

You must worry!

The interpretation of *mustn't* varies with context and verbal complement

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Abstract. We investigate experimentally whether American English (AE) adult speakers are influenced in their interpretation of *mustn't* by pragmatic context (contexts favoring *lack of necessity/necessity not to* readings) and/or the semantic properties of the verbal complements of the modal (verbs denoting events in the physical realm vs. verbs expressing undesirable mental activities). In an experiment combining a forced choice task and a gradient acceptability task, participants saw sentences containing *mustn't* and physical events/negative mental activities in *lack of necessity/necessity not to* contexts (e.g., *You mustn't worry. The woman will give you money*) They had to choose the most suitable interpretation of *mustn't* ('it is necessary not to'/'it is not necessary' interpretations). They then had to rate the acceptability of the sentences containing *mustn't* in context on a Likert scale from 1 to 7. We find that participants split into two groups: an Interdiction Group, which always treated *mustn't* as expressing interdiction, and a Variation Group, which tended to interpret *mustn't* as lack of necessity when the context favored such a reading and when the verbal complement the modal combined with was a negative mental activity. We argue that the *lack of necessity* reading of *mustn't* is obtained via pragmatic weakening from its primary interdiction reading, and that this process is sensitive to context, as well as to the cognitive difficulty of imposing or forbidding mental (but not physical) activities to others.

Keywords. American English; deontic modality; deontic necessity; negation; interdiction; context-sensitivity; mental activities

1. Introduction. In the current paper, we investigate experimentally how *mustn't* is interpreted in AE, probing into whether such interpretation may vary with pragmatic context and the semantic properties of the verb taken as a complement by the modal. While *mustn't* is generally assumed to express interdiction (as in *You mustn't smoke*), context and verbal semantics may lead to a weaker interpretation akin to *needn't*. Regarding pragmatic context, we are interested in whether AE speakers interpret *mustn't* differently depending on whether the pragmatic context of the utterance favors a *lack of necessity* reading or a *necessity not to* reading, in a similar fashion to how speakers vary their interpretation of scalar items depending on context (Ronai & Xiang 2020). For instance, (1a) exemplifies a *lack of necessity* context: it is not necessary to eat the bread today, since it will be good to eat tomorrow as well. (1b), on the other hand, exemplifies a

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necessity not to context: it would be ideal not to eat the bread since there should be enough bread for the visitors when they come over.

- (1) a. Tom mustn't eat the bread. It won't go stale by tomorrow. (*lack of necessity* context)
- b. Tom mustn't eat the bread. They have visitors coming over. (*necessity not to* context)

Regarding the semantic properties of the modal complement, we are interested in whether AE speakers interpret *mustn't* differently depending on whether the lexical verb expresses a non-beneficial/negative mental activity or a physical event. Speakers may be more likely to interpret *mustn't* as *needn't* when the verbal complement of the modal expresses a negative mental activity, which may be more difficult to control than an event in the physical realm:

- (2) a. He mustn't panic. The teacher will give the class an easy test. (*lack of necessity* context)
- b. He mustn't panic. The bears will attack him otherwise. (*necessity not to* context)

2. Background.

2.1. BACKGROUND ON MODALITY AND NEGATION IN ENGLISH. English modals display an irregular behaviour in interaction with negation. While negation has a fixed position in English (i.e., always after a modal), its semantics is variable (i.e., the negation may scope below/above modality). This is true for different modals (3 a, b), as well as different flavors of the same modal (deontic & epistemic-3 b, c) (Palmer 1995).

- (3) a. The boy must not/mustn't go to the party. (OBLIGATION>NOT)
- b. The girl may not in the park this evening. (NOT>PERMISSION)
- c. The girl may not be doing her homework. (POSSIBLE>NOT)

Various attempts at generalizations have been put forth, either in terms of the possibility/necessity distinction (Cormack & Smith 2002), or in terms of the deontic/epistemic modality distinction (Coates 1983, Picallo 1990), but, as pointed out by these authors themselves, there are always exceptions to these generalizations. Moreover, it is unclear what *n't* and *not* represent from a syntactic point of view (sentence or adverbial negation). In the ideal situation, sentence negation translates as external negation (NEG>MODALITY), and adverbial negation translates as internal negation (MODALITY>NEG) — see Palmer (1995), for instance. However, we find cases where what looks like sentence negation (*n't*) expresses internal negation (see (3a)).

2.2. BACKGROUND ON THE MEANING OF *MUST* IN INTERACTION WITH NEGATION. Deontic *must not* and *mustn't* are generally argued to express interdiction (Coates 1983, Palmer 1995, Papafragou 2000, Huddleston & Pullum 2002, Cormack & Smith 2002 a.o).

