The ability to choose

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Abstract In this paper, I connect two strands of literature: (i) the literature discussing several distinctive properties of ability modals, properties that set them apart from other root modals and epistemics; (ii) the literature on free choice disjunction. I show that in the intersection of these two strands a dilemma arises. Given the currently dominant pragmatic analysis of free choice effects, and given that ability modals do not allow for so-called distribution of disjunction, it is expected that there can be no free choice ability. I show that this is an undesirable prediction. Ability and free choice may be reconsiled, however, by assuming that ability expressions come with an excluded middle presupposition.

keywords: ability modals, free choice, pragmatics, excluded middle

1 Distribution over disjunction and ability modals

In standard modal logics, distribution over disjunction (DOD), as given in (1), is a theorem. For instance, in a possible world semantics for modals, (1) follows from its semantics: if there is no accessible p-world and no accessible q-world, then there can't be an accessible $p \vee q$-world.

(1) $\Diamond[p \vee q] \Rightarrow \Diamond p \vee \Diamond q$ (DOD: distribution over disjunction)

As Kenny (1976) famously argued, however, distribution over disjunction is invalid for ability modals. The argument goes as follows. Say, there is a deck of regular playing cards in front if you. The cards are face down, concealing the colours. If you were to pick one of these cards, it will either be red or black. You obviously have the ability to pick a card, so (2) is true. However, if DOD holds, it should follow from that either (3) or (4) is true. But unless you are a skilled conjuror, you simply won't have the ability to pick a card and predict its color. Whether the card you pick is red or black relies completely on chance.

(2) John can pick a card from the stack.

(3) John can pick a red card from the stack.

(4) John can pick a black card from the stack.

In part due to Kenny's observations there have been many proposals that give a semantics of ability that does not yield distribution over disjunction (for instance, a.m.o. Horty and Belnap 1995; Hackl 1998; Thomason 2005.) The intuition behind many of these is the following: someone is able to p means that there is some action that will reliably result in p to be true. With such a view of ability, DOD no longer holds. If some action reliably makes $p \vee q$ true, this does not entail that there is an action that reliably brings p about or that there is an action that reliably brings q about. For instance, Brown (1988) uses a semantics that has models made up of a set of worlds W and a function N that maps worlds to propositions (the available actions in that world). Ability is now interpreted as follows:

(5) α has the ability to A in w if and only if $\exists m \in N(w) : \forall w \in m : A(w)$.

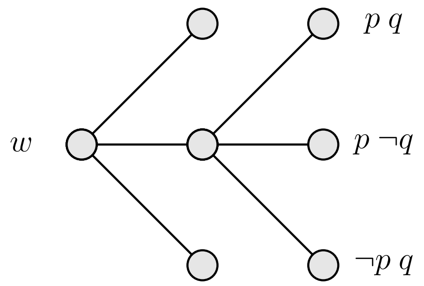
Portner (2009) suggests that within a Kratzerian framework there is the option of assigning ability modals like *can* the semantics of *good possibility*, which has this same structure of a combination of existential and universal quantification.

(6) For a modal base F and an ordering source g: p is a good possibility w.r.t. $\langle F, g\rangle$ if and only if $\exists w \in F\, \forall w'[w >_g w' \rightarrow p(w')]$.

Clearly, $p \vee q$ can be a good possibility even if neither p nor q is a good possibility. What *good possibility* shares with Brown's action semantics is that it combines existential and universal force.

In what follows, I will not commit to any specific semantics for ability but focus on this general strategy of avoiding distribution over disjunction by combining existential and universal force. I will abstract away from any specifics by representing the semantics of ability modals as the simple combination $\Diamond\Box$. In fact, clearly, in standard modal logic that combination also fails to validate DOD: (8) illustrates a situation where in $\Diamond\Box[p \vee q]$ is true in w, but neither $\Diamond\Box p$ nor $\Diamond\Box q$ are true in w.

