Ability Modals and Homogeneity

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Abstract Ability modals exhibit a puzzling asymmetry in quantificational force: they're strong in positive contexts, but weak in negative contexts. To solve this problem, I sketch an analogy with plural definites which exhibit a similar strength asymmetry known as *homogeneity*. I then show how we can solve the initial puzzle by combining an event-relative semantic for ability modals with the exhaustification-based theory of homogeneity due to Bar-Lev (2018, 2021). In the resulting theory, ability ascriptions have variable force: in positive contexts, they are $\Diamond\Box$ modals, while in negative contexts, they are $\Diamond$ modals. Finally, I argue that the exception-tolerance of ability modals can be modeled analogously to non-maximality in plural definites.

Keywords: ability modals; homogeneity; exhaustification; exception-tolerance

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The verb 'can' is a peculiar one.

Austin (1961)

1 Introduction

John is a poor darts player. If he threw a dart a thousand times, he'd be lucky to hit the bull's eye even once. However, on any given throw, there is a non-zero chance John will hit the bull's eye. After all, even a bad darts player is occasionally lucky. It's puzzling, then, that a speaker can't use a sentence like (1a) or (1b) to express the thought that, even though John lacks the ability to hit a bull's eye, he might do so by sheer luck.[1]

(1) a. # John can't hit the bull's eye, but he's going to hit it on this throw.

b. # John is unable to hit the bull's eye, but he he will hit it on this throw.

Given this data, we want a semantics which validates the following schema: $\ulcorner S$ can't A and S will $\mathsf{A}\urcorner \models \bot$.[2] However, given a naïve semantics for ability modals which treats them as circumstantial possibility modals, this has implausible downstream consequences.[3] If our semantics predicts that *can't-will* contradictions are genuine semantic contradictions, then, given a classical entailment relation and

[1] This observation goes back to Thalberg (1970). More recently, it has been central to Mandelkern et al. (2017) who use it to motivate a conditional-based account of ability and Willer (2021) who draws comparisons between this data and other more well-known Moorean phenomenon.

[2] Following Yalcin (2007), we can show that the unacceptability of (1a) and (1b) is not pragmatic by noting that it persists when embedded under counterfactual attitude verbs (*suppose*, *imagine*) and when placed in conditional antecedents.

[3] In what follows, I treat $\ulcorner$will $\mathsf{A}\urcorner$ as semantically equivalent to A, abstracting away from issues of tense which are not relevant for the puzzle. While this assumption may not be entirely innocent, Cariani and Santorio (2018) give cogent arguments that, while *will* is a modal, it's truth-conditionally equivalent to its prejacent in umebbeded contexts (modulo tense). I will also treat ability *can* and *able to* as synonyms, often employing the latter to control for non-ability readings of *can*.

the usual Boolean semantics for negation and conjunction, it must also satisfy the following:

Can't-ENTAILS-*won't*. ⌜*S* can't A⌝ ⊨ ⌜*S* won't A⌝

However, as Santorio (2022) observes, if *can't* entails *won't*, then a classical semantics also validates SUCCESS (i.e., the modal T Axiom) by contraposition.

SUCCESS. ⌜*S* As⌝ ⊨ ⌜*S* can A⌝

Kenny (1975, 1976) gave an influential argument against SUCCESS. Kenny observed that being able to A seems to require some degree of control in A-ing. Since flukes are always possible, mere achievements seem insufficient to witness possession of a genuine ability. For example, suppose that, while black-out drunk, John trips over someone's foot at the pub, releasing the dart he's holding in the process. By some stroke of luck, John's accidental and extremely bad throw results in a bull's eye. In such a context, it seems bizarre to ascribe to John an ability to hit the bull's eye.[4] As Kenny (1975) argues, "A hopeless darts player may, once in a lifetime, hit the bull, but be unable to repeat the performance because he does not have the ability to hit the bull" (p. 136). Unfortunately, since they're contrapositives, capturing both the validity of *can't* entails *won't*, and the invalidity of SUCCESS is impossible given a classical semantics and consequence relation.

[4]Of course, we might say that John *was* able to hit the bull's eye. This intuition has been echoed more recently by Boylan (2021) who defends SUCCESS by noting that the following reasoning sounds acceptable:

i I hit the bull's eye. So, I was able to hit the bull's eye.

We suspect that the acceptability of (i) is attributable to facts about the interaction of ability modals with aspect. Bhatt (1999) observed that, when ability modals occur with the past perfective, they give rise to "actuality entailments." That is, with the past perfective, ⌜*S* can A⌝ behaves like the implicative verb ⌜*S* managed to A⌝ and, accordingly, entails ⌜*S* did A⌝.

As a result, many extant approaches fail to validate both principles. The standard contextualist semantics of Lewis (1976) and Kratzer (1977) treats ability modals as existential quantifiers over a circumstantial modal base $f_c(w)$–the set of worlds compatible with the contextually salient facts.

(2) $[\![\text{can}]\!]^{w,f_c} = \lambda p_{\langle s,t\rangle}.\exists w' \in f_c(w) : p(w') = 1$

Since a circumstantial modal base is *realistic* in the sense that the actual world is always consistent with the relevant facts (i.e., $w \in f_c(w)$), the Lewis-Kratzer semantics validates *can't* entails *won't*, and predicts that ⌜S can't A and S will A⌝ is a contradiction, but this comes at the cost of validating Success. So, while the standard semantics correctly predicts that *can* is weak in negative contexts, it fails to predict that *can* is strong in positive contexts.

