Free Choice in Deontic Inquisitive Semantics (DIS)

Martin Aher

University of Osnabrueck, Institute of Cognitive Science

Abstract. We will propose a novel solution to the free choice puzzle that is driven by empirical data from legal discourse and does not suffer from the same problems as implicature-based accounts. We will argue against implicature-based accounts and provide an entailment-based solution. Following Anderson's violation-based deontic logic, we will demonstrate that a support-based radical inquisitive semantics will correctly model both the free choice effect and the boolean standard entailment relations in downward entailing contexts. An inquisitive semantics is especially suited to model sluicing effects where the continuation "but I do not know which" coerces an ignorance reading. It also demonstrates that the counterarguments to deontic reduction failed to take into account the different effects of inquisitive and informative utterances in conversation, such that a refined definition of radical inquisitive entailment renders such inferences invalid. Furthermore, we will argue that the problem of strengthening the antecedent that is used as a counterargument against entailment-based accounts also fails under a refined notion of entailment.

Introduction

Example 1. A country may establish a research center or a laboratory.

Example 2. A country may establish a research center.

Example 3. A country may establish a laboratory.

When (1) is international law, it gives permission to establish a research center and it gives permission to establish a laboratory. (Although it does not necessarily give permission to establish both.) The so called free choice reading reverses standard entailment relations between the disjuncts and disjunction such that (1) entails (2) and (3). It is now the same entailment relation as between a conjunction and its conjuncts. In a non-deontic setting disjuncts entail the disjunction.

Example 4. A country established a research center or a laboratory.

Example 5. A country established a research center.

Example 6. A country established a laboratory.

Either disjunct - (5), (6) - entails (4). Free choice disjunction has become one of the better documented puzzles in semantics since it was investigated by Hans Kamp [14].

The approach to free choice outlined here is based on an investigation of World Trade Organisation dispute texts, which documents discourse in a deontic setting between a complainant, respondent and a panel of judges. The results of previous work [1] suggest that judges organize legal discourse around central questions on whether specific laws have been violated. The complainant has the burden of proof to demonstrate that an act was performed and to specify the law that it violated. The respondent has to either deny the act or break the link between the act and the law.

A violation-based deontic logic gravitates around the question whether an act violates a specific law. A permission sentence in a law text provides information on what is not a violation. This should mostly be relevant in cases where there is also a general prohibition in force, so that the permission sentence effectively provides an exception. For example, in case pets are not permitted in malls, the following sentence explicitly tells you that you do not violate that prohibition by bringing a guide dog into the mall.

Example 7. Customers may bring guide dogs into the mall.

Legal discourse that gravitates around violations suggests an approach based on Anderson's reduction of a permission utterance $\Diamond p$ to $p \rightarrow \overline{v}$ [4] which will be shown to be a successful approach to the free choice permission puzzle when implemented in the framework of inquisitive semantics.

Previous Accounts

Zimmermann [21] provides a solution through positing a pragmatic mechanism that reinterprets disjunction as a conjunctive list of epistemic possibilities: $\Diamond A \wedge \Diamond B$. Unfortunately, such an approach does not explain why this reinterpretation arises in those contexts. Furthermore, Alonso-Ovalle [3], and Simons [20, p. 8] draws attention to the fact that disjunctive permission in a downward entailing context once again behaves standard - an effect Zimmermann fails to predict.

Many following accounts accepted that free choice is essentially a pragmatic effect and suggested that the phenomenon is an implicature. These accounts include Schultz [18], Eckardt [7], Fox [8] and the game theoretic implicature account by Franke [9]. As approaches to free choice have been extensively discussed in the literature, for example by Schultz [17] or more recently by Barker [5], we will concentrate on examining [7] to expatiate on general issues with implicature-based solutions.

Eckardt derives the free choice effect utilizing an implicature through the maxims of manner and quality. The free choice inference of disjunctive permission statements is derived through the following pragmatic steps.