(7) $\Diamond\Box[p \vee q] \not\Rightarrow \Diamond\Box p \vee \Diamond\Box q$

(8) 

The details of the semantics are immaterial for the larger point I am making: any semantics that renders DOD invalid will do. For, as I will show next, the invalidity of DOD has consequences for the pragmatic interaction of modality and disjunction.

2 Distribution over disjunction and free choice

In the literature on natural language semantics of modals, distribution over disjunction has received little attention. This is for quite obvious reasons. First of all, for most modals, DOD is just a straightforward consequence of the semantics of the modals. Second, the phenomenon of *free choice disjunction* is a much more general inference involving modals and disjunction to be accounted for. Free choice is the effect where modal statements involving disjunction tend to receive an interpretation that is strictly stronger than their literal meaning (Kamp, 1973, 1978; Zimmermann, 2000). The information that *John might be in Antwerpen or Brussel* tells us that the speaker considers it possible that John is in Antwerpen and that she considers it possible that he's in Brussel, even though from a logical point of view $\Diamond[p \vee q]$ is compatible with $\neg\Diamond p$ and with $\neg\Diamond q$, it's just not compatible with both disjunctions being impossible. Rather than DOD, for natural language semantics the following free choice schema usually takes centre stage.

(9) $\Diamond[p \vee q] \;\Rightarrow\; \Diamond p \wedge \Diamond q$ (FC, free choice)

Probably the most dominant theoretical trend in the study of free choice is to take free choice to be a pragmatic phenomenon.[1] In particular, free choice is considered to be a kind of second order implicature. While there is considerable variation in the details of such accounts (most notably with respect to what the theories in question take an implicature to be), the underlying mechanism is in essence the same. In particular, I take Kratzer and Shimoyama (2002), Fox (2007), Franke (2009), Franke (2011), van Rooij (2010) and Geurts (2011) all to be variations on the following theme.

Take a sentence like (10) as the conventional meaning of a speaker's utterance:

(10) $\Diamond[p \vee q]$

A hearer may now reason about the speaker's intentions: why did the speaker use a disjunction and not simply one of the disjuncts? She then concludes that the speaker didn't convey the simpler message $\Diamond p$ for one of two reasons: either $\Diamond p$ was false or $\Diamond p$ would have lead to the false conclusion by the hearer that $\Diamond p$ was the only permission to be had. In other words, the hearer concludes that $\neg\Diamond p \vee \Diamond q$. She does the same for the other disjunct yielding $\neg\Diamond q \vee \Diamond p$. Together, we now have the implicature in (11):

(11) $\Diamond p \leftrightarrow \Diamond q$

So p and q are either both permitted or both not permitted:

(12) $(\Diamond p \wedge \Diamond q) \;\vee\; (\neg\Diamond p \wedge \neg\Diamond q)$

Let's try now to disqualify the second disjunct, to yield the truth of the first disjunct, i.e. the free choice effect. This is only possible if the hearer can assume that at least one of the disjuncts

[1]The alternative is to take free choice as a phenomenon that is more or less directly encoded in the modal operator. Various version of this line of account include Zimmermann (2000), Geurts (2005), Aloni (2003), Simons (2005). In this paper I will ignore this type of account. They escape the problem I point out below, but only because free choice is so-to-say hardwired in each individual operator for which we observe the phenomenon.

is permissible. That, in turn can only be concluded from (10) if she assumes DOD to hold: it follows from (10) and DOD that either $\Diamond p$ or $\Diamond q$ is true, and it follows from that and (12) that both are true. Without distribution of disjunction, however, the free choice effect does not follow. In other words, $\Diamond\Box[p \vee q]$ is predicted not to implicate $\Diamond\Box p \wedge \Diamond\Box q$.

