immediately raises the question of whether one of these analyses can be reduced to the other. I have to leave the possibility of assimilating Schlenker's cosuppositional analysis to the exemplification-based analysis to future work. Here I would like to point out that a reduction in the opposite direction is probably not desirable. Suppose we make the exemplification hypothesis cosuppositional as follows.

(48) **The exemplification hypothesis, cosuppositionalized.** If a pointing gesture IX toward individual T_{IX} accompanies a quantificational noun phrase α the scope of which is β, it triggers the presupposition that if $\alpha(\beta)$ is true then $\text{T}_{\text{IX}} \in S_\alpha$.

To be concrete, we now predict the *many* example to trigger the inference in (49b), cf. the inference predicted by the non-cosuppositional version of the exemplification hypothesis in (49c).

(49) a. $\overline{\text{Many students}}^{\text{IX}}$ failed the exam. (IX to John)
b. *If there are **many** students who failed then John is one of the students who failed the exam*
c. *If there are **some** students who failed then John is one of the students who failed the exam*

The difference between the two inferences cannot be detected in the case of (49a), given the assertive content of the sentence. The two come apart, however, when (49a) is embedded in a non-veridical environment, as in (50).

(50) If the exam involved math then $\overline{\text{many students}}^{\text{IX}}$ failed. (IX to John)

a. Cosuppositional prediction: *If the exam involved math and if there are **many** students who failed then John is one of the students who failed the exam*

b. Original prediction: *If the exam involved math and if there are **some** students who failed then John is one of the students who failed the exam*

I believe that an inspection of intuitions regarding (50) reveals that the non-cosuppositional inference (50b) is more adequate. The cosuppositional version predicts that the utterance in (50) is true if the exam involved math, a few students failed but John did not. My consultants all agreed that (50) would be false in such a situation. Of course, the judgment is delicate and merits further scrutiny. I tentatively conclude, then, that *if* the cosuppositional analysis and the exemplification-based one are to be assimilated, at least one of the two options (i.e., making the exemplification hypothesis cosuppositional) is not the right approach.

On the one hand, above I pointed out that a unified approach to co-nominal pointing and iconic co-predicative gestures on the *theoretical* side is not straightforward. I would like to close this section by pointing out that, on the other hand, the two cases share substantial peculiarities. Specifically, both types of gestural enrichment show the same behavior in non-monotonic and focus-sensitive constructions.

Regarding the non-monotonic case, consider the predicate *unaware*. This predicate has a positive presupposition, (51a), and a negative assertion, (51b), making it non-monotonic in its clausal argument.

(51) Mary is unaware that some students failed.

a. *Presupposition:* Some students failed.

b. *Assertion:* It is not the case that Mary believes that some students failed.

As pointed out by Schlenker, embedding iconic gestures in the clausal complement of *unaware* leads to an interesting pattern: the gestural inference enriches the presupposition but not the assertive content of the sentence.

(52) Mary is unaware that John [punished his son]$_{\text{SLAP}}$.

a. *Presupposition:* John punished his son by slapping him

b. *Assertion:* It is not the case that Mary believes that John punished his son *(in any way)*

The same applies to co-nominal pointing.

(53) Mary is unaware that Bill failed $\overline{\text{many of his students}}^{\text{IX}}$. (IX to John)

a. *Presupposition:* Bill failed many of his students and John is one of them

b. *Assertion:* It is not the case that Mary believes that Bill failed some of his students [i.e., for all Mary knows, Bill did not fail any of his students]

Regarding the focus-sensitivity constructions, as again pointed out by Schlenker,

iconic inferences 'disappear' (or at least *can* disappear) under ellipsis, (54), and in the computation of focus-alternatives, (55).

(54) a. John [punished his son]$_{\text{SLAP}}$, and Bill did too.
⇝ Bill punished his son, in a way that is possibly different from slapping
b. John [punished his son]$_{\text{SLAP}}$, but Bill did not.
⇝ Bill did not punish his son in any way

(55) (Between John and Bill,) only John [punished his son]$_{\text{SLAP}}$.
⇝ Bill did not punish his son in any way

The same applies to co-nominal pointing.

