On epistemic and deontic free choice

Maria Aloni
[joint work with Michael Franke]

ILLC/Department of Philosophy, University of Amsterdam

Introduction

- A number of constructions in various languages display different behavior in the scope of epistemic and deontic modals:
  - Romanian epistemic determiner *vreun*   [Fălăuș 2009,11,12]
    - Licensed under epistemics, not licensed under deontics
  - Slovenian concessive scalar particle *magari*   [Crnič 2011, 2012]
    - Licensed under deontics, not licensed under epistemics
  - German epistemic determiner *irgendein*   [Kratzer & Shimoyama 02]
    - Gives rise to different inferences under the two modals
      [Aloni & Port 2011]
- Common (implicit) assumption recent analyses:
  - Deontic and epistemic modals differ in the way they license free choice inferences   MODAL VARIABILITY HYPOTHESIS

Free Choice and Modal Variability Hypothesis

▶ Free choice (FC) inferences:

(1) a. Disjunction: $\Box/\Diamond(p_1 \lor p_2) \rightsquigarrow \Diamond p_1 \land \Diamond p_2$
   b. Existential: $\Box/\Diamond\exists x\varphi(x) \rightsquigarrow \forall x\Diamond\varphi(x)$

▶ Illustrations:

(2) Deontic FC   [Kamp 1973]
   a. You may go to the beach or to the cinema.
   b. $\rightsquigarrow$ You may go to the beach and you may go to the cinema.

(3) Epistemic FC   [Zimmermann 2000]
   a. Mr. X might be in Victoria or in Brixton.
   b. $\rightsquigarrow$ Mr. X might be in Victoria and Mr. X might be in Brixton.

▶ MODAL VARIABILITY HYPOTHESIS (MVH):
   Epistemics and deontics have a different FC-potential:
   ▶ Epistemic FC: well-behaved pragmatic inference
   ▶ Deontic FC: more able to penetrate into the compositional
     computation of semantic values

Outline

- Review relevant data/proposed analyses
  - Romanian epistemic determiner *vreun*
  - Slovenian concessive scalar particle *magari*
  - German epistemic determiner *irgendein*
  - Further support for MVH: Recent experiments on universal free choice
- Why should the Modal Variability Hypothesis (MVH) hold?
  - Dismiss semantic accounts of MVH
  - Propose pragmatic explanation in terms of difference in relevance and persistence of deontic vs epistemic information
- Implement proposal in a dynamic semantics
- Discuss a number of applications

Romanian *vreun* [Fălăuș 2009, 2011, 2012]

- *Vreun*: epistemic indefinite with limited distribution
  - Epistemic indefinites: existentials that signal ignorance on the part of the speaker
  - *Vreun* occurances restricted to negative polarity and a subset of modal contexts
- *Vreun* in modal contexts:
  - Licensed under epistemic modals (conveys ignorance effect):

    (4) Trebuie/Poate să fie vreun angajat care lucrează
    must/may SUBJ be.3SG VREUN employee who work.3SG
    până târziu.
    until late
    "It must/might be some employee working late."

  - Ungrammatical under deontic modals:

    (5) #Trebuie/Pot să citesc vreo carte până mâine.
    must/can SUBJ read.1SG VREUN book by tomorrow
    "I must/can read some book by tomorrow."

Modal inference of *vreun* under epistemic modals

- Total vs partial variation   [Alonso-Ovalle & Menéndez-Benito 2010]
  - TOTAL VARIATION: $\forall x \Diamond \phi$ [standard FC]
    all alternatives in the relevant domain qualify as a possible option
  - PARTIAL VARIATION: $\exists x \exists y (x \neq y \wedge \Diamond \phi(x) \wedge \Diamond \phi(y))$
    more than one (but not necessarily all) alternatives in the relevant domain qualify as a possible option
- *Vreun* in epistemic contexts merely conveys partial variation effects:

  (6) E   posibil ca Irina să se fi întâlnit cu vreun
       be.3SG possible that Irina SUBJ REFL be met   with VREUN
       prieten, dar nu poate fi Luca, tocmai l-am   vâzut.
       friend, but NEG can be Luca, just   SC-have.1SG seen
       "It is possible that Irina met some friend, but it cannot be Luca, I
       have just seen him."   (Fălăuş 2011, p.418)

Modal inference of *vreun* under epistemic modals

- *Vreun* even incompatible with situations in which total variation would hold:

  (7) THE SHELL GAME: The shell game requires three shells or boxes and a small ball. The ball is placed under one of the shells and then the operator quickly shuffles the shells around. In order to win, the player has to correctly identify the shell containing the ball.

      a. The ball might be in any box.
      b. ??Mingea trebuie să   fie în vreo cutie.
         ball-the must   SUBJ be.3 in VREUN box
         "The ball must be in some box."   (Fălăuş 2012, p.38)

⇒ *Vreun* expresses, beside partial variation, also an anti-total variation inference:

  - ANTI-TOTAL VARIATION: $\neg \forall x \diamond \phi$

    Not all alternatives in the relevant domain qualify as a possible option

Fălăuș' analysis

- Couched in Chierchia's alternative-based approach:
  - (i) polarity items (e.g. *vreun*, *any*) activate alternatives;
  - (ii) active alternatives require application of exhaustification (Fox 2007)
  - (iii) differences between items accounted for in terms of variation in (i) the type of alternatives they may activate and (ii) the mode of exhaustification they employ
- Different types of alternatives give rise to different modal inferences:
  - recursive exhaustification + domain alternatives ⇒ total variation
  - recursive exhaustification + *singleton* alternatives ⇒ partial variation
- Fălăuș: *vreun* activates singleton alternatives and allows recursive exhaustification (EXH)
- Partial variation and anti-total variation derived under epistemics:

  (8)　Epistemic: Trebuie să fie vreun angajat care lucrează până târziu.
  - a.　Partial var.: $\exists x \exists y (x \neq y \land \Diamond_e \phi(x) \land \Diamond_e \phi(y))$　　[via EXH]
  - b.　Anti-total var.: $\neg \forall x \Diamond_e \phi$　[competition with FCI *un oarecare*]

Vreun under deontics

- Assume existentials under deontic modals give rise to **total variation (FC) inferences** for independent reasons. Ban on total variation would then explains ungrammaticality of (9):

  (9)   Deontic: #Trebuie să citesc vreo carte până mâine.
       a.   Partial variation: $\exists x \exists y (x \neq y \wedge \Diamond_d \phi(x) \wedge \Diamond_d \phi(y))$ [EXH]
       b.   Anti-total variation: $\neg \forall x \Diamond_d \phi$ [competition]
       c.   Total variation: $\forall x \Diamond_d \phi$ [independent reasons]
                                                   ($\Rightarrow$ contradiction)

- Crucial to this explanation:
  - $\Rightarrow$ Total variation (FC) inferences independently generated under deontic modals, but not under epistemic modals

- We cannot use Fox' EXH to generate deontic FC-inferences unless we assume that *vreun* activates different kinds of alternatives under different kinds of modals

Concessive scalar particles [Crnič 2011, 2012]

- *magari*: blanket term for concessive scalar particles in various languages including Slovenian *magari/makr*
- Two main kinds of environments in which *magari* can occur:
    - In downward entailing contexts, where it is glossed with *even*
    - Under priority modals, such as imperatives, deontic, bouletic and teleological modals

    (10)   Preberi magari SINTAKTIČNE STRUCTURE.
            read.imp MAGARI Syntactic   Structures
            "Read at least Syntactic Structures!"