This illustration is close to the simple recipe of Kratzer and Shimoyama (2002). Fox (2007), who implements this recipe in a grammatical mechanism for implicature, straightforwardly inherits the prediction that free choice would not arise without DOD.[2]

The account of free choice implicatures in Geurts (2011) is framed differently, but follows a reasoning pattern that is quite similar to that of Kratzer and Shimoyama (2002). The idea is that hearers reason about the intentional state of the speaker. For a sentence $\Diamond[p \vee q]$ the hearer may entertain one of four possibilities: (i_1) $\Diamond p \wedge \Diamond q$, (i_2) $\Diamond p \wedge \neg\Diamond q$, (i_3) $\Diamond q \wedge \neg\Diamond p$, (i_4) $\neg\Diamond p \wedge \neg\Diamond q$. The hearer may dismiss i_4 straight away since it is not compatible with the speaker's assertion that $\Diamond[p \vee q]$ is true. She then reasons that i_2 and i_3 can also be disregarded, because if the speaker had been in one of these states she would have said something shorter, namely something that simply conveyed $\Diamond p$ or $\Diamond q$, respectively. This way, the hearer arrives at the conclusion that the speaker must be in state i_1, the state where the free choice inference holds.

This result crucially relies on the hearer being able to dismiss i_4. If DOD does not hold, as with $\Diamond\Box[p \vee q]$, i_4 *is* compatible with the literal meaning of the assertion. The result then is that either $\Diamond\Box p \wedge \Diamond\Box q$ or $\neg\Diamond\Box p \wedge \neg\Diamond\Box q$. Quite a similar issue arises in Franke (2009, 2011) and van Rooij (2010), since these are also frameworks that rely on dividing up a logical space. The invalidity of DOD makes the modal statement consistent with more partition cells than if DOD had been valid.

In summary, current pragmatic theories of free choice make the free choice effect dependent on the validity of DOD. Given Kenny's observation in the previous section and the proposal to interpret ability modals in such a way to invalidate distribution of disjunction, the pragmatic theories come to predict that there is no free choice ability.

[2]Technically, without DOD the alternatives $\Diamond p$ and $\Diamond q$ are *innocently excludable*, leading to the implicature $\neg\Diamond p \wedge \neg\Diamond q \wedge \neg\Diamond[p \wedge q]$, quite the opposite of free choice.

3 Ability modals and free choice

At first sight, the prediction that ability modals don't give rise to free choice effects may appear to be a welcome one. Consider a sentence like (13):

(13) John can speak English or German.

Now consider two contexts that are intended to fix the modal flavour of *can*:

(14) John is going to the Czech Republic and Peter is worrying how he's going to be able to communicate with the locals. Sue tells him not to worry, and then utters (13) as a justification of that.

(15) Peter and Sue have two candidates for the job of new sales rep. They are comparing two candidates and Sue is arguing John is the better candidate. She think one of the main advantages to choose John is that he is bilingual. She voices her argument by uttering (13).

It seems to me that whereas Sue may felicitously use (13) in (14), it is rather odd to use (13) in (15). The difference is arguably that (14) sets things up so that *can* in (13) is interpreted as a teleological modal: what is at stake is the set of options John has to reach the goal of making himself understood. In contrast, (15) clearly steers towards an ability understanding of *can* and this, it seems, is less felicitous.

This intuition may be strengthened by an example that unmistakenly involves ability, such as (16), which is quite infelicitous. (Note that its negations are fine.)

(16) ??My son can walk or talk.

Further suggestions that free choice may be unavailable with ability modals come from an experiment in van Tiel (2011). The focus of the experiment was rather different from that of the current paper, but part of the results are very relevant. Participants were given a sentence and a conclusion and were asked to indicate how strongly they thought the conclusion followed from the sentence. The experiment contained five items with dynamic modality:

(17) Thomas can speak French or Italian.

(18) Hans can play the guitar or the drums.

(19) Karel can read Greek or Latin.

(20) Karin can write a haiku or a limerick.