- (4) You must not/mustn't smoke.

However, in special polarity-sensitive contexts like contrastive negation (Israel 1996, Homer 2011, Iatridou & Zeijlstra 2013, Zeijlstra 2017, a.o.), deontic necessity scopes below negation:

- (5) No student **MUST** read 5 articles on the topic but one student is encouraged to do so.
 Meaning “It is not necessary that all students read 5 articles on the topic but one student is encouraged to do so.”

In polarity-neutral contexts, however, there seems to be general consensus that deontic *must not* and *mustn't* lead to an interpretation where deontic necessity scopes above negation. In the case of *must not*, this interpretation could be explained by arguing that *not* is actually adverbial negation, negating the verbal complement rather than sentence negation. In the case of *mustn't*,

however, such an explanation cannot hold, given that *n't* is a clear marker of sentence negation. Consequently, we are in a situation where there seems to be no transparent mapping between syntax and semantics. From a syntactic point of view, *n't* negates the modal, while, from a semantic point of view, it negates the verbal complement of the modal.

Our question is whether *mustn't* always expresses interdiction or whether it can also express lack of necessity in combination with certain verbs and in certain contexts. With this aim in mind, we conducted a search in the Contemporary Corpus of American English (COCA, Davies 2008) for examples from AE containing *mustn't*, which are odd under an interdiction reading. We draw attention to cases such as (6), which are not (obviously) polarity-dependent, and which seem to involve *lack of necessity* contexts and negative mental activity verbs.

- (6) a. You *mustn't* worry about money. I'll cover all your expenses.
 b. Don't worry. I'll always take care of you. You *mustn't* worry about being old.
 c. Every man is to find his own strength. When you meet hardships you *mustn't* panic, no matter how big the challenge is.

Interestingly, *mustn't* worry is less frequent than *needn't* worry, which always expresses a *lack of necessity* meaning (*mustn't* worry occurs in 38 examples in COCA, whereas *needn't* worry occurs in 248 examples). In the examples where it does occur with mental verbs such as *worry* (6), *mustn't* seems to be interpreted more like *needn't*, such that deontic necessity scopes below negation. Since *n't* is typically a marker of sentence negation, *mustn't* may be more prone to a *lack of necessity* interpretation than *must not*, while *not* is ambiguous between sentence or adverbial negation depending upon stress. This idea seems to be supported by the fact that, *must not* worry is quite infrequent, being found only in 5 examples (see 7).

- (7) We must not worry about them. God is responsible for dealing with them.

Cases where *mustn't* has a similar interpretation to *needn't* are problematic for the semantics of *mustn't*, and it is not clear whether the different scope relations obtaining between deontic necessity and negation in such cases are a consequence of the *lack of necessity* context, the semantics of the verbal complement or of both.

3. Current experiment. To get a clearer picture of the effect of pragmatic context and the semantics of the verbal complement upon the interpretation of *mustn't*, we decided to conduct an experiment on AE adult speakers where we explicitly manipulate these factors.

3.1. PREDICTIONS. As far as context is concerned, if the scope of negation and deontic necessity in *mustn't* is fixed, then we expect the lack of necessity interpretation in both types of contexts. If, however, the scope of negation and deontic necessity in the case of *mustn't* is sensitive to context, *lack of necessity* contexts should lead to a *lack of necessity* reading of *mustn't*, while *necessity not to* contexts should lead to a *necessity not to* reading.

As far as verbal complement semantics is concerned, we predict that, from a cognitive perspective, it should be harder to forbid someone not to experience a certain negative mental state (like worry or panic) than to forbid them to do a certain action (like eating bread), because people have less control over their emotions than over their actions. Thus, we expect participants to interpret *mustn't* followed by negative mental activities as a suggestion rather than an interdiction. However, the opposite effect might be expected if one considers the contrast relation between *mustn't* and *needn't*, more specifically, the high frequency of *needn't* in combination with negative mental states compared to *mustn't* (*needn't* worry occurs in 248 examples in COCA, while *mustn't* worry only in 38).

3.2. PARTICIPANTS Using Mechanical Turk, we collected and analyzed answers from 34 AE adult speakers (Age range: 18-63, Mean age: 36;8). Participants received monetary compensation for completing the experiment.

3.3. METHODOLOGY The experiment was preceded by a warm-up, where participants read 4 acceptable or unacceptable sentences that contained either negative imperatives or the negative of *have to*. Participants had to interpret such sentences in terms of paraphrases of the type ‘it is necessary not to’ or ‘it is not necessary’. They were also asked to judge how acceptable these sentences were to them on a Likert scale from 1 to 7. Importantly, half of the sentences represented an inadequate use of the imperative or *have to* in order to increase participants’ attentiveness. Table 1 exemplifies one such warm-up sentence containing a negative imperative.