The Lewis-Kratzer semantics can be easily amended to correctly predict the strength of ability modals in positive contexts. The simplest implementation involves restricting ability *can*'s domain of quantification to a subset of "ideal" or "normal" worlds. For example, Portner (2009) suggests implementing a Kratzerian semantics based on the notion of a *good possibility* from Kratzer (1981, 1991) where g is an ordering source which induces a pre-order $\geq_g$.[5]

(3) $[\![\text{can}]\!]^{w,f_c,g} = \lambda p_{\langle s,t\rangle}.\exists w' \in f_c(w) : \forall w''[w' \geq_g w'' \rightarrow p(w'') = 1]$

Given this semantics, Success is invalid, because the prejacent may be true at the actual world even if it's not true in any of the ideal worlds. However, this again comes at a cost, because the predicted truth conditions for *can't* are now too weak. ⌜S can't A⌝ no longer entails ⌜S won't A⌝, because S may succeed in doing A in the

[5]Many similar theories which also involve two layers of quantification make correct predictions about the strength of ability modals in positive contexts. These include Brown's (1988) neighborhood semantics based on the minimal models of Chellas (1980), and STIT logics (Belnap and Perloff, 1988; Horty and Belnap, 1995; Horty, 2001). We discuss these proposals in the following section.

actual world even if S fails to do A in all the ideal worlds. As a result, the modified Lewis-Kratzer semantics predicts that *can't-will* contradictions are consistent.

We have a puzzle, call it the *strength puzzle*: Kenny's intuition suggests that ability modals are stronger than circumstantial possibility modals in positive contexts, but inability contradictions suggest that ability modals are as weak as circumstantial possibility modals in negative contexts. As Santorio (2022) observes, this generates a parallel logical puzzle, because, given any consequence relation that contraposes, it's impossible to validate *can't* implies *won't* without also validating Success. In the rest of the introduction, I survey three extant views concerning the force of ability modals, arguing that none is satisfactory. I then sketch an alternative solution based on an analogy with homogeneity in plural definites.

1.1 Extant theories

The strength puzzle suggests that, in positive contexts, ability modals cannot be treated as circumstantial possibility modals. There are two prominent solutions to this problem: one approach analyzes ability modals as covert conditionals, while the other approach introduces a layer of universal quantification, treating ability modals as $\Diamond\Box$ modals. While both approaches predict that ability modals are strong in positive contexts, neither predicts that ability modals are weak in negative contexts. By combining aspects of both approaches, the act-conditional analysis of Mandelkern et al. (2017) solves this problem. However, while the act-conditional analysis solves the strength puzzle, it does so at the cost of validating a questionable analogue of Conditional Excluded Middle.[6]

[6] Willer (2021) also has recently proposed a semantics which yields a solution to the strength puzzle; however, since the Willer adopts in a bilateral update semantics which is radically different than the theories presented below, I omit discussion of Willer's theory for reasons of space.

1.1.1 *The conditional analysis*

According to the conditional analysis, the ability ascription ⌜S is able to A⌝ has a covert conditional semantics roughly equivalent to ⌜if S tries to A, then A⌝ (Austin, 1961; Cross, 1986; Thomason, 2005).[7] We can state the view formally as follows:

(4) $[\![\text{can}]\!]^{w,f} = \lambda x_e.\lambda p_{\langle s,t\rangle}.\forall w' \in f^{+x \text{ tries to } p}(w) : p(w') = 1$

where $f^{+\mathsf{A}}(w) = f(w) \cap \mathbf{A}$.[8] Since the nearest worlds where an agent tries to bring about the prejacent will not, in general, contain the actual world, the conditional analysis correctly predicts the failure of Success. However, it fails to predict that *can't* entails *won't* for the same reason: the closest world where the agent tries to bring about the prejacent and fails may not be the actual world. Hence, the conditional analysis predicts the strength of ability modals in positive contexts, but fails to predict their weakness in negative contexts.

1.1.2 *The double modal analysis*

The other prominent solution, the double modal solution, treats ability ascriptions as ◇□-modals (Brown, 1988; Belnap and Perloff, 1988; Horty and Belnap, 1995; Horty, 2001). According to the double modal analysis, the ability ascription ⌜S is able to A⌝ is true just in case there is an action available to S which reliably brings about A. We can state the view formally as follows:

[7] I will use *able to* and *can* interchangeably throughout the article. Since *can* has circumstantial, deontic, and, when negated, epistemic readings, I use *able to* to control for variation in flavor.

[8] We require $f^{+\mathsf{A}}$ to satisfy the usual Lewis-Stalnaker constraints on closeness. It's worth noting that if we assume à la Stalnaker that $f^{+\mathsf{A}}(w)$ picks out the *unique* closest world–then, given the usual assumption that $f^{+\mathsf{A}}(w) \subseteq \mathbf{A}$, the conditional analysis incorrectly predicts that Success is valid, but does validate the *can't*-to-*won't* inference.

(5) $[\![\text{can}]\!]^w = \lambda p_{\langle s,t\rangle}.\exists \mathbf{A} \in \mathcal{A}_{x,w} : \forall w' \in \mathbf{A} : p(w') = 1$

where $\mathcal{A}_{x,w}$ is a set of propositions corresponding to the actions available to x at w which partitions the space of worlds. While the double modal analysis correctly predicts the failure of Success, it too fails to predict the validity of *can't*-entails-*won't*. Instead of ⌜S can't A⌝ entailing ⌜S won't A⌝, as desired, the double modal analysis predicts that ⌜S can't A⌝ means something weaker:

(6) $[\![\text{can't}]\!]^w = \lambda p_{\langle s,t\rangle}.\forall \mathbf{A} \in \mathcal{A}_{x,w} : \exists w' \in \mathbf{A} : p(w') = 0$

These truth-conditions state that ⌜S can't A⌝ is true only if, for every action available to S, it's possible that she fails to A. However, these truth-conditions are far too weak. They imply, for example, that, if an agent only has actions available to her which bring about the prejacent most of the time, but sometimes fail to bring about the prejacent, then *can't* is false.[9]

1.1.3 The act-conditional analysis

The *act-conditional analysis* of Mandelkern et al. (2017) combines elements of both the conditional and double modal analyses. According to Mandelkern et al.'s semantics, ⌜S can A⌝ is true only if there is an action such that, if S tries to perform that action, she succeeds in Aing.