(21) Marcel can navigate a tank or an airplane.

In the crucial trials, participants had to indicate to what extent these sentences gives rise to the conclusion that the modal holds of just one of the disjuncts. For instance, does (17) support the conclusion that Thomas can speak French. On a scale of 0-100, participants indicated a median strength of this type of conclusion of 48. For similar deontic and epistemic items, the median strength of free choice inferences was 95 and 88, respectively.

The items in (17)-(21) were of course given out of context in the experiment, so it is entirely possible that participants interpreted the items sometimes as teleological. This would suggest that the strength of free choice inferences for items with modals that are unambiguously interpreted as ability modals could be even lower.

Despite all this, I think it is wrong to conclude that free choice is unavailable with ability. There are plenty of examples that seem problematic in the face of such an assumption. Geurts gives the following in his books Geurts (2011):

(22) Betty can balance a fishing rod on her chin or her nose.

It seems to me that examples like (15) (and similarly the examples used in van Tiel's experiment, in their dynamic guise) are infelicitous for a different reason. Consider the following example context:

(23) John2000 is a service robot Peter is interested in buying. Sue is the sales person trying to persuade him to go ahead with the purchase. She lists all the actions he can perform. Robot John's most impressive feature, she thinks, is the fact that there is a big dial on his

chest that allows you to choose which language you want him to communicate in. The left of the dial says "English" and the right says "German". Sue now utters (13).

It seems to me that in this context, Sue's utterance is fully felicitous, even though what is at stake is the free choice inference that the robot has the ability to speak English and that he has the ability to speak German.

What I think is going on here is a feature of free choice that is not often discussed: free choice permission only occurs when the permissions given are related options; relevant alternatives, if you want. Eckardt (2007) is a noticeable exception in discussing this constraint: "disjoint lists of mutually independent privileges do not give rise to free choice effects" (Eckardt, 2007, p.15). The example in (24) shows the effect of this constraint.

(24) What new privileges does Judy gain when she's 18 year's old? #She may drive a car, or marry without her parent's consent.

Note, however, the Eckardt's example is not an ability modal, but a deontic one. And her generalization also describes things in terms of permission. However, Eckardt notices that the same constraint is active elsewhere in the world of free choice too. So, we may recast the observation into more general terms:

(25) Dependent alternatives for free choice:
disjoint lists of mutually independent alternatives do not give rise to free choice effects

Admittedly, it is hard to see how to formulate (25) in such a way that it makes precise predictions, as it is unclear to me how to flesh out the relevant notion of dependency. However, awaiting further research on the nature of (25), what *is* clear is that free choice ability does exist.

4 The dilemma

We have now stumbled on a dilemma: (i) we have seen that ability modals do not allow for distribution over disjunction; (ii) we have seen that ability modals do give rise to free choice effects; (iii) we have seen that the dominant view on free choice effects depends on distribution over disjunction to be valid.

It is time to have a much closer look at the crucial examples involving distribution over disjunction. Instead of Kenny's card picking example, let us turn to another example of his, one involving a darts board and John's ability to accurately throw darts. At the heart of the problem lies the semantic equivalence of (26) and (27).

(26) John hits the board.

(27) John hits the top half of the board or he hits the bottom half of the board.

Given this equivalence, DOD would falsely predict the entailment of (28) to (29).

(28) John is capable of hitting the board.

(29) John is capable of hitting the bottom half of the board or he is capable of hitting the top half of the board.

Note, however, that if we replace (26) for (the equivalent) (27) in (28), intuitions change: (30) does entail (29). In fact, it follows from (30) that (31).

(30) John is capable of hitting the top or the bottom half of the board.

(31) John is capable of hitting the top half of the board and he is capable of hitting the bottom half of the board.

