Existential presupposition projection from *none*? An experimental investigation[*]

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Abstract

The question of how presuppositions project from the scope of quantificational sentences, and in particular negative quantificational sentences such as *none* in (1), continues to be controversial, both theoretically and empirically: some theories only predict the existential presupposition projection reading in (1-a) (for example, [2, 3, 26, 13]), while others derive the universal projection reading in (1-b) ([15, 20, 21, 12, 10, 11], among others). In addition, any theory has to account for presupposition suspension, yielding an interpretation without a (global) presupposition (1-c).

(1)   None of the bears won the race.
   a.   *At least one of the bears participated and none of them won.*
   b.   *All of the bears participated and none of them won.*
   c.   *None of the bears both participated and won.*

Previous empirical studies have found evidence for universal projection ([7]), while others have provided evidence for alternatives to universal projection ([24, 14]). To our knowledge, however, there exists no definitive positive evidence for the existential reading in (1-a). We report a study that directly compares the existential, universal, and presuppositionless readings of (1) through the use of a 'covered box' picture selection task [16, 5]. We find clear evidence for existential readings (as well as presuppositionless readings), but no evidence for universal ones. This result challenges theories that predict only universal readings. Our results, taken together with those reported in [7], suggest that any adequate account of presupposition projection must be able to explain all three interpretive options in (1).

1   Introduction

There is a long-standing debate in the presupposition literature concerning the projection of presuppositions from the scope of quantifiers, and in particular of negative quantifiers such as *none* in (2) (the underlined content corresponds to the presuppositional content). While some theories predict

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existential presupposition projection (2-a) ([2, 3, 26, 13], among others), others derive universal projection (2-b) ([15, 20, 21, 12, 10, 11]).[1] Additionally, both views assume a mechanism for suspending presuppositions, in order to account for the presuppositionless interpretation in (2-c).

(2)   None of the bears won the race.
     a.   EXISTENTIAL: *At least one of the bears participated* and none of them won.
     b.   UNIVERSAL: *All of the bears participated* and none of them won.
     c.   PRESUPPOSITIONLESS: *None of the bears both participated and won.*

The present study focuses on the prediction of what we will call Universal-Only theories, stated in (3).

(3)   **Prediction of Universal-Only theories:**
Sentences like (2) only give rise to the universal projection reading (2-b) and the presuppositionless reading (2-c), but not to the existential projection reading (2-a).

[7] reports evidence from an inferential task paradigm for the universal projection reading in (2-b). Such a result is in line with the prediction in (3). More recently, [24] and [14] report evidence from truth value judgment tasks for interpretations of sentences like (2) that do not involve a universal projection reading. However, their designs do not allow us to distinguish between existential and presuppositionless readings. Their results are therefore compatible with the prediction in (3), and do not constitute a challenge for Universal-Only theories, which can capture non-universal responses to (2) through the reading in (2-c). To summarize, there exists evidence for the availability of universal projection readings of sentences like (2), compatible with (3), but there is no direct evidence for existential projection readings. Existing experimental data thus seem to be consistent with Universal-Only theories of presupposition projection in quantificational sentences.

     The present study investigates sentences like (2) and directly compares the existential and universal interpretations through the use of a 'covered box' picture selection task [16, 5]. We find clear evidence for existential projection readings and presuppositionless readings, but no evidence for universal projection readings. This result challenges the prediction of Universal-Only theories stated in (3), and, when taken together with the results of [7], indicates that accounts of presupposition projection must be able to capture all three interpretive options in (2).

     The rest of this paper is organized as follows. In 1.1, we briefly review the notions of presupposition and presupposition projection in quantificational sentences. In 1.2, we summarize the three previous studies mentioned above, and flesh out the motivation of the present study based on these previous findings. In section 2, we present our experiment and discuss the results. In section 3, we conclude with discussion of possible extensions of this work.

1.1   Theoretical background

Sentences containing expressions like *win*, *stop*, and *know* systematically give rise to inferences with certain characteristic properties, traditionally called 'presuppositions.' For example, sentences like (4-a) and (5-a) presuppose (4-b) and (5-b), respectively.