Forced Choice Task								
In <i>Don't be tall! There are enough tall people in the room</i> , the sentence <i>Don't be tall!</i> means:								
a. It is necessary that you are not tall.								
b. It is not necessary that you are tall.								
Acceptability Judgment Task (on a Likert scale from 1 to 7)								
How acceptable do you think the sentence <i>Don't be tall!</i> is in the context <i>Don't be tall! There are enough tall people in the room</i> ?								
(Fully unacceptable)	1	2	3	4	5	6	7	(Fully acceptable)

Table 1: Sample warm-up items

Our experiment combined a forced choice task and a gradient acceptability task for 8 critical sentences containing *mustn't* and 16 control sentences containing *needn't* and *shouldn't*. Just as in the warm-up, participants had to first choose the most adequate interpretation of a sentence (either ‘it is necessary not to’ or ‘it is not necessary’), and then judge the acceptability of that sentence on a Likert scale from 1 to 7. The critical sentences used different verb types (mental/physical) in different pragmatic contexts (*lack of necessity/necessity not to*). Participants saw verbs occurring in only one context. For each verb type, 4 verbs were tested: negative mental verbs such as *worry*, *panic*, *be sad*, *be upset* and physical verbs such as *eat*, *drink*, *do*, *speak*. Half of the sentences had 2nd person pronouns, and half 3rd person pronouns. In the critical conditions, participants read a sentence containing *mustn't* and had to choose the most suitable interpretation (either ‘it is necessary not to’ or ‘it is not necessary’ interpretations — see Table 2 and Table 3 for examples involving both mental and physical activities). They then had to rate the acceptability of the sentence in context on a Likert scale from 1 to 7.

Forced Choice Task								
Lack of necessity context: In <i>You mustn't worry. The woman will give you money</i> , the sentence <i>You mustn't worry</i> means:								
Necessity not to context: In <i>You mustn't worry. You will get sick otherwise</i> , the sentence <i>You mustn't worry</i> means:								
a. It is necessary that you do not worry.								
b. It is not necessary that you worry.								
Acceptability Judgment Task (on a Likert scale from 1 to 7)								
Lack of necessity context: How acceptable do you think the sentence <i>You mustn't worry</i> is in the context <i>You mustn't worry. The woman will give you money</i> ?								
Necessity not to context: How acceptable do you think the sentence <i>You mustn't worry</i> is in the context <i>You mustn't worry. You will get sick otherwise</i> ?								
(Fully unacceptable)	1	2	3	4	5	6	7	(Fully acceptable)

Table 2: Sample critical items for combining *mustn't* with a mental activity verb

Forced Choice Task								
Lack of necessity context: In <i>You mustn't drink alcohol. You are already in good spirits</i> , the sentence <i>You mustn't drink alcohol</i> means:								
Necessity not to context: In <i>You mustn't drink alcohol. It will make you feel sick</i> , the sentence <i>You mustn't drink alcohol</i> means:								
a. It is necessary that you do not drink alcohol.								
b. It is not necessary that you drink alcohol.								
Acceptability Judgment Task (on a Likert scale from 1 to 7)								
Lack of necessity context: How acceptable do you think the sentence <i>You mustn't drink alcohol</i> is in the context <i>You mustn't drink alcohol. You are already in good spirits</i> ?								
Necessity not to context: How acceptable do you think the sentence <i>You mustn't drink alcohol</i> is in the context <i>You mustn't drink alcohol. It will make you feel sick</i> ?								
(Fully unacceptable)	1	2	3	4	5	6	7	(Fully acceptable)

Table 3: Sample experimental items for combining *mustn't* with a physical activity verb

Just as the critical sentences, the control sentences also used both types of verbs (mental/physical activities) in either acceptable or unacceptable contexts (see Tables 4 and 5). Just as the warm-up sentences, the controls represented a useful measure of participants' attention. Participants were expected to generally interpret sentences with *needn't* as expressing a *lack of necessity* meaning, while interpreting sentences with *shouldn't* as expressing a *necessity not to* meaning. Moreover, participants were expected to rate odd sentences as less acceptable.