1. *May S* refers to a subset W of all deontic alternatives for a subject a in world W*
   Presupposition: W needs to be a subset of a previously mentioned group Y.
2. A(W) predicates over all objects in subset W.
3. Disjunctive predication
   (a) Speaker utters (A or B)(W) and has sufficient knowledge.
   (b) Speaker violated the maxim of manner: be brief, as the speaker did not use either disjunct: A(W) or B(W).
   (c) Inference from quality: Speaker believes A(W) is not true and B(W) is not true.
   (d) Free choice effect: There are some worlds in W in which A is true and B is not, and other worlds in which B is true but A is not: $w_1, w_2 \leq W : A(w_1) \wedge \neg B(w_1), \neg A(w_2) \wedge B(w_2)$

The weakness of this account lies in (3c) as the intuition behind the deontic free choice effect is that the speaker's information state supports only worlds in which A and B are permitted. The reason why A(W) and B(W) in (3d) are not true is that there exist some worlds in the speaker's information state in which one of them is not true. But this is contrary to the intuition outlined above.

[20, p. 14] argues generally against implicature based accounts on the grounds that there does not seem to be a distinction between what is said and what is implicated in examples such as (1). Compare this to a classic example of generalized implicature from Grice [11, p. 32].

Example 8. X is meeting a woman this evening.

Grice states that such a statement generally implicates that the woman being met is not X's wife, mother, sister, etc. Thus, there exists a clear distinction between that which is said (X will meet a woman) and that which is implicated (X will meet a potential romantic acquintance). The lack of such distinctions in free choice sentences poses a challenge to any implicature based account.

[5, p. 16] demonstrates that another marker of implicatures is visibly lacking, namely cancellability. Observe the following example.

Example 9. You may eat an apple or a pear, although in fact you may not eat an apple.

When an implicature in cancelled, the utterance only has the meaning of what is said. If (8) were cancelled by "... but it's only her mother." then the utterance would lose the implicature that the woman is a romantic acquintance. Yet, instead of reverting the phrase to that which is said as opposed to that which is implied, the added phrase in (9) appears to make the statement contradictory.

There appears to be another possible route for cancellation, which is to utter either of the following continuations.

Example 10. You may eat an apple or a pear, although in fact you may not eat both.

Example 11. You may eat an apple or a pear, although in fact I do not know which.

The consequence of uttering (10) does not cancel the free choice effect. Permission is given to eat an apple and permission is given to eat a pear. Yet, the continuation provides the additional information that eating both an apple and a pear is prohibited. This additional information does not conflict with free choice readings.

(11) intuitively suggests that the speaker is ignorant. The speaker has limited knowledge of the governing permissions and prohibitions, and utters the most helpful utterance available. It is well known in the literature that such utterances have standard disjuntive entailment relations, and it can easily be accounted for by inquisitive semantics.

[5] proposes a semantic approach similar to the one pursued here, by following [15] in positing a normative ideality δ such that if φ is obligatory, then if φ then δ. This view is a contrapositive view of Anderson's reduction

and, thus, is in no conflict with the current solution to the free choice puzzle at a foundational level. But in terms of details, the analysis of WTO examples in [1] suggests that legal reasoning does not concern idealities but rather violations. While this might be contingent on the deontic context, in terms of legal language, the violation-based solution remains preferable.

Furthermore, [5, p. 11] correctly notes that if obligation is rendered as "if φ then δ" then doing φ guarantees the ideal universe. In a standard model, this means that if you may eat an apple, then eating an apple and killing a postman will invariably lead to the ideal universe. Barker introduces a resource sensitive calculus to render such inferences invalid.

As will be demonstrated, Barker's approach seems intuitively to be on the right track, but it lacks certain aspects which will be included in the approach to follow. For example, a violation based system allows for inferences with different violations, such as when two different laws are relevant to judge a case. An ideality based model would require significant work to account for these cases.

Also, while Barker's account of the free choice effect is entailment based, he introduces pragmatics to attain the default reading of negated disjunctive permission sentences. It would be more aligned with his project to provide a fully semantic account. This observation, albeit not a counterargument in itself, also holds for the semantic account of Aloni [2].

The Proposal

Negation of disjunctive permission utterances is one of the fundamental problems for many accounts on free choice and this fact is often taken as support for the idea that the phenomenon should be resolved by an implicature. We shall thus base the inquisitive deontic model on an independently motivated prior version of inquisitive semantics that focuses on the effects of negation - Radical Inquisitive Semantics. An earlier version of the language used here was developed and explored by Sano [16]. Our proposal adds clauses for deontic permission and discusses entailment in the radical environment. Unlike the original [13], this version of Radical Inquisitive Semantics is restricted. Also note the definition for the negation of implication, the original motivation for such a formulation is discussed at length elsewhere [13, pp. 18-23, 28-30].