(7) $[\![\text{can}]\!]^{w,f} = \lambda x_e.\lambda p_{\langle s,t\rangle}.\exists \mathbf{A} \in \mathcal{A}_{x,w} : \forall w' \in f^{+x\ \textbf{tries to}\ \mathbf{A}}(w) : p(w') = 1$

While the act-conditional analysis predicts strength in negative contexts, it does so only if, following Stalnaker (1968), we require that $f^{+\mathbf{A}}$ contains at most one world. However, if we make this assumption, then the conditional analysis validates the following agentive analogue of Conditional Excluded Middle (Stalnaker, 1980):

[9] Thanks to a reviewer for articulating this.

Ability Excluded Middle (AEM). $\models \ulcorner S$ is able to $\mathsf{A}\urcorner \vee \ulcorner S$ is able to $\neg\mathsf{A}\urcorner$

If AEM were valid, we would expect ability modals to license neg-raising inferences, because the following reasoning would be valid:

(8) John is either able to draw a red card or able to draw a non-red card.
John isn't able draw a red card.
$\Rightarrow$ John able to draw a non-red card.

However, it's clear that, in many contexts, if John is not able to see to it that he gets a red card, John will also not be able to see to it that he gets a non-red card (e.g., in a context where it's a matter of chance what card John draws).

Since Mandelkern et al. argue that ability ascriptions often lack determinate truth-values, they might attempt to explain why the neg-raising inference in (8) fails by adopting a supervaluationist theory of semantic indeterminacy.[10] Hence, while the instance of AEM in (8) is super-true, neither of its disjuncts is super-true. While this blocks the problematic neg-raising inference, it still predicts that instances of AEM should have the force of tautologies. However, this is wrong. For example, consider John, a compulsive gambler. He's compelled to bet on the color of the next card to be drawn from a fair deck. In this context, an instance of AEM seems unacceptable:

(9) # John is either able to draw a red card or he's able to not draw a red card.

Intuitively, John cannot see to it that he draws a red card, because he's as likely to get black as he is to get red, nor can he see to it that he doesn't draw a red card, because he's compelled to gamble.

[10] Thanks to an anonymous reviewer for this suggestion.

1.2 An analogy with homogenous plural definites

The strength asymmetry in ability modals parallels a well-known phenomenon in plural definite descriptions. Plural definites have differing quantificational force in positive and negative contexts. When unnegated, plural definites behave like universal quantifiers:

(10) The professors went to lunch.
≈ All of the professors went to lunch. ∀

But, when negated, they behave more like existentials:

(11) It isn't the case that the professors went to lunch.
≈ None of the professors went to lunch. ¬∃

This phenomenon is known as *homogeneity* (Fodor, 1970; Schwarzschild, 1993; von Fintel, 1997; Križ, 2015). Just as predication of plural definites is all-or-nothing, abilities are also all-or-nothing. Nouwen (2018), discussing someone's ability to balance a fishing rod, succinctly articulates the intuition:

> . . . if you lack the ability to balance the rod, gravity will make sure that the rod will fall down. Fishing rods don't accidentally stay upright. This is another way of saying that balancing-abilities are *homogeneous*: for any action, if it is the right one it will reliably result in a balancing rod; if it is not, it will reliably result in the rod falling down. (2018, p. 7)

There are, moreover, several suggestive empirical parallels between homogeneity in the nominal domain and ability modals. For example, when confronted with a homogeneity violation, speakers often respond with *well*. . . followed by a correction, whereas *true* or *false* tend to be dispreferred.[11]

[11] This phenomenon is attested experimentally. Križ and Chemla (2015), for example, presented

(12) **Context:** Half of the professors went to lunch, while the other half stayed behind.

A: The professors went to lunch.

B: Well. . . {# True, # False,} some of them did.

Speakers have a similar tendency to respond equivocally to fluky ability ascriptions. For example, consider Bob, a mediocre darts player. He often misses the bull's eye, but it's also not unusual for him to hit it. In such a context, (13a) strikes many speakers as infelicitous, because Bob's not *that* bad at darts. But, he isn't *that* good either so (13b) also seems inappropriate to many speakers.[12]

(13) a. # Since Bob hits the bull's eye one time out of ten, he's unable to hit the bull's eye.

b. # Since Bob hits the bull's eye one time out of ten, he's able to hit the bull's eye.

Maier (2018) argues that the desire to respond equivocally in these contexts poses a challenge to modal analyses of ability ascriptions, because "if ability is a modality, then exactly one of these judgments should seem right" (p. 412). However, if we adopt the view that ability modals are homogeneous, we can explain the desire to respond equivocally without abandoning a modal analysis of ability ascriptions.

A homogeneity-based analysis, moreover, provides a natural explanation of why AEM is not valid. Like with other homogeneity violations, there's a strong urge to respond to (9) with a correction, "Well. . . he's not really *able* to do either–he's a compulsive gambler." Križ (2019) offers a similar argument that Conditional

participants with sentences both with and without homogeneity violations and asked them to judge them as either *completely true*, *completely false*, or *neither*. They found that a roughly equal number of speakers judged sentences containing homogeneity violations as either *completely false* or *neither*.

[12] A reviewer points out that they find (13b) perfectly acceptable, whereas they find (13a) infelicitous. In §3, I explain how we can accommodate this intuition pragmatically.

Excluded Middle (CEM) arises due to homogeneity.[13] For example, he notes that, when the conditional's domain is not homogeneous, it's often infelicitous to accept either ⌜A > C⌝ or ⌜A > ¬C⌝. Instead, it seem more appropriate to respond with *well*... and a correction:

(14) a. **Context:** Nina's coming to the party may make Adam happy, but is not guaranteed to (depending on other factors).

b. A: If Nina comes to the party, Adam will be happy.