Forced Choice Task								
In <i>Tom needn't be offended. The woman didn't want to insult him at all</i> , the sentence <i>Tom needn't be offended</i> means:								
a. It is necessary that Tom is not offended.								
b. It is not necessary that Tom is offended.								
Acceptability Judgment Task (on a Likert scale from 1 to 7)								
How acceptable do you think the sentence <i>Tom needn't be offended</i> is in the context <i>Tom needn't be offended. The woman didn't want to insult him at all</i> ?								
(Fully unacceptable)	1	2	3	4	5	6	7	(Fully acceptable)

Table 4: Sample control item with *needn't* in an adequate *lack of necessity* context

Forced Choice Task								
In <i>You needn't sweep the floor. It is very dirty</i> , the sentence <i>You needn't sweep the floor</i> means:								
a. It is necessary that you sweep the floor.								
b. It is not necessary that you sweep the floor.								
Acceptability Judgment Task (on a Likert scale from 1 to 7)								
How acceptable do you think the sentence <i>You needn't sweep the floor</i> is in the context <i>You needn't sweep the floor. It is very dirty</i> ?								
(Fully unacceptable)	1	2	3	4	5	6	7	(Fully acceptable)

Table 5: Sample control item with *needn't* in an inadequate *necessity not to* context

3.4. RESULTS. We first take a look at participants' answers for control sentences. Participants generally interpret controls with *needn't* as expressing *lack of necessity* meanings (at a rate of 74.3% for pragmatically adequate sentences and 70.9% for sentences where *needn't* is pragmatically inadequate). However, in terms of acceptability, they give pragmatically adequate sentences with *needn't* a 6.05 rating, while they give pragmatically inadequate sentences with *needn't* a lower rating (3.76). In terms of response times, following Ronai & Xiang (2020), we removed the trials with extremely long and short responses, eliminating the top and bottom 2.5% of the data. Looking at the response times in the forced choice task, we find participants take longer to interpret pragmatically inadequate sentences with *needn't* (8659ms) compared to

pragmatically adequate sentences with *needn't* (6496ms). Looking at the response times in the acceptability task, we find that participants also take longer to judge the acceptability of pragmatically inadequate sentences with *needn't* (2833ms) compared to pragmatically adequate sentences with *needn't* (2314ms). As far as control sentences with *shouldn't* are concerned, we find that participants mostly interpret them as expressing *necessity not to* meanings in pragmatically adequate contexts (at a rate of 60.81%), as well as in pragmatically inadequate contexts (at a rate of 65.54%). In terms of acceptability, they rate pragmatically inadequate sentences with *shouldn't* as 3.74, a lower rating than for pragmatically adequate sentences (5.88). In terms of response times, they take slightly longer to provide interpretations for pragmatically inadequate sentences with *shouldn't* (9772ms) than for pragmatically adequate ones (9217ms). Moreover, they take longer to judge the acceptability of pragmatically inadequate sentences with *shouldn't* (3189ms) compared to pragmatically adequate ones (2441ms). Overall, the answers provided by participants in the control sentences suggest that participants were attentive when interpreting and evaluating the sentences they read. For this reason, we decided not to remove any participants from the data analysis.

We next consider the answers provided by participants for the critical trials containing *mustn't*. A look at the overall answers reveals a higher rate of *necessity not to* readings of *mustn't* in *necessity not to* contexts compared to *lack of necessity* contexts (Figure 1). Moreover, in *lack of necessity* contexts, participants seem to interpret *mustn't* as expressing a *lack of necessity* meaning more with mental verbs than with physical verbs.

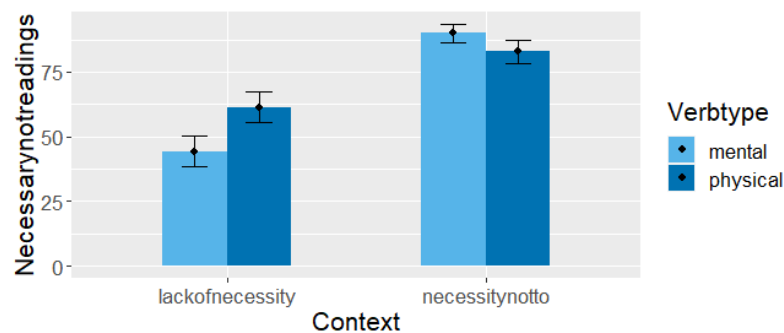


Figure 1: *Necessity not to* readings overall

Interestingly, participants found the use of *mustn't* in context quite natural, since *mustn't* was rated as very acceptable in both *necessity not to* (6.11) and *lack of necessity* contexts (5.44), with *mustn't* being rated slightly higher in *necessity not to* contexts. This suggests that both *necessity not to* and *lack of necessity* readings are available to AE adult speakers.