(4)   a.   Bear won.   (5)   a.   Bear stopped running.
     b.   ↝ *Bear participated*   b.   ↝ *Bear was running before*

     The first characteristic property of presuppositions is that they are generally inherited by complex sentences. For example, in contrast to standard truth-conditional meaning, the inference (4-b)(=(6-d))

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[1]Note that our Universal-Projection category encompasses both theories that predict universal projection uniformly for all quantifiers such as [15, 20, 21] and theories that make mixed predictions depending on the quantifier involved ([12, 10, 11]). As will become clearer in the discussion below, this distinction is irrelevant for the case of negative quantificational sentences, as these theories make the same universal-only prediction for these cases. Additionally, there are theories like [8] and [18], which predict both the universal and existential projection readings (see subsection 2.2.2).

'projects' from embedded environments like (6-a)-(6-c). That is, the inference remains present as an inference of the overall sentence, despite the embedding under negation, in a question, or in the antecedent of a conditional, respectively.

(6)　　a.　Bear didn't win.
　　　　b.　Did Bear win?
　　　　c.　If Bear won, he will celebrate.
　　　　d.　⤳ *Bear participated*

A second important property of presuppositions is that projection is not strictly obligatory. Presuppositions in embedded sentences can in fact be absent at the global level of the entire sentence. For example, while (6-a) generally gives rise to the inference in (6-d), it can be suspended or cancelled, as illustrated by the felicitous continuation in (7-b).

(7)　　a.　Bear didn't win.
　　　　b.　...He didn't even participate!

Without going into the details of any specific accounts, a common approach to presupposition suspension is to make it possible for the presupposition to be interpreted in the scope of negation. This operation of suspension is commonly referred to as *local accommodation* [15], as the presupposition is 'accommodated' locally in the scope of the relevant operator. If the presupposition of (7-a) is accommodated under negation, the sentence ends up with a meaning that can be paraphrased along the lines of, *It's not true that Bear participated and won.* This meaning is hence compatible with the continuation in (7-b).

　　　While the empirical picture is relatively clear for the cases in (6-a)-(6-c), the situation is more complex and controversial for quantificational sentences like (8). The central question is whether a sentence like (8) has an *existential* projection reading (8-a), a *universal* projection reading (8-b), or both (adopting the schematic notation of [7]).

(8)　　None of the bears won.　　　　　　　　　　　　　　　　$[Qx : R(x)]\ S_p(x)$
　　　　a.　EXISTENTIAL: ⤳ *At least one of the bears participated*　$[\exists x : R(x)]\ p(x)$
　　　　b.　UNIVERSAL: ⤳ *All of the bears participated*　　　　　$[\forall x : R(x)]\ p(x)$

In addition, all theories account for the presuppositionless reading of quantificational sentences (9), parallel to those for negation. As in the case of negation, we can posit a mechanism for interpreting the presupposition in the scope of the negative quantifier, yielding an interpretation that can be paraphrased as *None of the bears is such that it both participated and won*, schematically represented in (10).

(9)　　None of the bears won ...none of them even participated!

(10)　　$[Qx : R(x)]\ p(x) \wedge S_p(x)$　　　　　　　　　　　　　　PRESUPPOSITIONLESS

In sum, we can distinguish two types of theories of projection from quantifiers: Existential-Only theories predict only the existential inference in (8-a) ([2, 3, 26, 13]) and Universal-Only theories predict only the universal inference in (8-b), either for all quantifiers [15, 20, 21], or for negative quantifiers [12, 10, 11]. All existing theories predict the possibility of presuppositionless readings such as (10).

1.2　Previous studies

While experimental work on presuppositions has grown considerably in recent years (see [22] and [23] for recent overviews), we are aware of only three studies that have specifically targeted presupposition projection in quantificational sentences containing negative quantifiers.[2] We review these below.

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[2]See [25] for a study that looks at the presuppositions of possessives and *again* in the context of universal and existential quantifiers, with results that are argued to provide evidence for universal and existential presuppositions for the respective quantifiers.

1.2.1 Evidence for universal projection

[7] used an inference task to investigate quantified presuppositional sentences in French. Participants were asked to decide whether certain universal and existential inferences were 'suggested' by a variety of quantified sentences. The example in (11) illustrates the case of a universal inference involving the trigger *know* under a negative quantifier and its potential universal inference.