We shall only consider a propositional language of a finite set of propositional variables and the operators: $\overline{\varphi}, \wedge, \vee, \rightarrow, \neg$. Negation is defined as $\overline{\varphi}$ and $\neg$ is added as classical negation for comparison purposes and will only play a limited role in the deontic story.

We also need to define worlds as binary valuations for atomic sentences and states as non-empty sets of worlds. σ and τ are variables that range over states, w is the variable that ranges over worlds and W is the set of all (classical) valuation functions. Propositions expressed by sentences are defined through support. When a state supports φ then we write $\sigma \models^+ \varphi$ and when a state rejects φ then we write $\sigma \models^- \varphi$.

Definition 1. *Radical inquisitive semantics.*

1. $\sigma \models^+ p$ iff $\forall w \in \sigma : w(p) = 1$
   $\sigma \models^- p$ iff $\forall w \in \sigma : w(p) = 0$
2. $\sigma \models^+ \overline{\varphi}$ iff $\sigma \models^- \varphi$
   $\sigma \models^- \overline{\varphi}$ iff $\sigma \models^+ \varphi$
3. $\sigma \models^+ \neg\varphi$ iff $\forall \tau \subseteq \sigma.\tau \not\models^+ \varphi$
   $\sigma \models^- \neg\varphi$ iff $\sigma \models^+ \varphi$
4. $\sigma \models^+ \varphi \vee \psi$ iff $\sigma \models^+ \varphi$ or $\sigma \models^+ \psi$
   $\sigma \models^- \varphi \vee \psi$ iff $\sigma \models^- \varphi$ and $\sigma \models^- \psi$
5. $\sigma \models^+ \varphi \wedge \psi$ iff $\sigma \models^+ \varphi$ and $\sigma \models^+ \psi$
   $\sigma \models^- \varphi \wedge \psi$ iff $\sigma \models^- \varphi$ or $\sigma \models^- \psi$
6. $\sigma \models^+ \varphi \rightarrow \psi$ iff $\forall \tau \subseteq \sigma.(\ \tau \models^+ \varphi$ implies $\tau \models^+ \psi)$
   $\sigma \models^- \varphi \rightarrow \psi$ iff $\exists \tau.(\tau \models^+ \varphi$ and $\forall \tau' \supseteq \tau.(\tau' \models^+ \varphi$ implies $\sigma \cap \tau' \models^- \psi))$

Definition 2. *Propositions.*

1. $\|\varphi\|^+ := \{\tau \subseteq W \mid \tau \models^+ \varphi\}$
   $\|\varphi\|^- := \{\tau \subseteq W \mid \tau \models^- \varphi\}$

The model is persistent, as $\|\varphi\|^+$ and $\|\varphi\|^-$ are closed under $\subseteq$ ie. when a state supports $\|\varphi\|^+$ then so does each of its substates.

The clauses for possibilities and counter-possibilites differ from those in [13] with respect to the addition of a filter that ensures that possibilities and counter-possibilities are maximal states that support or reject a sentence.

Definition 3. *Maximality restriction.*
Given any $\chi \subseteq Pow(W)$, χ_{MAX} is defined as all the $\subseteq$-maximal elements of χ, ie. $\sigma \in \chi_{MAX}$ means that, for any $\tau \in \chi$ with $\sigma \subseteq \tau$, $\sigma = \tau$.

This allows us to define possibilities and counter-possibilities. We define for every sentence φ in our language, the proposition $\lceil\varphi\rceil$ expressed by φ, and the counter-proposition $\lfloor\varphi\rfloor$ for φ. Both $\lceil\varphi\rceil$ and $\lfloor\varphi\rfloor$ will be sets of possibilities. We will refer to the elements of $\lceil\varphi\rceil$ as the possibilities for φ and to the elements of $\lfloor\varphi\rfloor$ as the counter-possibilites for φ.