We also look at response times, keeping in mind, however, that they should be taken with caution. Since we did not control for sentence length, contexts with physical verbs were sometimes longer, involving more words and transitive verbs, which may have affected the results in the forced choice task and the acceptability judgment task. In the forced choice task, participants took longer to interpret answers in *lack of necessity* contexts (8194ms) compared to *necessity not to* contexts (6232ms). In *necessity not to* contexts, participants took slightly longer to interpret *mustn't* when combined with physical verbs (6650ms) compared to mental verbs (5813ms). In *lack of necessity* contexts, participants took longer to interpret *mustn't* when combined with physical verbs (9342ms) than with mental verbs (7045ms).

In the rating task, participants took longer to rate answers in *lack of necessity* contexts (3445ms) compared to the *necessity not to* contexts (3015ms). In *necessity not to* contexts, par-

Participants took slightly longer to rate *mustn't* when combined with mental verbs (3093ms) compared to physical verbs (2938ms). In *lack of necessity* contexts, participants took longer to rate *mustn't* when combined with physical verbs (4285ms) than with mental verbs (2606ms).

In order to see whether the variation in the forced choice answers characterizes every participant or only some, we also looked at the answers provided by individual participants. We notice that all participants seem to converge in their interpretation of *mustn't* as expressing a *necessity not to* meaning in *necessity not to* contexts, but that there seems to be interparticipant variation in the interpretation of *mustn't* in *lack of necessity* contexts. 15 participants, who we shall refer to as the *Interdiction Group*, interpret *mustn't* as expressing *lack of necessity* in *lack of necessity* contexts more than 75% of the time (see Figure 2). 19 participants, who we shall refer to as the *Variation Group*, were more context-sensitive, providing more *lack of necessity* readings than *necessity not to* readings in *lack of necessity* contexts, especially with mental verbs (see Figure 3). Interestingly, the Interdiction Group judged sentences in *necessity not to* contexts as 5.95 on a Likert scale from 1 to 7, while rating sentences in *lack of necessity* contexts as 5.01. In contrast, the Variation Group judged sentences in *necessity not to* contexts as 6.23 on a Likert scale from 1 to 7, while rating sentences in *lack of necessity* contexts as 5.75. The Variation Group was thus more at ease with the use of *mustn't* in both *lack of necessity* and *necessity not to* contexts, while the Interdiction Group judged the use of *mustn't* in *lack of necessity* contexts to be somewhat less acceptable.

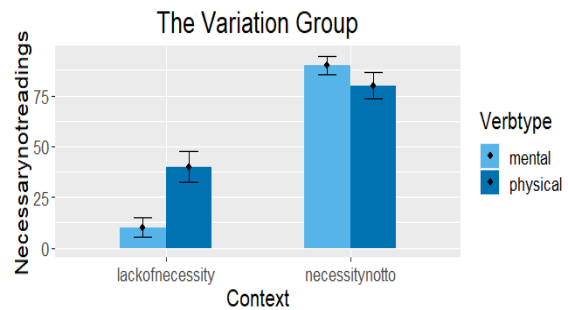
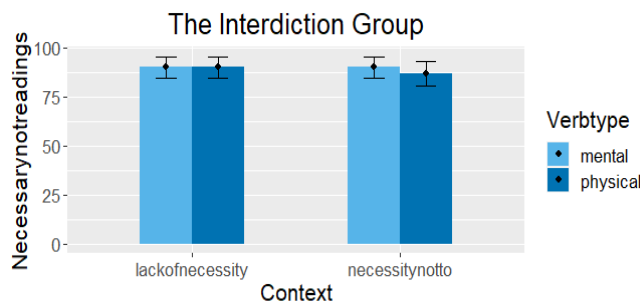


Fig. 2: Necessity not rates (Interdiction Group) Fig. 3: Necessity not rates (Variation Group)

In terms of the response times in the forced choice task, participants from the Interdiction Group took longer to interpret mental verbs compared to physical verbs in both *necessity not to* contexts (7508ms>6684) and *lack of necessity* contexts (7101ms>5937ms). Participants from the Variation Group took longer to interpret *lack of necessity* contexts (5566ms) compared to *necessity not to* contexts (9411ms). In *necessity not to* contexts, the Variation Group took slightly longer to interpret *mustn't* and physical verbs (5990ms) compared to mental verbs (5142ms). In *lack of necessity* contexts, the Variation Group took longer to interpret *mustn't* and physical verbs (1109ms) compared to mental verbs (7813ms).

In terms of Likert rating times, the Interdiction Group was generally slower in rating *mustn't* in combination with physical verbs than with mental verbs in both *necessity not to* contexts (4195ms>3063ms) and *lack of necessity* contexts (5146ms>2776ms). In contrast, the Variation Group was faster in rating *mustn't* with mental verbs (2489ms) than with physical verbs (3644ms). However, in *necessity not to* contexts, the Variation Group was faster in rating *mustn't* with physical verbs (1970ms) compared to mental verbs (3116ms).