B: Well... He might be. Križ (2019)

Many different accounts of homogeneity exist in the literature, ranging from theories which treat it as a kind of scalar implicature (Magri, 2014; Bar-Lev, 2018, 2021) to supervaluationist theories (Spector, 2013; Križ and Spector, 2021). For the moment, let's assume the traditional theory that homogeneity arises due to a presupposition (Schwarzschild, 1993; Löbner, 2000). That is, ⌜the *F*s are *G*s⌝ presupposes that every *F* is a *G* or no *F* is a *G*. Nouwen (2018) suggests the following entry which combines a homogeneity presupposition with a ◇□-semantics:

(15) $[\![\text{can } A]\!] = \begin{cases} \textbf{presupposes: } \Box[\Box A \vee \Box\neg A] \\ \textbf{asserts: } \Diamond\Box A \end{cases}$

In other words, ⌜*S* can A⌝ is defined just in case every action available to *S* only contains A-worlds or ¬A-worlds.[14] Given this homogeneity presupposition, *can't* entails *won't* is valid, because *can't* is only true and defined when every action reliably brings about the falsity of the prejacent. However, Success is not valid,

[13] See also Cariani and Goldstein (2018) who argue for a homogeneity-based analysis of CEM as a way to avoid logical results which show that CEM coupled with Simplification of Disjunctive Antecedents (SDA) leads to modal triviality.

[14] Santorio (2022) and Nadathur (2023) have also recently proposed accounts where ⌜*S* is able to A⌝ carries the homogeneity-like presupposition that *S* is a necessary and sufficient cause of A. Santorio and Nadathur both spell out their accounts in causal model-based semantics.

because *can*'s homogeneity presupposition may not be satisfied even when its prejacent is true in the actual world. Finally, we escape the earlier logical puzzle noticed by Santorio, because the addition of the homogeneity presupposition makes our underlying logic trivalent; so, the Law of Excluded Middle (LEM) fails to hold, because both ⌜*S* is able to A⌝ and ⌜*S* is unable to A⌝ may be undefined.

1.3 Outline

Having both sketched how homogeneity can solve the strength puzzle, and highlighted a few problems with the extant views, here's the plan for the paper. In §2.1, I integrate an event-relative version of the Lewis-Kratzer semantics with the *Exh*-based theory of homogeneity due to Bar-Lev (2018, 2021). The resulting theory solves the strength puzzle by treating ability modals as having variable force: they have a ◇□ semantics in positive contexts, but a ◇ semantics in negative contexts. In the remainder of §2, I explore how the resulting theory interacts with disjunction, the debate over whether ability ascriptions have duals, and actuality entailments. In §3, I argue that the exception tolerance of ability modals can be explained analogously to *non-maximality* in homogeneous plural definites. I then sketch an implementation of this idea drawing on the pruning-based account of non-maximality also due to Bar-Lev.

2 Ability Modals as Homogeneous Modals

The view I sketched in §1 adds a homogeneity presupposition to a run-of-the-mill ◇□-analysis of ability modals. However, treating homogeneity as a presupposition is problematic because homogeneity does not project like standard presuppositions,

as illustrated by (16).

(16) a. If the professors went to lunch, I'd be surprised.
$\rightsquigarrow$ Every professor went to lunch or none did.

b. If Bob is able to hit the bull's eye, I'd be surprised.
$\rightsquigarrow$ Every action results in a bull's eye or none does.

Since implicatures do not occur in downward-entailing environments like conditional antecedents, many have adopted the view that, in the nominal domain, homogeneity is an implicature.[15] In §2.1, I integrate the an event-relative version of the Lewis-Kratzer semantics for ability modals with the exhaustification-based theory of homogeneity due to Bar-Lev (2018, 2021). In the remainder of §2, I then explore how the resulting theory interacts with disjunction, the debate over whether ability modals have duals, and theories of actuality entailment.

2.1 An *Exh*-based theory of homogeneity

Let's assume that the LF contains an optional covert scalar exhaustification operator *Exh* (Chierchia et al., 2012). Following Bar-Lev and Fox (2017) and Bar-Lev (2018, 2021), we will adopt a semantics where *Exh* quantifies over both innocently excludable (*IE*) and innocently includable (*II*) alternatives.[16]

[15] In addition to the projection data, other facts also support an implicature analysis. For example, evidence from acquisition shows that, unlike adults, many children interpret plural definites as existential in both positive and negative contexts (Tieu et al., 2019). Though the finding in Tieu et al. (2019) also appears incompatible with the implicature analysis proposed by Magri (2014), because Magri's account involves computing a *some-but-not-all* implicature, but the children in the study failed to compute these implicatures.

[16] Wehbe (2022) givens an argument that homogeneity is non-at-issue which has lead Guerrini and Wehbe (2024) to implement Bar-Lev's theory of homogeneity using a presuppositional exhaustification operator *pex* (Bassi et al., 2021; Del Pinal et al., 2024). My account sketched can be easily implemented in a *pex*-based theory of homogeneity.

(17) a. $[\![Exh_C]\!]^w = \lambda p_{\langle s,t\rangle}.\, p(w) \wedge \forall q \in IE(p,C) : \neg q(w) \wedge \forall r \in II(p,C) : r(w) \;\; C = Alt$

b. $IE(p,C) = \bigcap\{C' \subseteq C : C'$ is a maximal subset of C, s.t.

$\{\neg q : q \in C'\} \cup \{p\}$ is consistent$\}$

c. $II(p,C) = \bigcap\{C'' \subseteq C : C''$ is a maximal subset of C, s.t.