Definition 4. *Possibilities and counter-possibilities.*

1. $\lceil\varphi\rceil := \|\varphi\|^{+}_{MAX}$
2. $\lfloor\varphi\rfloor := \|\varphi\|^{-}_{MAX}$

To reason about deontic statements in the framework of inquisitive semantics, one requires an interpretation of permission statements with the modality "may". Following Anderson [4] and the way in which WTO judges reason, we take permission statements to provide information about what is not a violation. This can be captured via introducing the proposition v that provides the information that a specific violation has occurred.

Generally, v shall designate a specific law or regulation that is being violated. To account for different types of violations that can occur within a single legal framework, one can designate v_1, v_2, etc. for each specific violation. For example, v_1 may be taken as the proposition "Violation of law number 1 has occurred." As violation propositions are specific, violations can be reasoned about in the same manner as any other proposition. So the violation of one law does not lead to violations of other laws, nor does not violating one law save one from indictments due to other deeds.[1]

This will be defined in the semantics as follows.

Definition 5. *Permissive "may".*

1. $\sigma \models^{+} \Diamond\varphi$ iff $\forall\tau \subseteq \sigma.(\ \tau \models^{+} \varphi$ implies $\tau \models^{+} \overline{v})$
   $\sigma \models^{-} \Diamond\varphi$ iff $\exists\tau.(\tau \models^{+} \varphi$ and $\forall\tau' \supseteq \tau.(\tau' \models^{+} \varphi$ implies $\sigma \cap \tau' \models^{-} \overline{v}))$

The effect of uttering $\lceil\Diamond p\rceil$ is thus the same as uttering the following implication: $\lceil p \to \overline{v}\rceil$.

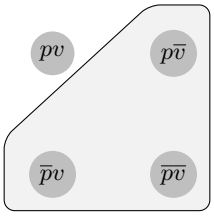

Fig. 1. $\lceil\Diamond p\rceil$

For this account to provide a solution to the free choice puzzle, we must interpret "may" as taking scope over disjunction. And, indeed, this interpretation follows from general observations regarding disjunction and scope. Following Eckardt [7, pp. 9-10] we argue that in case of ambiguities, one chooses the strongest of the alternatives. In this paper, strongest is understood classically as most eliminative, while the standard measure for strength in inquisitive semantics is homogeneity [12, p. 23], which states that a sentence ought to be more eliminative and less inquisitive to be stronger. As can be seen by comparing figures (b) and (o), "may" taking scope over disjunction provides the stronger reading.

The solution to the free choice puzzle arises throught the following equivalence.

Example 12. $\lceil\Diamond(p \vee q)\rceil \equiv \lceil(p \vee q) \to \neg v\rceil \equiv \lceil(p \to \overline{v}) \wedge (q \to \overline{v})\rceil$

In this formulation, a disjunctive permission sentence eliminates three worlds: $< p, \overline{q}, v >, < \overline{p}, q, v >$ and $< p, q, v >$. The result is a single possibility that includes the remaining worlds.

[1] This formulation might yield interesting results with classic deontic logic puzzles, such as the Chisholm's paradox and the gentle murder paradox. Yet, as these fall out of the scope of describing the natural language semantics of permissive disjunction sentences, it will not be discussed in this article.

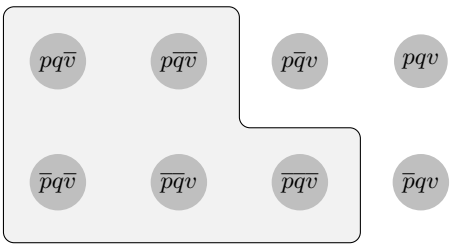

Fig. 2. A country may nominate a state funded research center or a private laboratory.

This appears to be in line with our intuitions regarding permission being granted for both disjuncts. Notice that the possibility for a disjunctive permission sentence does not prejudice whether p and q are in fact the case. The possibility is a set of worlds that includes $< \overline{pqv} >$, which is a world in which neither p nor q is true. This accounts for the intuition that permission sentences do not require one to in fact perform the act that is permitted. Furthermore, the possibility includes the world $< \overline{pq}v >$, where a violation does occur, but neither p nor q is true. This world allows for a more fine-grained analysis of interaction between different permissions and prohibitions, as a permission for one thing, in this case $p \vee q$ does not guarantee that a violation may not occur when another thing, for example r, is true.