It is not clear whether the response times differences presented above bear statistical significance, but, at a first glance, both the response times in the forced choice task and the Likert

rating times seem to suggest that the Variation Group is somewhat more sensitive to context and the type of verb compared to the Interdiction Group.

In terms of statistical analysis, we first conducted an overall analysis of the data. Using R 4.0.5 (2021), we fitted a generalized mixed effects model with Answer in the forced choice interpretation task as a dependent variable (DV), coded as 1 if sensitive to context and 0 in case not, and Verb Type (Mental/Physical), Context (*Necessity not to/Lack of necessity*) and their interaction as fixed effects and random slopes per Item and Participant. We found a significant effect for Context ($\beta = 3.098$, $SE = 0.851$, $Z = 3.640$, $p < .01$) and the interaction between Verb Type and Context ($\beta = -1.926$, $SE = 0.943$, $Z = -2.040$, $p < .05$). Participants gave fewer *necessity not to* readings in *lack of necessity* contexts and with *mental* verbs. Interestingly, in *necessity not to* contexts, there is no difference in answers depending on the Verb Type.

To see whether acceptability ratings vary with Context and Verb Type, we fitted a linear mixed effects model with Likert rating as a DV and Verb Type (Mental/Physical), Context (*Necessity not to/Lack of necessity*) and their interaction as fixed effects and random slopes per Item and Participant. We found a significant effect for the interaction between Verb Type and Context ($\beta = -1.557$, $SE = 0.348$, $df = 5.009$, $t = -4.463$, $p < .01$). While there was no significant difference in ratings for *mustn't* in combination with physical or mental verbs in *necessity not to* contexts (*mustn't* + physical verb was rated 6.19, *mustn't* + mental verb was rated 6.04), there was a significant difference in these ratings in *lack of necessity* contexts: participants rated *mustn't* combined with physical verbs as 4.74, much lower than *mustn't* combined with mental verbs (6.13)

We also looked at response times for *lack of necessity* interpretations in the forced choice task: we ran a mixed effects regression with the logarithm of response times ($\log(RT)$) as a DV, Verb Type (Mental/Physical), Context (*Necessity not to/Lack of necessity*) and their interaction as fixed effects, and Item and Participant as random effects (as the random slopes models did not converge). The results reveal no significant effect. However, a parallel model run on the Likert rating times for *lack of necessity* readings reveals a significant interaction between Context and Verb Type ($\beta = 0.525$, $SE = 0.217$, $df = 171.238$, $t = 2.413$, $p < .05$). In *necessity not to* contexts, participants give faster ratings for sentences with physical verbs, but in *lack of necessity* contexts, they are faster with mental verbs.

We also analyzed the data from the Interdiction Group and the Variation Group separately. We performed a logistic regression, fitting the Interdiction Group answers in the forced choice task into a generalized linear mixed effects model with Verb Type (Mental/Physical), Context (*Necessity not to/Lack of necessity*) and their interaction as fixed effects and random slopes per Item and Participant. We found a significant effect of Context ($\beta = -7.811$, $SE = 3.183$, $Z = -2.454$, $p < .05$), but no other significant effect. To see whether Context and/or Verb Type had an effect on acceptability ratings, we fitted the data into a linear mixed effects model with Likert rating as a DV and Verb Type (Mental/Physical), Context (*Necessity not to/Lack of necessity*) and their interaction as fixed effects and random slopes per Item and Participant. We found a significant effect for the interaction between Verb Type and Context ($\beta = -1.49$, $SE = 0.464$, $df = 15.563$, $t = -3.214$, $p < .01$). While we found no significant difference in ratings for *mustn't* in combination with physical or mental verbs in *necessity not to* contexts (*mustn't* + physical verb was rated as 6, *mustn't* + mental verb was rated as 5.9), there was a significant difference in these ratings in *lack of necessity* contexts: participants rated *mustn't* combined with physical verbs as 4.23, much lower than *mustn't* combined with mental verbs (5.8). In terms of response times for interpretation in the forced choice task, we separately ran two linear mixed effects re-

gressions with the logarithm of response times for *necessity not to not/lack of necessity* interpretations as DV, Verb Type (Mental/Physical), Context (*Necessity not to/Lack of necessity*) and their interaction as fixed effects, and Item and Participant as random effects (since the models with random slopes did not converge). We found no significant effects. We also ran the parallel analyses for Likert rating times for *necessity not to/lack of necessity* interpretations, but also found no significant effects.