To summarise, let $r \leftrightarrow p \vee q$. The observation is that $\Diamond\Box(r) \not\Rightarrow \Diamond\Box p \vee \Diamond\Box q$, but that $\Diamond\Box[p \vee q] \Rightarrow \Diamond\Box p \wedge \Diamond\Box q$, and hence that $\Diamond\Box[p \vee q] \Rightarrow \Diamond\Box p \vee \Diamond\Box q$. The question that arises is how we can account for the fact that equivalent propositions yield different inferences when embedded under ability modals.

5 Ability and negation

As Hackl (1998) observes, negated ability statements are surprisingly strong.

(32) John can't swim.

If we take our DOD-invalidating semantics of the first section of this squib, we would expect this sentence to mean that there is nothing John can do that will reliably allow him to swim. But this seems too weak. What (32) seems to convey is rather that any action by John will reliably fail to allow him to swim. In other words, rather than (33), the semantics of (32) seems to be (34).

(33) $\neg\Diamond\Box$[John swims]

(34) $\Box\Box[\neg$John swims]

If we accept the strengthening of (33) into (34) as a general property of ability modals, then our dilemma disappears given two additional and relatively uncontroversial assumptions: (i) free choice is a pragmatic phenomenon that relies on the denial of alternatives; (ii) the individual disjuncts are among the alternatives for a disjunction. Given the semantics of ability, (35) fails to give the unwanted inferences of accidental abilities. Given that there is a simplex proposition, there will be no free choice effect, as there are no relevant alternatives to *John hits the board.*

(35) John can hit the board.

Now for the semantically equivalent sentence with disjunction, (36). Since (36) and (35) are equivalent, DOD is not valid.

(36) John can hit the bottom or top half of the board.

However, the pragmatic interpretation is strictly stronger. Following the recipe outlined above, it yields the implicature in (37).

(37) ($\Diamond\Box$[John hits top half] $\wedge$ $\Diamond\Box$[John hits bottom half])

$\vee$

$(\neg\Diamond\Box[\text{John hits top half}] \wedge \neg\Diamond\Box[\text{John hits bottom half}])$

Let's assume the second disjunct is true. Given the strengthening from $\neg\Diamond\Box p$ to $\Box\Box\neg p$ we get $\Box\Box[\neg\text{John hits top half}]$ and $\Box\Box[\neg\text{John hits bottom half}]$, that is, John can't hit the board. This is incompatible with (36) and so the first disjunct of (37) must be true, which means that John has the ability to hit the bottom half and he has the ability to hit the top half.

6 Ability and the excluded middle

The kind of strengthening discussed in the previous section is familiar from a number of phenomena and is often referred to as homogeneity. For instance, negated generic statements get an interpretation that is similar in strength to negated abilities.

(38) Tigers haven't got tusks.

The sentence in (38) does not just mean that it is not the case that, barring exceptions, tigers have tusks. Rather, it indicates that, barring exceptions, tigers don't have tusks. So, $\neg\text{Gen}_x[p(x)]$ becomes $\text{Gen}_x[\neg p(x)]$. In fact, as noticed by Nickel (2010), generic sentences involving disjunction trigger free choice effect and their behaviour under negation is an essential part of explaining why.

The term homogeneity comes from the discussion of a similar kind of strengthening of negation with definite plurals (Fodor, 1970; Löbner, 2000). The observation is that (39) seems to have a universal flavour in that it seems stronger than the assertion that John saw some of the boys. However, its negation in (40) also seems strong: it conveys that John didn't see any of the boys, rather than that he merely didn't see all of them.

(39) John saw the boys.

(40) John didn't see the boys.

In this sense, plural definites are homogeneous: the members of the plurality tend to either be "all in" or "all out".