(11)   "None of these 10 students knows that he is lucky."
        suggests that:
        Each of these 10 students is lucky.
        No?   *Yes?*

[7] compared presupposition projection in sentences like the one in (11) with cases involving scalar implicatures like (12), which involves the potential universal inference of a negatively quantified sentence embedding a strong scalar term, *all*. Moreover, he compared cases like (11) and (12) with corresponding cases involving other quantifiers such as *every*, *some*, and *more than one*.

(12)   "None of these 10 students missed all of their exams."
        suggests that:
        Each of these 10 students missed some of their exams.
        No?   *Yes?*

In the presupposition condition, participants were reported to endorse the universal inference in the case of the negatively quantified sentences more than 80% of the time, a percentage which was significantly higher than in the cases involving other (non-universal) quantifiers. Moreover, in the case of negative quantifiers, no difference was observed between the acceptance of existential and universal inferences. Importantly, in the corresponding scalar implicature condition, the corresponding universal inference was endorsed significantly less often than the existential inference. The difference between the acceptance rate of the universal inference in negatively quantified sentences versus sentences involving other quantifiers, together with the interaction between the force of the projection inference (universal vs. existential) and the type of inference (presupposition vs. scalar implicature), provide evidence for the availability of universal projection readings in cases like (11), compatible with the prediction in (3).

1.2.2 Evidence for existential projection

In a more recent study, [24] used a truth value judgment task to investigate whether participants would judge sentences such as (13-a), involving the presupposition trigger *both* in the scope of *none*, to be good descriptions of pictures that falsified the universal projection reading (13-b), i.e. where one of the depicted circles had only one square in its cell. Nonetheless, [24] found that around half of the participants were happy to accept (13-a) as a description of the picture. This result suggests that at least some speakers allow non-universal projection readings for sentences like (13-a).

(13)   a.   None of these three circles have the same color as both of the squares in their own cell.
        b.   UNIVERSAL: ⤳ *All of the circles have exactly two squares in their own cell*

In a similar study, [14] report evidence for non-universal projection readings of *none*-sentences. In the relevant condition, participants saw pictures where, for instance, four of five circles were connected to a square (always of a different color). They then had to answer 'True', 'False', or 'Don't know' to the description in (14). Participants accepted such sentences more than 92% of the time (Experiment 1), despite their being false on the universal projection reading in (14-b).[3]

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[3]Note that [14] were primarily interested in the possibility of restricting the domain of universal quantification to those individuals that satisfy the presupposition of the scope of the quantifier. Domain restriction is indeed an important variable which interacts with (what appears to be) a universal versus an existential projection inference. [7] used an explict partitive to control for domain restriction (*among these ten students, none of them...*). We also explicitly introduced the domain using an overt numeral in the description of the context

(14)   a.   No circle has the same color as the square to which it is connected.
        b.   UNIVERSAL: ⇝ *All of the circles are connected to a square*

In sum, both of these studies provide evidence for non-universal projection. However, they do not allow us to distinguish between existential projection and presuppositionless readings, and therefore they leave open the status of the prediction in (3). We turn next to our experiment, which aimed to directly assess whether existential projection readings exist, allowing us to test the prediction in (3).

2   Experiment

Our experiment investigated the possible interpretations of sentences like (15), and in particular focused on the prediction of Universal-Only theories, repeated below in (3).

(15)   None of the bears won the race.
        a.   EXISTENTIAL: *At least one of the bears participated and none of them won.*
        b.   UNIVERSAL: *All of the bears participated and none of them won.*
        c.   PRESUPPOSITIONLESS: *None of the bears both participated and won.*

(16)   **Prediction of Universal-Only theories:**
        Sentences like (15) only give rise to the universal projection reading (15-b) and the presuppositionless reading (15-c), but not to the existential projection reading (15-b).

We presented recordings of sentences like (15), accompanied by pictures that varied in whether *none* or *only some* of the bears participated. Notice that both of these contexts are equally *incompatible* with the reading in (15-b), and equally *compatible* with the reading in (15-c). Based on (16), which predicts (15-b) and (15-c) to be the only possible interpretations of (15), we thus expect no effect of the context manipulation. In contrast, if the existential projection reading in (15-a) exists, a difference based on context could emerge if that reading is more readily available than (15-c), since (15-a) is compatible with the *only some* context but not with the *none* context.