Radical Inquisitive Entailment

The classic problem with violation based deontic logics is that from the assumption p and the definition of obligation as $\overline{p} \rightarrow v$ one can derive the validity of $p \rightarrow \Box p$ which is an obviously false prediction, known as the naturalistic fallacy. It isn't valid to derive from the fact that something is the case that it is also obligatory. The manner in which [4] derived this is the following.

1. $\Box p := \overline{p} \rightarrow v$
2. p
3. $\overline{\overline{p}}$
4. $\overline{\overline{p}} \vee v$
5. $\overline{p} \rightarrow v$
6. $p \rightarrow \Box p$

Anderson's derivation poses a technical challenge, but it is not intuitively plausible that this counterargument will hold in natural language semantics. The steps that are most problematic are those from 3 to 4 and 4 to 5. When one knows p or $\overline{\overline{p}}$, it is dubious to assume that disjunctive addition does not create problems. It raises threefold issues. Firstly, one adds inquisitiveness, which previously wasn't present. Secondly, in a non-restricted system such as [6], one would draw attention to a new possibility, which needs to be justified. And, thirdly, one should be able to attest to the relevance of the added proposition. Unfortunately, challenging any of these three assumptions would require the addition of a great deal to this framework, so noting the limitations for this paper, we decided to concentrate on the move from step 4 to 5. We can give a preliminary solution to this issue by investigating the notion of entailment with additional attention to negative responses. The proposed definition of entailment will also prove useful to deal with examples of strengthening the antecedent discussed earlier.

Inquisitive semantics provides the basic machinery for drawing the required distinctions that falsify the step from 4 to 5. As these utterances constitute different possibilites, the effects of these utterances will similarly differ.

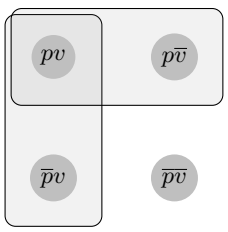

Fig. 3. $\lceil \overline{\overline{p}} \vee v \rceil$

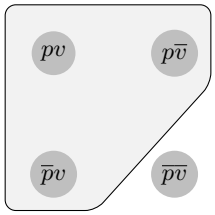

Fig. 4. $\lceil \overline{p} \rightarrow v \rceil$

While figure 3 represents a hybrid sentence that both eliminates one world and generates two possibilities, then $\lceil \overline{p} \rightarrow v \rceil$ depicted in figure 4 is a purely informative utterance that forms a single possibility that represents

the connection between $\overline{p}$ and v. The fact that these utterances are informatively equivalent, but unavailable for use as substitutes in natural language was already noted by Grice [10, p. 67].[2]

Intuitively, the utterances have a different effect on the conversation. While a disjunction has two possibilities and is thus inquisitive, the implication loses the inquisitive content. This is in itself a distinction that is dubious to ignore, but rather than block entailment at this stage, in a radical framework, one can capture the difference in conversational effect through investigating negative responses.

The idea behind drawing valid conclusions through inference is that the conclusion provides less information than the preceding step. This should mean that if one did not have a problem with the preceding step, then the following step cannot be problematic either. This is true in a classical setting and one can generalize that $\varphi \models \psi$ iff $\neg\psi \models \neg\varphi$. This should also hold for a disjunction to entail an implication, but the following provides reason to doubt this.

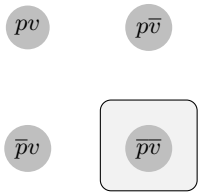

Fig. 5. $\lfloor \overline{\overline{p}} \vee v \rfloor$

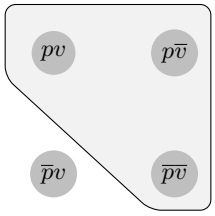

Fig. 6. $\lfloor \overline{p} \to v \rfloor$

As can be seen on figures 5 and 6, to reject step 4, one must eliminate two more worlds than to reject step 5. It follows that a person that did not have enough information to reject 4 might have enough information to reject step 5. For example, when a supposed interlocutor knows that $\overline{p}v$ is false, then this does not conflict with both possibilities of the disjunction, but it does conflict with the possibility for the implication. Thus, when responding to the disjunction, he can only reject one possibility and thus affirm the other one.