A proper characterisation of the all or nothing behaviour of ability modals would be the exluded middle principle in (41):

(41) $\Box[\Box\varphi \vee \Box\neg\varphi]$ (Excluded middle)

Given this principle, we infer from $\neg\Diamond\Box p = \Box\neg\Box p$ that $\Box\Box\neg p$. As a general principle, this is obviously much too strong. It says that from any accesible world we can either only access p worlds or only $\neg p$ worlds. One problem with the principle becomes apparent when we return to the premisse of distribution over disjunction, $\Diamond\Box[p \vee q]$. The principle tells us that a proposition like this cannot be true due to the accessibility of a world from where we have access to a mixture of worlds, some p but not q worlds and some q but not p worlds. In effect, such a sentence can only be true if either $\Diamond\Box p$ or $\Diamond\Box q$. In other words, if we assume (41) for any φ, then distribution over disjunction follows.

Once more there is a parallel with generics. We do not want to assume that elephants either all live in Africa or never live there. But as soon as we formulate a generic statment like *Elephants live in Africa* or *Elephants don't live in Africa* exactly that assumption is presupposed. Similarly, it would make sense to view (41) as the result of a homogeneity presupposition, as in von Fintel's theory of conditionals (1997). An ability statement $\Diamond\Box\varphi$ presupposes (41). This means that *John is capable of hitting the board* and *John is capable of hitting the bottom half or the top half of the board* have the same presupposition: that in every accessible world it either becomes reliably true that John hits the board or reliably false that he hits it. However, the implicature calculation for the latter sentence adds further presuppositions for the individual disjuncts. These presuppositions will strengthen the negation in the implicatures, resulting in free choice implicatures.

7 Conclusion and a final remark on scope

We've now come full circle: (i) ability modals do not support distribution over disjunction and are as such predicted not to trigger free choice effects; (ii) I have provided data suggesting that ability modals do trigger free choice effects; (iii) in order to allow for free choice I assumed that the alternatives triggered by disjunction come with an excluded middle presupposition. The free choice implicature entails the validity of distribution over disjunction. As such, we have explained why, even though DOD is invalid in simple cases, it becomes valid whenever there is a syntactically explicit disjunction.

It may seem to follow from all that I have stated above that any sentence that combines existential and universal quantification should only be able to trigger free choice effects by making use of a similar homogeneity presupposition.

This is not the case, however. The reason for this is that in contrast to lexicalised combinations of quantificational forces like ability modals or the generic quantifier, the overt combination of two seperate quantificational forces will allow scope interactions. Take (42) or (43) as an example:

(42) John is allowed to feed every hamster a peanut or an olive.

I think there are two possible interpretations for sentences like this. On the first we conclude that John has permission to feed some hamsters a peanut and he has permission to feed some an olive. This is weak because it leaves open whether he has free choice or not. To account for this reading one could assume there is an embedded variation inference of the type in (43).

(43) John feeds every hamster a peanut or an olive
$\Rightarrow$ John feeds some hamster a peanut
$\Rightarrow$ John feeds some hamster an olive.

Embedding this type of inference in (42) we get: John is allowed to feed every hamster a peanut or an olive and he has permission to feed some hamsters a peanut and some hamsters an olive

There is, however, a second, stronger reading, one in which John has permission to feed every hamster a peanut and he has permission to feed every hamster an olive. In other words, this reading strengthens (44) to (45).

(44) $\Diamond\forall x[p(x) \vee q(x)]$

(45) $\Diamond\forall x[p(x)] \wedge \Diamond\forall x[q(x)]$

However, as we have seen above, such a pragmatic strengthening can only work if we assume some kind of homogeneity principle. But this seems to strong: *John is not allowed to feed every hamster a peanut* does not mean that he has to feed no hamster a peanut.

For cases like (42), however, there is another route to free choice. All we need to assume is that free choice is a result of disjunction taking intermediate scope, between the two quantificational operators. That is, the logical form of (42) is (46):

(46) $\Diamond[\forall x[p(x)] \vee \forall x[q(x)]]$

With this in place, the sentence is a classical example of a free choice permission sentence: deontic modality with disjunction in its immediate scope. The inference in (45) follows on any standard account.

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