- Crucially, *magari* is reported not to be licensed under epistemic modals (Crnič 2011, p.4)

Crnič's analysis

- *magari* spells out two operators EVEN and AT LEAST:

  (11) a. $[\![\text{EVEN}]\!]^{g,c} = \lambda C.\lambda p : \forall q \in C[p \neq q \rightarrow p <_c q].\ \lambda w.p(w)$

  b. $\text{EVEN}_C\ p$ presupposes that p is the least likely among a set C of focal alternatives

  (12) a. $[\![\text{AT LEAST}]\!]^{g,c} = \lambda C.\lambda p.\lambda w.\exists q \in C[q \leq_c p \wedge (p(w) \vee q(w))]$

  b. AT LEAST$_C\ p$ asserts that p or some least likely alternative in C is the case

- Example: assume C is {Peter won bronze, Peter won silver, P won gold}

  (13) a. $[\![[\text{EVEN}\ C]\ \text{Peter won gold}_F]\!]^{g,c}(w)$ is defined only if it is least likely that Peter won gold. If defined, it is true iff Peter won gold in w

  b. $[\![[\text{AT LEAST}\ C]\ \text{Peter won bronze}_F]\!]^{g,c}(w)$ is true iff Peter won bronze or silver or gold in w

Predictions: *magari* under epistemic modals

- In positive episodic environments, *magari* is out because it produces contradictory presuppositions:

  (14) #Peter won *magari a bronze$_F$ medal.
     a. #[$_{\text{ZP}}$[EVEN C'][$_{\text{XP}}$[AT LEAST C] Peter won a bronze$_F$ medal]]
     b. $[\![C]\!]^{g,c} = \{$bronze, silver, gold$\}$
     c. $[\![\text{XP}]\!]^{g,c} = ($bronze $\vee$ silver $\vee$ gold$)$
     d. $[\![C']\!]^{g,c} = \{$bronze $\vee$ silver $\vee$ gold, silver $\vee$ gold, gold$\}$
     e. $[\![\text{ZP}]\!]^{g,c}(w)$ is defined only if
        (bronze $\vee$ silver $\vee$ gold) $<_c$ (silver $\vee$ gold), gold.
        If defined, true iff Peter won bronze or silver or gold in w

  [(bronze $\vee$ silver $\vee$ gold) cannot be less likely than the other alternatives in C', because the latter asymmetrically entail the former]

- Same prediction for *magari* under epistemic modals:

  (15) a. #You must have won *magari a bronze$_F$ medal.
     b. [$_{\text{ZP}}$[EVEN C'][$_{\text{XP}}\square_e$[[AT LEAST C] you win bronze$_F$]]]
     c. Scalar presupposition triggered by EVEN:
        $\square_e(b \vee s \vee g) <_c \square_e(s \vee g), \square_e g$

Predictions: *magari under deontic modals

- In a deontic sentence, if **embeddable** FC-**inferences are generated**, no contradictory presupposition is produced and *magari* is predicted to be grammatical:

(16)   You must win *magari a bronze$_F$ medal.

    a. $[_{ZP}[\text{EVEN } C'][_{XP}\Box_d[[\text{AT LEAST } C] \text{ you win bronze}_F]]]$

    b. $[\![XP]\!]^{g,c} = \Box_d(b \vee s \vee g) \wedge (\Diamond_d b \wedge \Diamond_d s \wedge \Diamond_d g)$

    c. $[\![C']\!]^{g,c} = \{\Box_d(b \wedge s \vee g) \wedge (\Diamond_d b \wedge \Diamond_d s \wedge \Diamond_d g),$
            $\Box_d(s \vee g) \wedge (\Diamond_d s \wedge \Diamond_d g), (\Box_d g \wedge \Diamond_d g)\}$

    d. $[\![ZP]\!]^{g,c}(w)$ is defined only if
            $\Box_d(b \vee s \vee g) \wedge (\Diamond_d b \wedge \Diamond_d s \wedge \Diamond_d g) <_c$
            $\Box_d(s \vee g) \wedge (\Diamond_d s \wedge \Diamond_d g), \Box_d g \wedge \Diamond_d g$
            If defined, it is true iff you must win bronze or silver or gold
            in w

[The fact that you are allowed to win an unremarkable bronze medal (and silver and gold) can be less likely than that you are required to win some shinier medal]

Conclusions on Crnič's analysis

- Crucial to this explanation:
  - ⇒ total variation (FC) inferences independently generated under deontic modals, but not under epistemic modals
- Crnič (2012) uses Fox' EXH to generate embeddable deontic FC-inferences, but EXH overgenerates:
  - Fox' machinery blind towards the difference between deontics and epistemics;
  - potentially rescuing FC-inferences derived also in the scope of epistemics.