(56) a. Mary failed $\overline{\text{many of his students}}^{\text{IX}}$, and Bill did too. (IX to John)
⇝ Bill failed many of his students, but John may not have been one of them [indeed, it could be that John is not even one of Bill's students]
b. Mary failed $\overline{\text{many of his students}}^{\text{IX}}$, but Bill did not. (IX to John)
⇝ Bill did not fail many of his students, no inference pertaining to John [indeed, it could be that John is not even one of Bill's students]

(57) (Between Mary and Bill,) only Mary failed $\overline{\text{many of his students}}^{\text{IX}}$.
(IX to John)
⇝ Bill did not fail many of his students, no inference pertaining to John [indeed, it could be that John is not even one of Bill's students]

Does this empirical similarity between pointing and iconic gestures lend support to the idea that the same mechanism underlies both cases? Perhaps, but not necessarily. Note that at least the data pertaining to focus-sensitive constructions can be replicated based on the interpretation of ϕ-features on (bound) pronouns (Heim 2008; Kratzer 2009; Sauerland 2013, a.o.).

(58) a. Mary$_i$ did her$_i$ homework, and John did too.
*⇝ John did **his** homework*
b. (Between Mary and John,) [only Mary]$_i$ did her$_i$ homework.
*⇝ John did not do **his** homework*

In this context, the case of *unaware* becomes interesting. Can we replicate (52) and (53) above with pronouns? Clearly, if a pronoun is deictic (i.e., free) this is not possible; in (59), for example, the gender feature on the pronoun cannot be ignored; the inference is inescapable that Mary knows that whoever *she* refers to is female.

(59) Mary is unaware that she is French. (*she* refers to a female passing by)

Things become more interesting when we look at data pertaining to bound pronouns. As shown below, *regardless of whether the relevant pronoun is bound by a focus-sensitive operator or not*, there is a possible reading in which the gender feature on the pronoun only enriches the presupposition.

(60) a. *Context: My father threw a big party recently. He knows that one (and, let's say, only one) friend of mine was at the party, but he does not know whether that friend of mine is male or female.*

My father is unaware that (among the people at the party) [only my friend]$_i$ brought her$_i$ partner.
⇝ *(i) My friend is, in fact, female. (ii) My father may or may not know this.*

b. *Context: My father is a famous writer, and he is coming to my class today to give a guest lecture. My students are big fans of his.*
My father is unaware that [every student of mine]$_i$ has brought her$_i$ copy of his book to sign.
⇝ *(i) All my students are, in fact, female. (ii) My father may or may not know that I have no male students.*

In the first example (60a), the gender feature on the pronoun clearly triggers the inference at root that the friend in question is female. This inference, however, need not be something that the speaker's father believes for the sentence to be true; for all he knows, the friend in question is male. Similarly, in (60b) the gender feature on the pronoun projects universally from the scope of the universal quantifier and is felt clearly at root; the truth of the sentence as a whole by no means requires the speaker's father to have any particular beliefs regarding this inference. As (60b) in particular makes clear, presuppositions triggered by (at least) the gender feature on bound pronouns, embedded under *unaware*, behave in a way that is quite similar to gestural enrichments.

Let me close this section by pointing out that, as of yet, the facts pertaining to gestures embedded in focus-sensitive and non-monotonic environments are not accounted for. Schlenker is quite explicit about this (I refer the reader to his paper), and I may as well point out that the exemplification hypothesis is no better. Finally, the facts in (60) are also not accounted for by any extant analysis of gender features in English, as far as I know. The similarity between these phenomena, then, remains a descriptive generalization at this point.

7 Conclusion and outlook

In Section 1.2, I made several limitations of this study explicit. However, even the narrow class of examples that were discussed in this paper exhibit at least one potential shortcoming of the exemplification hypothesis. Consider example (61a), from Section 4. In this example, co-nominal pointing triggers two inferences, only one of which is accounted for. Specifically, while the conditional inference is accounted for, the inference that the pointing target is one of the students is not. One might suspect that this inference comes about via exemplification of the Maximal Set (as defined in Section 2) *on top of the* Reference Set.[10] But notice that if this were the case, we would predict the inference in (61b).