Looking at the implication, the world $\overline{p}v$ is also noteworthy as uttering an implication intuitively informs about whether the consequent follows from the antecedent. If the conversation weren't interested in whether the consequent follows the antecedent, it would be infelicitous to utter the implication in the first place. But if the combination of the antecedent and consequent is known to be false, the rule can only be proven to be false.

This suggests that standard inquisitive entailment [12, p. 10] does not capture the notion of drawing valid conclusions regarding disjunction and implication. In radical inquisitive semantics we require a more refined definition for entailment. We will follow the intuition that drawing conclusions is valid only when the preceding step is more difficult to negate than the following.

Definition 6. *Radical inquisitive entailment.*

1. $\varphi \models \psi$ iff $\forall \alpha \in \lceil \varphi \rceil : \exists \beta \in \lceil \psi \rceil : \alpha \subseteq \beta$ and $\bigcap \lceil \psi \rceil \subseteq \bigcup \lfloor \varphi \rfloor$

What radical entailment says is that when φ entails ψ, then not only must every possibility in φ be contained in a possibility for ψ, the intersection of counter-possibilities in ψ must be contained in the union of counter-possibilities for φ.

With radical inquisitive entailment, step 4 ($\overline{\overline{p}} \vee q$) in Anderson's counterargument no longer entails step 5 ($\overline{p} \to q$) as the counter-possibility to step 5 includes the worlds $< p\overline{q} >$, $< \overline{p}q >$ and $< \overline{p}\overline{q} >$ while the counter-possibility to step 4 consists of only one world $< p\overline{q} >$.

Note that the clause for the entailment of counter-possibilities is restricted by taking the intersection and union of counter-possibilities, respectively. Unlike with the positive clause, one will probably find that drawing inferences from negative utterances can lead astray. This can be seen with $\lceil p \vee q \to \overline{v} \rceil \models \lceil p \to \overline{v} \wedge q \to \overline{v} \rceil$.

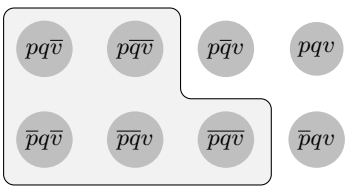

Fig. 7. $\lceil p \vee q \to \overline{v} \rceil$

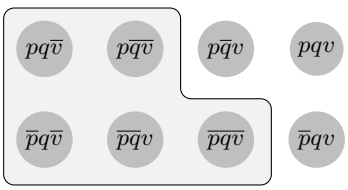

Fig. 8. $\lceil p \to \overline{v} \wedge q \to \overline{v} \rceil$

[2] Grice also added "not both p and not q" as an informatively equivalent substitute that people are unhappy to use.

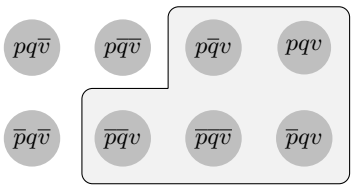

Fig. 9. $\lfloor \overline{p \vee q \rightarrow \overline{v}} \rfloor$

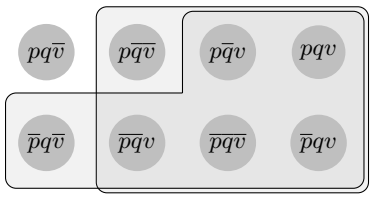

Fig. 10. $\lfloor \overline{p \rightarrow \overline{v} \wedge q \rightarrow \overline{v}} \rfloor$

In radical inquisitive semantics, the negation of conjunction is inquisitive. This allows one to account for the fact that after a conjunction is rejected, one can ask: "Why?" and the other interlocutor can specify which conjunct was unacceptable. Yet, this fact creates a problem for drawing conclusions on the basis of counter-possibilities alone. The worlds $< p\overline{q}\overline{v} >$ and $< \overline{p}q\overline{v} >$ are not eliminated, and instead remain in a counter-possibility, but inferring that either of these worlds is the case will not be warranted. These worlds might represent the world, but they also might not. Thus, to keep the additional functionality that having inquisitive rejection of conjunctive utterances provides, we have decided to tackle this issue of valid inferences at the level of entailment itself by taking intersection of the counter-possibilities for $\lfloor \psi \rfloor$ to limit inferences to only guaranteed worlds.