German *irgendein* [Kratzer & Shimoyama, Aloni & Port]

- German *irgendein*: epistemic determiner with various uses
  - Ignorance effect (epistemic partial variation) in positive episodic contexts   **[Specific Unknown (SU) uses]**

    (17)   Irgendein   Student hat angerufen, (#nämlich Peter).
            IRGEND-ONE student   has called   (#namely   Peter)
            "Some student called. The speaker doesn't know who."

  - Plain narrow scope existential meaning in downward entailing contexts   **[NPI uses]**

    (18)   Niemand hat irgendeine Frage   beantwortet.
            Nobody   has IRGEND-ONE question answered
            "Nobody answered any question."

- *Irgendein* under epistemic and deontic modals:

  (19)   a.   Epistemic: $\Box_e$ (... *irgend* ...) $\Rightarrow$ partial variation   **[epiU]**
           b.   Deontic: $\Box_d$ (... *irgend* ...) $\Rightarrow$ total variation   **[deoFC]**

German *irgendein* under epistemic modals

- *Irgendein* can be used in situations in which epistemic total variation would not hold [Aloni & Port 2010, Lauer 2010]

  (20) HIDE AND SEEK: Juan is hiding in one of the rooms in the house, but we know he is not in the bathroom or in the kitchen. [Alonso-Ovalle & Menendez-Benito 2010]
    a. Juan muss in irgendeinem Zimmer im Haus sein.
       Juan must in IRGEND-ONE room in-the house be
       "Juan must be in some room of the house." [**epiU**]
    b. ??Juan might be in any room in the house.

⇒ *Irgendein* gives rise to a partial variation inference under epistemic modals

German *irgendein* under deontic modals

▶ Kratzer & Shimoyama 2002: (21) ambiguous between a wide scope ignorance interpretation represented in (21-a) and a narrow scope free choice interpretation represented in (21-b).

(21)   Maria muss irgendeinen Arzt   heiraten.
        Mary   must IRGEND-ONE doctor marry

     a.   'There is some doctor Mary must marry, the speaker doesn't know who'   **[SU]**

     b.   'Mary must marry a doctor, any doctor is a permissible option'   **[deoFC]**

▶ Narrow scope interpretations (forced by stress) incompatible with situations in which total variation would not hold (A&P 2012):

(22)   Maria muss IRGENDEINEN Arzt   heiraten, (#aber bestimmt
        Mary   must IRGEND-ONE   doctor marry   (but   definitely
        nicht Doktor Schulz).
        not   doctor Schulz
        'Mary must marry a doctor, any doctor is a permissible option'

⇒ *Irgendein* gives rise to a total variation inference under deontic modals

Aloni & Port on epistemic indefinites

- ► Epistemic indefinites: existentials with two additional characteristics:
  [Kadmon & Landman 1993]
  - ► **Domain shift:** induce an obligatory domain shift;
  - ► **Felicity Conditions:** are licensed only if such a shift is for a reason.
- ► Differences between different epistemic indefinites captured in terms of the different kinds of domain shift they can induce
- ► German *irgendein* able to shift domain in two different ways:
  - ► it can either shift method of identification (CC-shift);
  - ► or it can widen the domain (domain widening, DW).
- ► Felicity conditions for *irgendein*:
  - ► CC-shifts are justified only if otherwise, the speaker would not have been able to identify the witness of the existential claim;
  - ► DW is justified only if it does not create a weaker statement.
- ► Predictions of implementation in Dynamic Semantics with CC:
  - ► CC-shift ⇒ epistemic partial variation uses   **[SU, epiU]**
  - ► DW ⇒ negative polarity uses   **[NPI]**
  - ► Extra assumption needed for deontic total variation (FC) uses!