$\{r : r \in C''\} \cup \{\neg q : q \in IE(p,C)\} \cup \{p\}$ is consistent$\}$

Following Magri (2014), Bar-Lev (2018, 2021) assumes that plurals have a weak existential meaning which gets obligatorily strengthened by *Exh*.[17]

(18) [[the boys swam]] = John swam ∨ Richard swam

(19) a. C = {John swam ∨ Richard swam, John swam, Richard swam}

b. $IE(p,C) = \emptyset$

c. $II(p,C)$ = {John swam, Richard swam}

d. Exh_C[(18)] = John swam ∨ Richard swam ∧ John swam ∧ Richard swam

= John swam ∧ Richard swam

So, in the example above, while *the boys swam* is true just in case some boy swam, it is strengthened by *Exh*, generating the implicature that every boy swam because *John swam* and *Richard swam* are both innocently includable.

2.1.1 *Extending Bar-Lev's theory to ability modals*

To extend Bar-Lev's theory of homogeneity to ability modals, I'll employ the event-relative semantics for modals developed by Hacquard (2006, 2009). Following Hackl (1998), we assume that the prejacent of ability ascriptions always describes a change-of-state–the subject causing the prejacent event. We'll model this in terms

[17] There are significant differences between the account in Magri (2014) which relies on recursive applications of an *Exh* operator which only quantifies of IE alternatives and the account in Bar-Lev (2018, 2021) based on an *Exh* operator sensitive to both IE and II alternatives.

of a **cause** relation between events. Furthermore, we assume that the event variable introduced by the prejacent is bound by the existential closure operator in (20).

(20) $[\![\exists]\!] = \lambda w\,.\,\lambda P_{\langle s,\langle v,t\rangle\rangle}.\exists e[P(e,w) = 1]$

Putting all these pieces together we arrive at the following:

(21) $[\![\text{John is able to swim}]\!] = \exists e[\exists w' \in f(w) :$
$\textbf{agent}(e) = j \wedge \textbf{cause}(e,e') \wedge \textbf{swimming}(e',w')]$

The *Exh* operator then quantifies over the modal sub-domain alternatives:

(22) $C = \{\Diamond_{\{w_1\}}[\text{John swims}], \Diamond_{\{w_2\}}[\text{John swims}], \Diamond_{\{w_1,w_2\}}[\text{John swims}]\}$

(23) a. $Exh_C[\Diamond_{\{w_1,w_2\}}[\text{John swims}]]$

b. $[\![(23a)]\!] = \exists e[\forall w' \in \{w_1,w_2\} :$
$\textbf{agent}(e) = j \wedge \textbf{cause}(e,e') \wedge \textbf{swimming}(e',w')]$

In positive contexts, ⌜S is able to A⌝ is strengthened from its weak meaning–there is an event e such that, in some circumstantially possible world w', the subject is the agent of e and e causes an event e' which makes the prejacent is true in w'–to a stronger meaning–there is an event e, such that, in every circumstantially possible world w', the subject is the agent of e and e causes an a prejacent-event e' in w'. Since mere achievements only witness the truth of the prejacent in some world, they are insufficient to entail the exhaustified ability ascription. However, given the constraint that *Exh* cannot be inserted in downward-entailing contexts (Fox and Spector, 2018), it follows that ⌜S can A⌝ only has an existential meaning in the scope of negation and other downward-entailing operators. In other words, our semantics predicts that ability ascriptions have variable force–ability ascriptions are ◇□ modals in positive contexts, but ◇ modals in negative contexts.

2.1.2 *Why do ability modals undergo obligatory exhaustification?*

For my story to succeed, ability ascriptions must always be strengthened by *Exh*. Luckily, there's reason to think this is the case. Magri (2009, 2011) argues that individual-level predicates (ILPs) undergo obligatory exhaustification. Likewise, Hackl (1998) observes that that ability ascriptions appear to behave like individual-level predicates. For example, like paradigmatic ILPs, ability modals are infelicitous with temporal modifiers, quantificational adverbs, and *when*-clauses.[18]

(24) a. #In the morning, John is tall. TEMPORAL MODIFIERS

b. #In the morning, John is able to speak Finnish.

(25) a. #John always is tall. QUANTIFICATIONAL ADVERBS

b. #John always is able to swim.

(26) a. #When John is tall, he's quite good at basketball. *When*-CLAUSES

b. #When John is able to speak Finnish, he's quite fluent.

In contrast, on their purely circumstantial reading, *can* and *able to* behave like stage-level predicates (SLPs).[19] Magri proposes that ordinary ILPs, like *tall*, undergo obligatory exhaustification. In cases like (24)-(26), this exhaustified meaning is inconsistent with the common ground. For example, when strengthened, (24a) licenses scalar inference that John is tall only in the morning; however, it's common ground that people's height does not vary with the time of day. Similarly, when strengthened, (24b) licenses the scalar inference that John has the ability to speak Finnish only in the morning; however, it's common ground that people's ability to speak a language does not vary with the time of day.

[18] For classic discussions of these tests, see Carlson (1977) and Kratzer (1995).

[19] This use of *can* is what Hackl, following Austin (1961), "opportunity *can*." Hackl furthermore argues that this use of *can* is raising, whereas ability *can* is control.

2.1.3 Recap

In sum, by integrating the *Exh*-based theory of homogeneity due to Bar-Lev (2018, 2021) with the modified version of the Lewis-Kratzer semantics for ability ascriptions proposed by Hackl, we resolve the strength problem by treating ability modals as having variable force: ability modals have a $\Diamond\Box$ semantics in positive contexts and a $\Diamond$ semantics in negative contexts. Moreover, if we adopt the account of ILPs given by Magri (2009, 2011), then we expect ability ascriptions, as ILPs, to undergo obligatory exhaustification. In the rest of this section, we explore several consequences of the resulting theory. Then, in §3, we show how the pruning-based approach to non-maximality proposed by Bar-Lev can capture the exception tolerance of positive ability ascriptions.

2.2 Issue #1: Distribution over Disjunction

Unlike other possibility modals, ability modals fail to validate Distribution over Disjunction (DoD).