As far as the Variation Group is concerned, we fitted the answers in the forced choice task into a generalized mixed effects model with Answer as a DV, coded as 1 for *lack of necessity* readings and 0 for *necessity not to* readings, with Verb Type (Mental/Physical), Context (*Necessity not to/Lack of necessity*) and their interaction as fixed effects and random slopes per Item and Participant. We found a significant effect of Context ($\beta = 4.678$, $SE = 1.174$, $Z = 4.187$, $p < .01$), but no other significant effect. A similar analysis with Accuracy as a DV reveals no significant effect of context or other effects, showing that participants are quite sensitive to the Context and Verb Type manipulations. In order to see the effect of Context and/or Verb Type upon Likert ratings, we fitted the data into a linear mixed effects model with Likert rating as a DV and Verb Type, Context and their interaction as fixed effects and random slopes per Item and Participant. We found a significant effect for the interaction between Verb Type and Context ($\beta = -1.025$, $SE = 0.446$, $df = 12.384$, $t = -2.294$, $p < .05$). In *necessity not to* contexts, there was no significant difference in acceptability ratings for combining *mustn't* with physical verbs (Likert rating = 6.32) or mental verbs (Likert rating = 6.15). However, in *lack of necessity* contexts, participants rated *mustn't* in combination with physical verbs as 5.12, significantly lower than *mustn't* in combination with mental verbs (6.38).

In terms of response times in the forced choice task, we ran a mixed effects regression with the logarithm of response times for *lack of necessity* readings as a DV, Verb Type (Mental/Physical), Context (*Necessity not to/Lack of necessity*) and their interaction as fixed effects, and random slopes per Item and Participant. We found no significant effect of Context on the RTs. We ran a parallel model for response times in the acceptability judgment task and found a significant effect for the interaction between Context and Verb Type ($\beta = 0.853$, $SE = 0.437$, $Z = 66.9$, $t = 1.940$, $p = .055$). Moreover, we also computed similar models for response times for *necessity not to* readings in the forced choice task and the acceptability judgment task, where we found no significant effects.

4. Discussion. The interpretation of *mustn't* in AE varies between speakers: for some AE speakers, *mustn't* always expresses a *necessity not to* meaning, regardless of context, whereas for some AE speakers, *mustn't* may express either a *necessity not to* meaning or a *lack of necessity* meaning, depending on pragmatic context and lexical verb type. Interestingly, speakers who always preferred an interdiction reading for *mustn't* tended to give lower ratings for the use of *mustn't* in *lack of necessity* contexts, while speakers who were more context-sensitive also accepted *mustn't* in both *necessity not to* and *lack of necessity* contexts with more ease. The variation observed for English is a regular pattern in other languages, e.g., Romance languages where *Negation + Obligation Verb* can contextually express either *not necessary* or *necessity not to* (see (8) for an example from Romanian):

- (8) a. Nu trebuie să mergi la doctor. Nu este un doctor bun. (Romanian)
 not must SĂ go to doctor. not be.3SG a doctor good
 ‘You must not go to the doctor. He is not a good doctor.’
 b. Nu trebuie să mergi la doctor. Ești sănătoasă.
 not must SĂ go to doctor. be.2SG healthy

‘You need not go the doctor. You are healthy.’

Several proposals may capture the availability of both the strong *necessity not to* reading and the weak *lack of necessity* reading in AE adult speakers. According to a Neg-Raising Approach (Hacquard 2010, Homer 2011, Iatridou & Zeijlstra 2013) or an Implicature Account (Jeretič 2021), the strong interdiction reading is derived from the basic order NEG>MODALITY via negative strengthening (MODALITY>NEG). According to Pragmatic Weakening (Condoravdi 2012, von Stechow 2019), the *lack of necessity* reading obtains as a suggestion from the basic strong *necessity not to*. According to an Ambiguity Approach, *mustn't* is ambiguous between two basic readings (strong/weak). Our results suggest that the two readings of *mustn't* are not equally available to AE adult speakers, but rather *mustn't* has a primary interdiction reading. Please note that participants from the Variation Group interpret *mustn't* as *necessity not to* to a certain degree even in *lack of necessity* contexts, and the participants who vary less in their interpretation (the Interdiction Group) understand *mustn't* as expressing interdiction, not lack of necessity, independently of context. The fact that the *necessity not to* reading of *mustn't* seems more available is in line with the Pragmatic Weakening account. Moreover, the fact that participants rate physical verbs higher and faster than mental verbs in *necessity not to* contexts, but mental verbs higher and faster than *mustn't* with physical verbs in *lack of necessity* contexts also supports an account based on sensitivity to pragmatic context and verb type. Interestingly, we do not see this effect in response times in the forced choice task, but, as already mentioned, such data should be taken with a grain of salt.