Deontic uses of *irgendein*

- *Irgendein* felicitous only if one of its domain shifts (CC-shift or DW) is for a reason
- Potential problem: under a classical analysis of deontics, neither CC-shift nor DW is justified:
  - Changing method of identification has no impact for existentials in the scope of classical modal operators   CC-shift unjustified
  - Extending the domain of an existential in the scope of a modal leads to a weaker statement   DW unjustified

  (23) $\Box_d \exists x_A \phi \models \Box_d \exists x_B \phi$ $[A \subseteq B]$

- Assume now a grammar which generates FC-inferences under deontics:
  - Extending the domain of an existential under a modal does no longer lead to a weaker statement, **if we incorporate its FC-inference**:

  (24) $\Box_d \exists x_A \phi \wedge \forall x_A \Diamond_d \phi \not\models \Box_d \exists x_B \phi \wedge \forall x_B \Diamond_d \phi$ $[A \subseteq B]$

  $\Rightarrow$ DW justified, *irgendein* felicitous, total variation effects explained
- Crucial to this explanation:
  $\Rightarrow$ total variation (FC) inferences independently generated under deontics, but not under epistemics

Modal Variability Hypothesis

- Three different explanations of seemingly different sets of observations:
    - Fălăuş on *vreun*
    - Crnič on **magari*
    - Aloni & Port on *irgendein*
- One common assumption:
    - MODAL VARIABILITY HYPOTHESIS:
      Deontic and epistemic modals have a different FC-potential. In particular, deontic FC seems to enter into the recursive computation of compositional semantic values, whereas epistemic FC does not.

PLAN

- Further evidence for MVH: universal free choice
    - recent experiments carried out to settle debate localist/globalist accounts of conversational implicatures
- Why should MVH hold?
    - Dismiss semantic accounts of MVH
    - Propose explanation in terms of pragmatic fossilization
- Implementation in a dynamic semantics
- Applications

Further evidence for MVH: Universal free choice (UFC)

- FC-inferences associated with disjunction under deontic modals can take scope under universal quantifiers, so-called *universal free choice*:

  (25) Deontic [Chemla 2009]
     a. All of the boys may go to the beach or to the cinema.
     b. $\leadsto$ All of the boys may go to the beach and all of the boys may go to the cinema.
     c. $\forall x \Diamond_d (\phi \vee \psi) \leadsto \forall x (\Diamond_d \phi \wedge \Diamond_d \psi)$

  [$\Rightarrow$ evidence against globalist accounts]

- Universal free choice does not arise as readily for epistemic modals:

  (26) Epistemic [Geurts & Pouscoulous 2009, van Tiel 2011]
     a. According to the professor, every research question might be answered by a survey or an experiment.
     b. ?? $\leadsto$ According to the professor, every research question might be answered by a survey, and, according to the professor, every research question might be answered by an experiment.

  [$\Rightarrow$ evidence against localist accounts]

Semantic accounts of MVH

- ▶ Assume formal/sortal difference between deontics and epistemics:
    - ▶ Deontic FC-inference as semantic entailment (embeddable)
    - ▶ Epistemic FC-inference as pragmatic implicature (non-embeddable)

    [⇒ compatible with globalist accounts]

- ▶ EMPIRICAL PROBLEM: deontic FC-entailments predicted for all indefinites (also for *John may marry someone*)
    - ▶ Partial solution in alternative-based accounts (e.g. Aloni 2007): deontic FC-entailments generated only for alternative-inducing indefinites (e.g. not for *someone*);
    - ▶ But Italian *un qualche* is alternative-inducing, and doesn't give rise to deontic FC-effects (Chierchia p.c.):
        - (27) Per aprire un pub, devi avere *un qualche* diploma, tipo . . .
          To open a pub you must have some diploma, for example . . .