Distribution over Disjunction (DoD). $\Diamond(A \vee B) \models \Diamond A \vee \Diamond B$

Kenny (1975, 1976) provided the following classic counterexample to DoD for ability modals:

(27) a. John is able to hit either the top or bottom of the dartboard.
b. John is able to hit the top of the dartboard.
c. John is able to hit the bottom of the dartboard.

It's easy to imagine a scenario in which (27a) is true, but both (27b) and (27c) are false. For example, John might be good enough that he never misses the

dartboard entirely, but still lacks the control needed to consistently hit a particular section of the board. However, this failure of DoD is limited to upward-entailing environments. This can be observed by embedding instances of DoD under a negative attitude verb like *doubts* which is equivalent to *believes not*.

(28) a. Bill believes that John is both unable to hit the top of the dartboard and unable to hit the bottom.

b. Bill doubts that John is able to either hit the top of the dartboard or the bottom of the dartboard.

Hence, while DoD fails for ability modals, its contrapositive is still valid.

CONTRAPOSITIVE DOD. $\neg\Diamond A \wedge \neg\Diamond B \models \neg\Diamond(A \vee B)$

Give my semantics, DoD fails in upward-entailing contexts because $\Diamond\Box(A \vee B)$ may be true even when $\Diamond\Box A \vee \Diamond\Box B$ is false. In contrast, the contrapositive of DoD is valid because, since *Exh* cannot be inserted in downward-entailing contexts, $\neg\Diamond A \wedge \neg\Diamond B$ does not get strengthened by *Exh* and, therefore, entails $\neg\Diamond(A \vee B)$.

2.3 Issue #2: Duality

Hackl (1998) argued that, at least in English and many other languages, ability modals do not have lexicalized duals.[20] He argues that ability modals do not have duals, because ability modals take prejacents which describe intentional actions and "intentionality presupposes 'having a choice' which is incompatible with the meaning generated by a universal modal restricted to a circumstantial base" (p. 23). More recently, Mandelkern et al. (2017) have challenged this prevailing wisdom, arguing that the duals of ability modals are *compulsion modals*, like those in (29).

[20] Hackl claims Bulgarian, Dutch, French, German, Greek, Hindi, and Italian all lack a lexicalized dual of the ability modal.

(29) a. I'm not able to not sneeze. I **must** sneeze.

b. I **cannot but** eat another cookie.

In English, it's unclear that compulsion modals constitute a lexicalized dual of ability modals. Both Willer (2021) and Loets and Zakkou (2022) have given compelling arguments that compulsion modals are not the duals of ability modals.

(30) a. Bob can't play Liszt's *Campanella*. Willer (2021)

b. Bob cannot but not play Liszt's *Campanella*.

For example, as Willer observes, while (30b) suggests that Bob inevitably fails to play Liszt's *Campanella* no matter how hard he tries, (30a) merely suggests that Bob currently isn't in a position to perform the notoriously difficult piece.

If the strength asymmetry in ability modals is best captured by an implicature-based account à la Bar-Lev, then our analogy with homogeneity in the nominal domain gives us further reason to doubt Mandelkern et al.'s claim.[21] The extant implicature-based approaches to homogeneity assume that homogeneity effects are triggered by dual-less existentials which undergo scalar strengthening. This general strategy has been employed elsewhere to explain homogeneity-like effects, including bare conditionals which behave like universal quantifiers in positive contexts but existential quantifiers in negative contexts (Bassi and Bar-Lev, 2018), the Hebrew determiner *kol* which behaves like a universal quantifier in positive contexts but an existential in negative contexts (Bar-Lev and Margulis, 2014), and the Warlpiri coordinator *manu* which behaves like a conjunction in positive contexts but a disjunction in negative contexts (Bowler, 2014), among others. This has led Staniszewski (2022) to posit that modals which lack a dual always undergo strengthening in positive contexts. Insofar as this hypothesis is correct, we have

[21] I owe this observation to Luka Crnič (p.c.).

good reason to doubt Mandelkern et al.'s claim given our earlier argument that ability modals undergo obligatory strengthening.

2.4 Issue #3: Actuality entailments

So far, I've said little about how tense and aspect interacts with ability modals, but here too the analogy with homogeneity is useful. Bhatt (1999) observed that, when ability modals occur with the past perfective, they give rise to *actuality entailments*; that is, ⌜S was able to A⌝ behaves like the implicative verb ⌜S managed to A⌝ and, accordingly, entails ⌜S did A⌝. [22]

Actuality Entailment (AE). $\check{\Diamond}\mathsf{A} \models \mathsf{A}$

(31) Jane a pu prendre le train pour aller à Londres, #mais elle a pris l'avion.
Jane can-past-pfv take the train to go to London, #but she took the plane.
'Jane managed to take the train to go to London, #but she took the plane.'
(Hacquard, 2009, ex. 11a)

However, assuming that (31) has [Past[Perfective[can[VP]]]] as its LF, the standard semantics for the perfective in (32) combined with the naïve Lewis-Kratzer semantics does not license the AE.

(32) $[\![\textsc{perf}]\!] = \lambda P \lambda t . \exists e [\tau(e) \subseteq t \wedge P(e)(w)]$

(33) $[\![(31)]\!]^{w,f} = \exists t' < t_c . \exists e [\tau(e) \subseteq t' \wedge \exists w' \in f(w) :$
$\textbf{agent}(e) = j \wedge \textbf{take-the-train}(e)(w')]$

To derive AEs, many extant approaches to AEs invoke something like homogeneity– for example, Borgonovo and Cummins (2007) propose that the perfective makes

[22] Following Alxatib (2019), I use $\check{\Diamond}$ to denote an actualized possibility modal.

the modal base totally realistic, while Homer (2011, 2021) proposes an "actualistic" coercion operator which makes the modal base homogeneous. So, perhaps unsurprisingly, we see also empirical parallels with homogeneity. As Hacquard (2009) observes, negated AE-licensing modals entail the negation of their prejacent.