2.1   Methods

2.1.1   Participants

We tested 36 native speakers of English, recruited through Amazon Mechanical Turk. Participants took about 10 minutes to complete the task, and received $1 for their participation.

2.1.2   Materials & procedure

We used a Covered Box paradigm ([16]), adapting the designs of [24] and [5]. Participants were presented with sentences like (15), accompanied by two images, and were instructed to choose the image they thought matched the sentence. Crucially, one image was visible, and one was introduced to participants as 'hidden' (behind a black square). Participants were expected to select the visible image if it was consistent with the sentence, and the covered image otherwise. Each trial included a context followed by a target, as illustrated in (17); see Figure 1 for the accompanying images. The inclusion of the context picture and description was meant to improve felicity of the target sentence, and, more importantly, to control for domain restriction by explicitly introducing the three relevant animals (e.g, *these three bears...*), which are described both in the context and the target picture.

(17)   *Context (Fig. 1a):* In the morning race, these three bears did really well, and in the end one of them won. I thought they would do well later in the day as well, but. . .
        Target (Fig. 1a or 1b): None of the bears won the afternoon race.

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immediately preceding the target sentence (see section 2.1.2).

There were two kinds of target pictures, as illustrated by the images in Figures (1b) and (1c). Participants were presented with either (b) or (c) alongside a black box representing the *covered* picture. OnlySome targets (c) were inconsistent with the universal projection reading (that all bears participated), but consistent with the existential projection reading (that at least one bear participated) and with the presuppositionless reading (that no bear both participated and won). Covered picture choices in this condition therefore indicated access to a universal projection reading. The NoRunner targets (b) were inconsistent with the existential and universal projection readings, but consistent with the presuppositionless reading. Visible picture choices in this condition therefore indicated the availability of the presuppositionless reading, while covered picture choices indicated access to one of the other two readings. Since covered picture choices indicate presuppositional readings, we will present the results in terms of the rate of *covered picture* selections.

The prediction of Universal-Only theories is that participants should choose the covered picture equally often in both conditions, since they do not assume an existential reading. Both target pictures are only expected to be acceptable if a presuppositionless reading can be accessed. In contrast, if existential projection is possible, acceptance of (c) does not require access to the presuppositionless reading, while (b) does. Assuming the existential reading is more readily available than the presuppositionless one (given that local accommodation is commonly assumed to be dispreferred), we would expect different response patterns for (b) and (c).
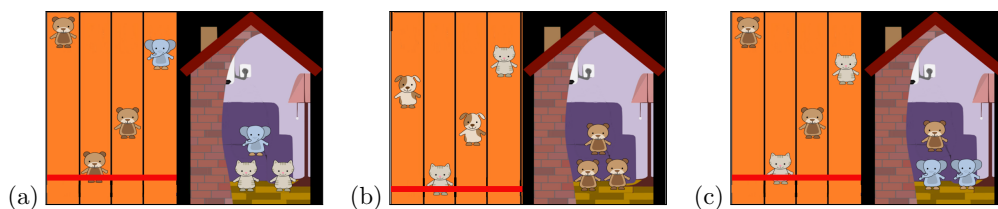

Figure 1: Sample target images accompanying (17). (a) depicts the context image; (b) depicts the *visible* picture on a NoRunner target; (c) depicts the *visible* picture on an OnlySome target. On a given trial, (b) or (c) was presented alongside a *covered* picture.

The two critical test conditions were presented in blocks with order counterbalanced across participants. All participants received four OnlySome targets and four NoRunner targets, as well as two clearly true and two clearly false controls in which the universal presupposition was satisfied, i.e. where all of the bears participated in the race, and one of them won (False control) or none of them did (True control). These control conditions provided a baseline for identifying presuppositionless and universal readings. The presuppositionless reading was compatible with the NoRunner targets but not with the False controls. Greater acceptance on NoRunner targets than on False controls was therefore indicative of presuppositionless readings. On the other hand, the universal projection reading was compatible with the True controls but not with the OnlySome targets (the other two readings were compatible with both). Greater rejection on OnlySome targets than on True controls was therefore indicative of universal projection readings. Finally, eight additional true/false controls were included in order to make sure that participants could correctly identify who had participated in a given race, and to ensure that participants could respond correctly to non-presuppositional sentences containing *none* and *participate*.