The radical definition of entailment also deals with the problem of strengthening the antecedent. If it is permitted to eat an apple, then intuitively it should not be the case that both eating an apple and killing a postman should still lead to a non-violation world.[3] As one can see in the following figures, this inference is blocked by radical entailment.

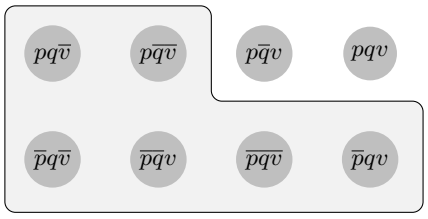

Fig. 11. $\lceil p \rightarrow \overline{v} \rceil$

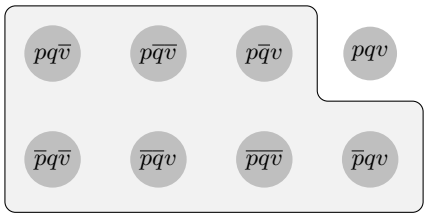

Fig. 13. $\lceil (p \wedge q) \rightarrow \overline{v} \rceil$

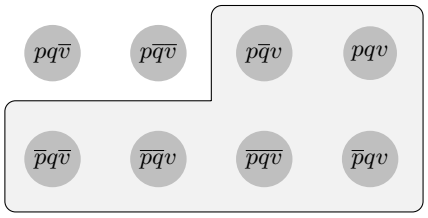

Fig. 12. $\lfloor p \rightarrow \overline{v} \rfloor$

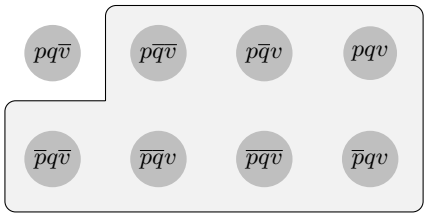

Fig. 14. $\lfloor (p \wedge q) \rightarrow \overline{v} \rfloor$

As the comparison of figures (12) and (14) demonstrates, the counter-possibility $\lfloor (p \wedge q) \rightarrow \overline{v} \rfloor$ is not contained in the counter-possibility $\lfloor (p \rightarrow \overline{v} \rfloor$, which means that the strengthened antecedent is not entailed by the original permission utterance.

Zimmermann [21] and Simons [19] draw our attention to the possibility of appending a disjunctive permission sentence with "... but I do not know which." such that the free choice effect gives way to an ignorance reading.

Example 13. A country may establish a research center or a laboratory, but I do not know which.

The entailment relations of these examples revert back to standard disjunction. We argue that this effect arises from the additional information blocking the modality from taking strongest scope - scoping over the disjunction. The result is a translation of (13) as a wide scope reading in which disjunction takes scope over "may" such that "may" distributes into the disjuncts.

Example 14. $\lceil \Diamond p \rceil \vee \lceil \Diamond q \rceil \equiv \lceil (p \rightarrow \overline{v}) \rceil \vee \lceil (q \rightarrow \overline{v}) \rceil$

[3] In the real world, eating an apple and murder would not be governed by the same violation, but to strengthen the argument, let us assume it is the same violation.

As disjunction is a hybrid between inquisitive and informative utterances, a wide scope disjunctive permission utterance raises an issue for the speaker to solve, modeled as two possibilities as shown in the graph below.

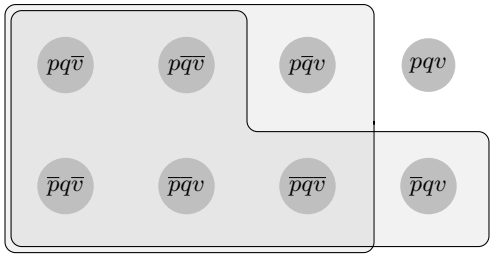

Fig. 15. A country may establish a research center or a laboratory but I don't know which.

The model still includes classical negation that takes the complement of a proposition. This allows us to model yet another effect. The following utterance is appended with "... and, also, I do not care."

Example 15. A country may establish a research center or a laboratory, but I do not know which, and, also, I do not care.