NON-ACTUALITY ENTAILMENT. $\neg\check{\Diamond}A \models \neg A$

Here again we see the the tell-tale sign homogeneity–$\check{\Diamond}$ is strong in positive contexts, but weak in negative contexts.

The standard scope-based derivation of actuality entailments due to Hacquard (2006, 2009) starts with the assumption that the perfective is true just in case there is a P-event in the actual world.

(34) $[\![\text{PERF}]\!] = \lambda P \lambda t.\exists e[\tau(e) \subseteq t \wedge \underline{e \text{ in } w} \wedge P(e)(w)]$

(35) $[\![[\text{Past}[\text{Perfective}[\text{able to } P]]]]\!]^{w,f,t_c} =$

$$\exists t' < t_c.\exists e[\tau(e) \subseteq t' \wedge \underline{e \text{ in } w} \wedge \exists w' \in f(w) : P(e)(w')]$$

However, the truth-conditions in (35) don't quite derive the AE–it only guarantees that there's an actual event which witnesses the truth of P in some circumstantially possible world, but this world needn't be the actual world. To circumvent this problem, Hacquard proposes a constraint called PRESERVATION OF EVENT DESCRIPTION (PED)–if e is a P-event in w_1, then e must be a P-event in w_2. In other words, PED requires that the relevant P-event exist in all circumstantially accessible worlds. However, by combining Hacquard's semantics for the perfective (34) with our homogeneity-based analysis of ability modals, we can derive AEs without assuming PED.

(36) $[\![[\text{Past}[\text{Perfective}[Exh_C(\Diamond A)]]]]\!] =$

$$\exists t' < t_c.\exists e[\tau(e) \subseteq t' \wedge \underline{e \text{ in } w} \wedge \forall w' \in \{w_1, w_2\} : A(e, w')]$$

In short, (36) is exactly what we get if we assume PED–there is an actual past A-event e such that e occurs in circumstantially possible world. This, I believe, is an upshot of my theory–we can explain AEs using Hacquard's well-motivated scope-based theory while avoiding the metaphysical baggage of the PED. Moreover, since *Exh* cannot be inserted in downward-entailing contexts, we correctly predict that the strength of ability modals in negative AEs as desired.[23]

3 Non-maximality in ability ascriptions

A common complaint is that the double modal analysis yields truth-conditions that are too strong. As Maier (2018) puts the complaint, "We often take ourselves to able to perform actions that we cannot quite *guarantee*" (p. 416). Imagine, for example, that Stephen Curry pulls up beyond the arc to attempt a three pointer. According to the double modal analysis, (37) is true only if, whenever Curry takes this shot, he reliably makes it.

(37) Curry is able to make this shot right now. Mandelkern et al. (2017)

Even though he's arguably best shooter in basketball history, Curry only makes 42.6% of his shots from beyond the three-point line.[24] But, if anyone has the ability to make this shot, it's Curry. However, since Curry cannot guarantee that he will make this shot, the double modal analysis predicts that (37) is false, even though (37) is clearly assertible. Plural definites exhibit a similar exception-tolerance. For

[23] Hacquard's theory (as well as many of the other theories mentioned) suffers from a well-known bug–it predicts that actualized possibility modals are equivalent to actualized necessity modals, even though they clearly differ in meaning (Nadathur, 2024, §2.3). If my homogeneity-based analysis were implemented with *pex* à la Guerrini and Wehbe (2024) instead, we might potentially solve this problem. Then actualized possibility modals would only be Strawson-equivalent to actualized necessity modals, but not classically equivalent.

[24] https://www.basketball-reference.com/players/c/curryst01.html

example, (38) is still assertible even when a few of the townspeople are still awake.[25]

(38) The townspeople are asleep. Lasersohn (1999)

However, as Kroch (1974) observes, (38) seemingly has to have a literal meaning that's universal, because (39a) is a contradiction.

(39) a. #Although the townspeople are asleep, some of them are awake.

b. Although most townspeople are asleep, some of them are awake.

In the literature on homogeneity, this type of exception-tolerance is known as *non-maximality* (Malamud, 2012; Križ, 2016; Bar-Lev, 2021; Križ and Spector, 2021).[26] Moreover, just as Curry can miss the majority of his shots from three and can still be said to have the ability to make a shot from three, a majority of individuals in the domain can be counterexamples to a plural definite and yet the plural definite can still be assertible, as Malamud's example (40) illustrates.

[25] With a few important caveats, for example, Križ (2016) notes that, if the few townspeople who are awake are throwing a very loud party in the street, then (38) seems much less acceptable.

[26] The non-maximality of plural definites can be removed by *all* while the non-maximality of generics can be removed by *always* both of which function as slack regulators (Lasersohn, 1999).

i **Context:** There are ten boys, nine of whom are swimming.

ii The boys are swimming.

iii # All the boys are swimming.

Likewise, Agha and Jeretič (2022) argue that *necessarily* similarly functions as a slack regulator in the modal domain.

i # The advice was that you shouldn't go, but that you can go.

ii The advice was that you shouldn't **necessarily** go, but that you can go.

However, it's not clear whether *necessarily* is a slack regulator or *shouldn't necessarily* receives a concord reading.