Response times (RTs) for response choices were also collected, in particular because previous experimental work on presupposition ([9, 19, 4], among others) suggests that presuppositionless responses are associated with delays in response times. This measure therefore has the potential to provide further information about the nature of the readings on which responses are based.
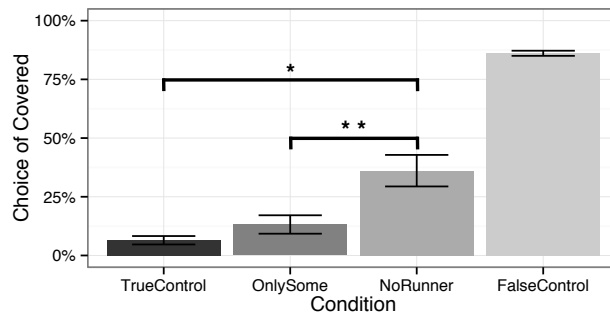
Figure 2: Percentage of covered picture selections in target and control conditions. Covered picture selections indicated access to universal projection readings in the ONLYSOME condition, and to either universal or existential projection readings in the NORUNNER condition.

2.2 Results & Discussion

2.2.1 Summary of results

Figure 2 presents the mean percentages of covered picture choices in the target and control conditions. A mixed-effect logistic regression using the maximal random effects structure that would converge ([1]), with random intercepts for participants and items, revealed more covered picture selections in the NORUNNER target condition than in the ONLYSOME target condition ($p < .01$) or the TRUE control condition ($p < .05$). The latter two conditions did not differ significantly from each other. The NORUNNER target condition also yielded significantly fewer covered picture selections than the FALSE control condition ($p < .01$).

For purposes of RT analyses, trials with RTs greater than two standard deviations above the mean were removed from the data (constituting 4.2% of the data, with equal distribution across NORUNNER and ONLYSOME conditions). A mixed-effect regression analysis, with random intercepts for participants and items, revealed that *visible* picture selections in the NORUNNER condition took significantly longer than in the ONLYSOME condition ($M = 4241ms$ vs. $M = 3855ms$; $\beta = -417.8$, $SE = 174.2$, $t = -2.398$).

2.2.2 Discussion

The greater rate of covered picture choices in the NORUNNER target condition, as compared to the ONLYSOME target condition, provides direct evidence for the existence of an existential projection reading. In contrast, we found no evidence that participants accessed a universal projection reading, with no significant differences observed between the ONLYSOME target and TRUE control conditions. The evidence for existential readings runs counter to the Universal-Only prediction in (16), and is therefore problematic for theories committed to this prediction ([15, 20, 21, 12, 10, 11], among others). Our results also provide evidence for the existence of a presuppositionless reading, as the visible picture was selected in the NORUNNER condition over 60% of the time. This interpretation can be accounted for in terms of local accommodation. The RT results further support the notion that acceptance in the NORUNNER condition requires local accommodation, whereas acceptance in the ONLYSOME condition does not; the relative RT delay for acceptances in the former condition is in line with previous findings of delays for local accommodation-based responses ([9, 19, 4]).

Our findings are in line with recent evidence for non-universal projection ([24, 14]). Unlike

the previous studies, however, we distinguish between genuine existential projection and presuppositionless readings, and find evidence for both interpretations. At this point, the relationship between our results and those of [7] deserves more discussion. While [7] found evidence for universal rather than existential projection readings, our results yielded the opposite pattern, with evidence for the latter but not for the former. Two points are worth highlighting here: first, these results are not necessarily incompatible, as each only provides positive evidence for one interpretation, and fails to provide direct evidence for the other (rather than providing direct evidence against it). Second, the two sets of studies utilized very different tasks, namely an inference-based task [7] and a picture selection task ([24, 14], and the present study), which could affect the outcomes. Moreover, Chemla's evidence for universal projection arose from the comparison between *none* and other quantifiers, and between presuppositions and scalar implicatures. Further investigation into potential effects of the different tasks, as well as the different quantifiers and environments, is therefore required in order to better understand the relationship between the two sets of results.