We model "I do not care." through double classical negation: $\neg\neg\lceil(\Diamond\varphi \vee \Diamond\psi)\rceil$ (known as non-inquisitive closure in [12, p. 4]), which results in the same possible worlds as (13), but it consists of only one possibility. This correctly does not guarantee that doing p or q does not result in a violation. Note, that the non-inquisitive closure only has an effect on inquisitive utterances, and "I do not care" is superfluous when added to the free choice examples.

Conclusions

This paper argued against the prevalent view that the solution to the free choice puzzle should be pragmatic, demonstrating that Anderson's reduction, when implemented in radical inquisitive semantics, provides an account that avoids many problematic cases known in the literature.

While negation has been especially problematic for previous solutions, specifying counter-possibilities and defining the negation of implication in the tradition of connexive logic provides a simple and principled account.

Counterarguments to Anderson's reduction were shown to rely on an overly simple notion of entailment and the refinement of standard inquisitive entailment into radical inquisitive entailment provided a solution to both of the largest issues concerning drawing implausible conclusions within a violation-based semantics.

Furthermore, a violation-based account aligns well with the way lawyers and judges use deontic language, which provides additional empirical support for an account where permission is defined as providing the information on what is not a violation.

References

1. Aher, M.: Inquisitive semantics and legal language. Proceedings of the 15th student session of the european summer school for logic, language and information, Ed. Slavkovik, M. (2010) 124-131
2. Aloni, M.: Free Choice, Modals, and Imperatives. Natural Language Semantics **15** (2007) 65-94
3. Alonso-Ovalle, L.: Equal right for every disjunct! Quantification over alternatives or pointwise context change? Presentation at Sinn und Bedeutung 9 (2004)
4. Anderson, A.R.: Some Nasty Problems in the Formal Logic of Ethics. Nous **1** (1967) 345-360
5. Barker, C.: Free choice permission as resource-sensitive reasoning. Semantics and Pragmatics **3** (2010) 1-38
6. Ciardelli, I., Roelofsen, F., Groenendijk, J.A.G.: Attention! Might in Inquisitive Semantics. Semantics and Linguistic Theory (2009)
7. Eckardt, R.: Licencing 'or'. Presupposition and Implicature in Compositional Semantics. Palgrave MacMillan (2007) 34-70
8. Fox, D.: Free choice disjunction and the theory of scalar implicature. Presupposition and implicature in compositional semantics. Palgrave MacMillan (2007) 71-120
9. Franke, M.: Free choice from iterated best response. Logic, Language and Meaning: 17th Amsterdam Colloquium, revised selected papers. Eds. Aloni, M; Bastiaanse, H; de Jager, T; Schulz, K (2009) 295-304
10. Grice, H. P.: Indicative conditionals. Studies in the Way of Words. Harvard University press (1989) chapter 4
11. Grice, H. P.: Logic and conversation. Studies in the Way of Words. Harvard University press (1989) chapter 2
12. Groenendijk, J.A.G., Roelofsen, F.: Inquisitive Semantics and Pragmatics. In Standford Workshop on Language, Communication and Rational Agency (2009)
13. Groenendijk, J.A.G., Roelofsen, F.: Radical Inquisitive Semantics. Preliminary version, presented at the Colloquium of the Institute for Cognitive Science, University of Osnabrueck (2010)
14. Kamp, H.: Free choice permission. Aristotelian Society Proceedings N.S **74** (1973) 57-74
15. Kanger, S.: New Foundations for ethical theory. Deontic Logic: Introductory and Systematic Readings. Ed. Hilpinen, R. Reidel Publishing Company (1971) chapter 12
16. Sano, K.: A Note on Support and Rejection for Radical Inquisitive Semantics. Unpublished. (2010)
17. Schultz, K.: You may read it now or later: A Case Study on the Paradox of Free Choice Permission. Master thesis, University of Amsterdam (2003)
18. Schultz, K.: A pragmatic solution for the paradox of free choice permission. Synthese: Knowledge, Rationality and Action **147** (2005) 343-377
19. Simons, M.: Dividing things up: the semantics of or and the modal/or interaction. Natural Language Semantics **13** (2005) 271-316
20. Simons, M.: Semantics and Pragmatics in the Interpretation of or. Proceedings of SALT XV (2005) 205-222
21. Zimmermann, T. E.: Free Choice Disjunction and Epistemic Possibility. Natural Language Semantics **8** (2000) 255-290