(61) a. If the exam involved math, did $\overline{\text{many students}}^{\text{IX}}$ fail the exam?
⇝ *John is one of the students*

[10]In this brief discussion, I will tentatively assume that co-nominal pointing can simultaneously exemplify two distinct sets. Thus, the idea is that in (61a), co-nominal pointing exemplifies both the Maximal Set and the Reference Set. However, given the fact that the Reference Set (and the Complement Set) is a subset of the Maximal Set, this assumption might prove unnecessary; that is, it could be that in (61a), the only available inference is the one that results from exemplifying the Reference Set, but certain processes of enrichment (perhaps along the lines sketched below) apply to this inference to strengthen that part of it which pertains to the student-hood of John.

⇝ *If the exam involved math, and if there is any student who failed, it is John*

b. *If the exam involved math, and if there are any students, then John is one of the students* (predicted inference)

I will leave this problem to future work; however, I would like to point out that two independently motivated facts might conspire to generate the attested inference on the basis of the predicted inference in (61b). First, it is well-known that presuppositions triggered in the consequent of conditionals are sometimes strengthened. This is known as the proviso problem. Thus in (62) the attested presupposition at root is that John has a sister, not that if John goes to Toronto, he has a sister.

(62) If John goes to Toronto, his sister will pick him up from the airport.
⇝ *John has a sister*

One intuition about this strengthening process pertains to whether the truth or falsehood of the antecedent is relevant to that of the presupposition. Indeed, in (62), it is reasonable to think that John's having a sister is entirely independent from his going to Toronto. Going back to (61a), it seems to me equally reasonable to assume that John's being a student is entirely independent from whether or not the exam in question involved math. Thus, whatever mechanism underlies the strengthening involved in (62) might also apply to the prediction inference in (61b), generating (63). (Note, on the other hand, that we would not expect the same to apply to the other inference: whether or not the exam involved math seems to be very much relevant to whether or not John is one of the students who failed, if any.)

(63) *If there are any students, then John is one of the students*

The inference in (63) is still too weak. But this time the same reasoning may or may not be possible, depending on the details of the strengthening process. Note that in worlds in which there are no students, John cannot possibly be a student either. Regardless, I think it is reasonable to assume that *many students* triggers the inference / presupposition that there are students. If this latter inference projects to root (as intuitively it does), then the conjunction of this inference with (63) allows us to derive the inference in question.

Finally, there are obvious ways in which the present paradigm can be systematically extended in a potentially insightful way. At the moment, we have an analysis of co-nominal pointing gestures, on the one hand, and an analysis of co-predicative iconic gestures on the other. What about co-nominal iconic gesture? (Or, co-predicative pointing gestures, for the matter—I have nothing to say about this latter here.) Consider the following example (here I report my own judgments).

(64) a. [Some of my students]$_{\text{TALL}}$ are in the basketball team.
⇝ *The students of mine who are in the basketball team are tall*

b. [Not all of my students]$_{\text{SHORT}}$ are in the basketball team.
⇝ *The students of mine who are not in the basketball team are short*

To begin with, note that the inferences generated by the gestures can be paraphrased with plural anaphora, much like co-nominal pointing inferences. This is done for (64a) in (65a), and for (64b) in (65b).

(65) a. Some^{i} of my students are in the basketball team, they$_{i}$ are tall.
b. Not all^{i} of my students are in the basketball team, they$_{i}$ are short.

Furthermore, note that as in the case of both co-nominal pointing and plural anaphora, *some* does not allow the iconic gesture that co-occurs with it to access the Complement Set, even at the pain of contextual incoherence. A but more surprisingly, neither does *not all* allow the iconic gesture to predicate something of the Reference Set.

(66) a. ??[Some of my students]$_{\text{SHORT}}$ are in the basketball team.
b. ??[Not all of my students]$_{\text{TALL}}$ are in the basketball team.

These observations, as sketchy as they are, strongly suggest that co-nominal pointing and iconic gestures rely on the same underlying rule. Both predicate something of the discourse referents that the determiner makes salient; iconic gestures such as TALL and SHORT do this by predicating that the set consists of tall / short individuals, while pointing does this by predicating that the set contains the pointing target.

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