Our results could also be accommodated by other accounts. The Neg-Raising Approach could argue that negative strengthening is an automatic process which obtains by default from NEG>MODALITY in the case of *mustn't*, such that its preferred reading is interdiction. Neg-raising modals have to raise above negation due to their positive polarity sensitivity (Homer 2011, 2015, Iatridou & Zeijlstra 2013). The weak reading would either be the primary, initial LF reading of *mustn't*, or it would obtain by not doing or by cancelling negative strengthening when the context favors a *lack of necessity* reading. However, given the complex nature of Neg-Raising, we believe Pragmatic Weakening explains the results in a simpler, more natural fashion. To account for our results, the Ambiguity Approach would need to be modified such that, even though *mustn't* has two available readings (a strong and a weak one), these are not equally accessible. More specifically, the interdiction reading is more salient, given that AE also makes use of *needn't*, which is used exclusively to express a *lack of necessity* meaning. In line with Grice's Manner Maxim (1975) — see (9), we can assume that speakers prefer to avoid ambiguity, thus using *mustn't* to primarily express the interdiction meaning:

(9) Maxim of Manner: Avoid obscurity; avoid ambiguity; be brief; be orderly.

Thus, our data can be best captured by Pragmatic Weakening and/or by an Ambiguity Approach which ascribes more salience to the interdiction reading of *mustn't* instead of treating the two readings as equally available.

In addition to context, the type of verb the modal combines with also matters. Mental activities give rise to more *lack of necessity* readings than physical activities in *lack of necessity* contexts. *necessity not to* readings. Our results can be explained within a cognitive account in terms of the difficulty of imposing one's will over another's (private) mental activities. From a Speech Act perspective, sentences containing *mustn't* are “directives”, i.e., they convey “attempts to get the speaker to do something” (Searle 1976:11). Directives thus require that *mustn't* should combine with a verb relating to doing something or a change-of-state verb. Generally,

states do not occur in the imperative, since people cannot be ordered to be in a certain state (Brown & Miller 1980, Bussmann 1996): statives “describe properties or relations which do not imply a change in state or motion and which cannot be directly controlled by the entity possessing the property, i.e. stative situations cannot be started, stopped, interrupted, or brought about easily or voluntarily” (Bussmann 1996:1120); in other words, statives are [-agentive] as the subject of the state is not consciously responsible for what happens (Vendler 1957, Dowty 1979, Kearns 2000, Griffiths 2006). The action restriction and the agentivity restriction account for the impossibility of directive speech acts with statives such as those in (10a) (such sentences would only be acceptable under an expressive *wish* reading), as well as the grammaticality of sentences with (durative) event verbs such as (10b).

- (10) a. *Resemble your father! *Have brown eyes! *Understand the chaos theory!
 b. Eat the pie! Build a barn! Walk in the park!

Interestingly, the mental verbs we used (*worry*, *panic*, *be sad*, *be upset*) are somewhat at the border between stative verbs and activity verbs. They are not action verb proper, but they can be conceived as dynamic if taken to express thought processes. They are also not agentive, but, rather, their subject expresses the thematic role of experiencer, being affected by an emotional or psychological state or experience (Brown & Miller 1980, Kreider 1998, Kearns 2000). According to Crystal (2008), a clear classification of verbs into statives and dynamics is disturbed by the existence of such verbs which seem to evince properties belonging to both. There are indeed clear cases where statives can never be conceived as dynamic: one can never say **Be tall*, given that tallness cannot be envisaged as the outcome of an intentional act. However, other stative predicates are open to dynamic aspectual shifts:

- (11) Be good! Be quiet! Don't be stupid! Know the answer by tomorrow! Have a good time!

Although mental verbs such as *worry*, *panic*, *be sad*, *be upset* can be used in directives, it might still be perceived as somewhat odd to command someone not to engage in certain thought processes which are to a large extent out of the interlocutor's control. Hence, sentences with *mustn't* and such mental verbs can be understood as expressing suggestions rather than interdictions.

5. Conclusion In conclusion, in the current paper, we have provided experimental evidence that *mustn't* may be understood differently by different AE adult speakers. While some speakers always interpret *mustn't* as expressing interdiction, other speakers are sensitive to whether the context favors a *lack of necessity* or a *necessity not to* reading, or whether the verb the modal selects as a complement is a physical or a negative mental activity verb. Essentially, these speakers tend to understand *mustn't* as expressing a *lack of necessity* reading in *lack of necessity* contexts and with negative mental verbal complements. We have argued that our results support a Pragmatic Weakening account, where *mustn't* has a primary interdiction reading, but, under certain conditions, speakers may weaken this interpretation.

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