As things stand, both results need to be accounted for: (18) can be associated with the inference in (18-a) or the one in (18-b) (in addition to the presuppositionless reading).

(18)   None of the bears won.

      a.   ⤳ *At least one of the bears participated*

      b.   ⤳ *All of the bears participated*

This situation is, prima facie, equally incompatible with Universal-Only and Existential-Only theories. Both kinds of theories would have to be supplemented in such a way as to account for the respective missing readings. One way of accounting for all of the relevant results then is to try to spell out what these supplementary assumptions might be. For example, a Universal-Only theory could include a further mechanism that weakens the universal presupposition in a manner distinct from local accommodation, for example through domain restriction. Similarly, proponents of an Existential-Only theory could try to capture the apparent universal effect reported in [7] by appealing to additional reasoning beyond what presupposition projection yields. For instance, in an inference task, participants may find a uniform scenario where all individuals in the domain of the quantifier are homogeneous with regards to the presupposition more plausible on independent grounds. These possibilities need to be assessed in greater detail, particularly in relation to other aspects of the results, such as the reaction times and results for the other quantifiers.

Another way to deal with the emerging empirical picture is to build the option of both readings into the presupposition projection mechanisms themselves. As mentioned above, 'mixed' theories exist, according to which the force of the projection inference depends on the quantifier involved. Trivalent theories such as [12, 10, 11] fall into this category. However, while these theories make more nuanced predictions than 'pure' Universal-Only theories, by varying the force of projection with the quantifier, they make the same prediction for the present case (see [24] for discussion) and therefore do not fare better in explaining our results.[4]

Scalar implicature-based theories of presupposition, on the other hand, such as [8] and [18], do in principle predict both a universal and an existential reading for sentences like (18), and

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[4]To be more precise, in addition to the universal and presuppositionless readings, these trivalent theories also predict the disjunctive presupposition reading in (i), which is weaker than the universal reading and stronger than the existential one. However, all of our targets were such that none of the bears won, so (i) in such contexts becomes equivalent to the universal reading, *All of the bears participated and none of them won.*

(i)   ⤳ *Either all of the bears participated and none of them won, or at least one bear participated and won*

are therefore more compatible with our results. However, by assimilating presuppositions to scalar implicatures (in particular presupposition triggers like *win* to scalar terms like *all*), such theories face challenges of their own. First, they need to explain [7]'s observed difference in the frequency of universal readings in the case of presuppositions and in the corresponding cases of scalar implicature, discussed in subsection 1.2.1. Second, data from different populations ([5, 17], among others) suggest differences between presuppositions and scalar implicatures that are unaccounted for by scalar implicature-based theories of presupposition.

3   Conclusion & Extensions

The goal of the present study was to assess the Universal-Only prediction in (16), by investigating the interpretation of sentences containing a presupposition trigger in the scope of the negative quantifier *none*. Our experiment revealed evidence for existential projection readings, and therefore provides evidence against the prediction in (16). Our results, taken together with those of [7], suggest that both universal and existential projection readings of such sentences need to be accounted for.

In comparing the different findings from the two studies, a further option to consider is that these are due to the fact that different presupposition triggers were used. Indeed, various authors have argued for differences between triggers with respect to the force of universal projection ([6, 11, 27]).[5] A promising next step then is to use both types of tasks with the relevant triggers, for example investigating *win* using an inferential task instead, and, conversely, investigating *stop*, one of the triggers used in [7]'s study, using a Covered Picture paradigm.

Finally, child language data may also be informative for our research questions. [5] report that children, unlike adults, tend not to access local accommodation readings under negation. Recall that in our paradigm, acceptance in the NoRunner condition requires local accommodation (of the existential presupposition), while acceptance in the OnlySome condition does not. [5]'s results would therefore lead us to expect that children tested on the current paradigm would select the visible image in the OnlySome condition but not in the NoRunner condition. Such a behavioral pattern in children would corroborate our interpretation of the present data.

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