- ▶ CONCEPTUAL PROBLEM: no reason why MVH should hold
    - ▶ Partial solution in performative analyses of deontics (Lewis 1979)
    - ▶ But embedded FC not confined to permission-giving sentences:
        - (28) a. All of the boys were allowed to go to the beach or to the cinema.
          b. ⤳ All of the boys were allowed to go to the beach and all of the boys were allowed to go to the cinema.

On why MVH should hold

- ▶ Diachronic perspective:

  > "It may not be impossible for what starts life, so to speak, as a conversational implicature to become conventionalized"
  > [Grice 1975, p.58]

- ▶ Pragmatic fossilization: yesterday's pragmatics gradually becomes tomorrow's semantics

- ▶ MVH: deontic and epistemic FC at different stages of pragmatic fossilization

- ▶ Why can deontic FC more readily penetrate compositional semantics than epistemic FC?

- ▶ Because deontic inferences convey information of the *right* type:

  - ▶ Practically relevant/frequent enough

    > "...it should suffice to note that for inferences to play a significant role in grammaticalization, they must be frequently occurring, since only standard inferences can plausibly be assumed to have a lasting impact on the meaning of an expression..." [Hopper & Traugott 1993, p. 75]

  - ▶ Persistent: survives information growth

The relevance of relevance

- Contextual relevance of inferred information crucial for availability of UFC-inference.
- Illustration: Scenario 1 in (30) more readily invites UFC-inference (29-b) than scenario 2:

    (29)   a.   Everybody at the ILLC can play the violin or the trombone.

            b.   ⤳? Everybody at the ILLC can play the violin, and everybody at the ILLC can play the trombone.

    (30)   a.   *Scenario 1*: Your task is to assemble an improvised university orchestra. The dean has given you permission to recruit and assign to instruments whoever you like. Time is short and the only piece of information that you get from us is (29-a). After that you go pick arbitrary members of the ILLC and assign them to instruments.   [(29-b) relevant]

            b.   *Scenario 2:* You claim that researchers at the ILLC, though certainly capable logicians, are lacking in musical talent, as nobody is able to play an instrument. We rebut your statement using (29-a).   [(29-b) not relevant]

- Deontic FC-inference much more readily relevant for practical purposes than epistemic one

Persistency of deontic vs epistemic information

- ▶ Deontic FC-inference is persistent, survives information grow
  - ▶ E.g., if you have been granted the *permission to kiss any girl*, gaining new information will not change this fact
- ▶ Epistemic FC-inference is not persistent
  - ▶ E.g., after discovering who is the culprit one stops believing that *anyone might have done it*
- ▶ Hypothesis: persistent implicatures fossilize more readily than non persistent ones

  On a Gricean view:
  - ▶ Interpretation is an information-accumulation process
  - ▶ Implicatures incorporated to optimize this process
  - ▶ Incorporation of non-persistent information: irrational move
- ▶ These insights made tangible in dynamic semantics
  - ▶ Different analyses for epistemics and deontics
    - ▶ Deontic inference: relevant, persistent
    - ▶ Epistemic inference: non relevant, non persistent
  - ▶ Straightforward technique of implicature incorporation suitable only for relevant, persistent inferences

Epistemic vs deontic modals

- Epistemic and deontic modals differ in many ways:
    - Distribution (e.g. Nauze 2008, Hacquard et al. 2012)

        (31)   a.   You might have to go to Amsterdam.
                b.   #You must might go to Amsterdam.

    - Meaning and use (Veltman 1997, Yalcin 2007):

        (32)   a.   #It is raining but it might not be raining.
                b.   You are here but you may go there.