(40) a. **Context:** I left two out of the eight windows in the house open. Upon hearing that it's going to rain, I say to my spouse:

b. We gotta go home. I left the windows open. Malamud (2012)

3.1 Bar-Lev (2018, 2021): non-maximality as pruning

Bar-Lev (2018, 2021) proposes that non-maximality arises from exhaustifying a pruned set of alternatives, while maximal readings arise from exhaustifying a non-pruned set of alternatives. Let's consider a simplified version of Malamud's example involving only three windows. Now suppose we eliminate all the atomic alternatives:

(41) C = {window-1-open ∨ window-2-open ∨ window-3-open,
window-1-open ∨ window-2-open,
window-1-open ∨ window-3-open,
window-2-open ∨ window-3-open,
~~window-1-open~~, ~~window-2-open~~, ~~window-3-open~~}

Given the pruned set of alternatives in (41), the plural definite in (40) receives the non-maximal reading that at least two windows are open. However, as Bar-Lev notes, we need to rule out unnatural prunings. For example, if we pruned all the alternatives except *window 1 is open*, then that alternative would be innocently excludable. As a result, *I left the windows open* would entail that one of the windows is closed, a result that is clearly undesirable. To avoid making such a prediction, Bar-Lev imposes the following constraint on pruning:

(42) $Exh_C\mathsf{A}$ is licensed for $C \subseteq Alt(S)$ given a contextually provided partition Q only if C is a maximal subset of $Alt(S)$ such that ...

a. $Exh_C\mathsf{A}$ is relevant to Q, and

b. $Exh_{Alt(S)}\mathsf{A} \models Exh_C\mathsf{A}$

This constraint on pruning involves two separate requirements. First, the clause in (42a) requires that, for any pruning C, $Exh_C\mathsf{A}$ must be relevant to the salient issue.

(43) A proposition p is *relevant* to an issue Q iff $\exists Q' \subseteq Q : p = \bigcup Q'$.

For example, in Malamud's example, the relevant issue is whether or not the floor will get wet. So, the exhaustification of the plural definite description in (40) must settle the issue in (44).

(44) $$Q = \begin{cases} i_1 & \text{At least one window is open (= wet floor)} \\ i_2 & \text{No windows are open (= dry floor)} \end{cases}$$

Second, the clause in (42b) requires that pruning can only result in a weaker meaning. This constraint–proposed by Crnič et al. (2015)–is an instance of the Strongest Meaning Hypothesis. The pathological pruning we imagined violates both constraints. If we pruned every alternative except *window 1 is open*, then the exhaustified meaning would not settle the issue in (44)–violating (42a).[27] Likewise, the exhaustified meaning given the pruned alternatives is not entailed by the exhaustified meaning given the full set of alternatives–violating (42b).

Finally, given the standard assumption that *Exh* cannot be embedded in downward-entailing environments (Fox and Spector, 2018), Bar-Lev's pruning-based account of non-maximality predicts a novel asymmetry positive and negative contexts–only positive contexts are compatible with non-maximal interpretations. There's empir-

[27] Given an issue different from (44), this pruning might not violate (42a).

ical evidence to support this prediction–for example, in an experimental setting, subjects are more likely to interpret plural definites under *every* non-maximally than plural definites under *no* (Augurzky et al., 2023).

3.2 A pruning-based theory of ability modals' exception tolerance

Let's consider a simple example which illustrates how Bar-Lev's pruning-based account of non-maximality could be applied to ability modals. Consider the following scenario adapted from Cross (1986). Suppose that Bob claims he can make a put on the next swing. If Bob's swing is disturbed by a sonic boom, and the ball doesn't go in, this isn't evidence that Bob's original claim was false, because this event is very abnormal–it's not indicative of Bob's ability to make the put under normal conditions.

Here's a toy model of Cross's example–there are three circumstantially possible putting worlds $\{w_1, w_2, w_3\}$. In w_1 and w_2, Bob makes the put under normal conditions, while, in w_3, Bob is disturbed by a sonic boom and fails to make the put. Let's assume the salient issue Q is whether or not Bob will make a put under normal conditions.

(45) $$Q = \begin{cases} i_1 & \text{Bob makes the put in normal circumstances} \\ i_2 & \text{Bob misses the put in normal circumstances} \end{cases}$$

Instead of considering all possible subdomain alternatives, we can instead consider only the subdomain alternatives relevant to Q; so, for example, we can eliminate the subdomain alternative where the domain is the singleton $\{w_3\}$, since it's not relavent to Q. Relative to the issue in (45), strengthening by *Exh* results in the weaker interpretation that $\{w_1, w_2\}$ is homogeneous with respect to *can*'s prejacent:

(46) a. Bob can make this put.

b. $Exh_C[\Diamond_{\{w_1,w_2,w_3\}}$Bob make this put] =

$\Diamond_{\{w_1,w_2,w_3\}}\exists e \in \{w_1, w_2, w_3\}[\textbf{agent}(e) = b \wedge \textbf{cause}(e, e') \wedge \textbf{making-put}(e', w')] \wedge$

$\Box_{\{w_1,w_2\}}\exists e \in \{w_1, w_2\}[\textbf{agent}(e) = b \wedge \textbf{cause}(e, e') \wedge \textbf{making-put}(e', w')]$

Finally, what about pruning in downward-entailing contexts? As we mentioned in the previous section, Bar-Lev's account predicts that pruning cannot occur in downward-entailing contexts–a prediction that has some empirical support. In general, ability ascriptions seem to pattern similarly–whereas a single failure does not show that a positive ability ascription is false, a single success *does* seem to establish the falsity of a negative ability ascription. This intuition appears to be borne out–for example, a referee reports that, whereas (13a) is clearly infelicitous, it's easy to hear (13b) as felicitous.

4 Conclusion

In this paper, I presented a puzzle about the strength of ability modals: ability modals are strong in positive contexts, but weak in negative contexts. To solve this problem, I drew an analogy with plural definites which exhibit a similar asymmetry in quantificational strength. To solve the strength problem, I then combine an event-relative semantic à la Hacquard (2006, 2009) with the *Exh*-based theory of homogeneity due to Bar-Lev (2018, 2021). In the resulting theory, ability modals have variable force–they are obligatorily strengthened to $\Diamond\Box$ modals in upward-entailing contexts, while they remain $\Diamond$ modals in downward-entailing contexts. The resulting theory also makes desirable predictions concerning Distribution over Disjunction and actuality entailments. Finally, I showed that a pruning-based

account of non-maximality proposed by Bar-Lev (2018, 2021) yields an explanation of the exception tolerance exhibited by ability modals.

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