- Classical relational semantics derives basic facts about deontics
- Epistemics more challenging: How to combine (32-a) with non-factivity of epistemic possibility?
    - Epistemic contradiction: $\phi \wedge \Diamond_e \neg \phi \models \bot$
    - Non-factivity of epistemic possibility: $\Diamond_e \neg \phi \not\models \neg \phi$
- Veltman & Yalcin's dynamic solution: epistemic modals as operators on local information states

Information in dynamic semantics

- Dynamic semantics: meanings are context change potentials
  - Contexts (information states): sets of possibilities (worlds)
- Two types of information
  1. Information encoded at the world level
     - Factual information (about the world)
     - Relevant: at issue, what is under discussion
     - Persistent: survives information grow
  2. Information encoded globally, at the level of the information state
     - Discourse information (about the conversational context)
     - Not relevant: not what conversation is about
     - Non persistent: need not survive information grow
- Deontic vs epistemic information
  - Deontics (type 1): formalized by classical relational semantics
    - $\diamondsuit_d \psi$ keeps world w only if ψ true in some worlds deontically accessible from w (Hintikka)
  - Epistemics (type 2) along the lines of Veltman/Yalcin's approaches
    - $\diamondsuit_e \psi$ test local state σ: if ψ consistent with σ, returns σ; otherwise $\bot$
  - Deontic information is what information states are *about*; Epistemic information is what information states *are*.

Implementation in a dynamic semantics: Main ingredients

1. Epistemic *vs* deontic modals:
   - Classical/relational analysis of deontics (Hintikka):
     $\Rightarrow$ deontic info: relevant and persistent
   - Dynamic/anaphoric analysis of epistemics (Veltman, Yalcin):
     $\Rightarrow$ epistemic info: non-relevant, non-persistent

2. Implicatures generated via calculation of optimal states:
   - Implicatures of ϕ: what holds in any state in $opt(\phi)$
   - $opt(\phi)$: set of states considered optimal for a speaker of ϕ
   - Algorithms to compute $opt(\phi)$ based on Gricean principles and game theoretical concepts (Schulz 2005, Aloni 2007, Franke 2009, 2011)

3. Incorporation of implicatures in terms of $+I$ operation:
   - $+I$ adds all info contained in $opt(\phi)$ after an update with ϕ

     (33) $\sigma[\phi + I] = \sigma[\phi] \cap opt(\phi)$

     $\Rightarrow$ Incorporation of non-relevant, non-persistent implicatures vacuous under $+I$

Implicatures in dynamic semantics

- Implicatures of ϕ: what holds in any state in $opt(\phi)$
- $opt(\phi)$: set of states considered optimal for a speaker of ϕ
  - Algorithms to compute $opt(\phi)$ based on Gricean principles and game theoretical concepts (Schulz 2005, Aloni 2007, Franke 2009, 2011)
- Illustrations (Franke 2009, 2011): [assume $W = \{w_a, w_b, w_{ab}, w_\emptyset\}$]

  (34)   a. $a \vee b$ [plain disjunction]

         b. $opt(a \vee b) =$

w_a
w_b

         c.   predicted implicatures: $\diamondsuit_e a \wedge \diamondsuit_e b$, $\neg(a \wedge b)$, ...

  $\Rightarrow$ Clausal and scalar implicatures derived for plain disjunctions

Uptaking implicatures via $+I$

- Definition:

  (35)　　$\sigma[\phi + I] = \sigma[\phi] + \cup(opt(\phi))$　　　　[propositional case: $+ = \cap$]

- Illustration: uptaking implicatures of plain disjunction

  (36)　$\begin{array}{|c|} \hline w_a \\ \hline w_b \\ \hline w_{ab} \\ \hline w_\emptyset \\ \hline \end{array}$ $[(a \vee b) + I] = \begin{array}{|c|} \hline w_a \\ \hline w_b \\ \hline w_{ab} \\ \hline \end{array} + \begin{array}{|c|} \hline w_a \\ \hline w_b \\ \hline \end{array} = \begin{array}{|c|} \hline w_a \\ \hline w_b \\ \hline \end{array}$

  $\Rightarrow$ scalar implicature $\neg(a \wedge b)$ & clausal implicature $\diamondsuit_e a \wedge \diamondsuit_e b$ hold in output state

  (37)　$\begin{array}{|c|} \hline w_a \\ \hline w_{ab} \\ \hline w_\emptyset \\ \hline \end{array}$ $[(a \vee b) + I] = \begin{array}{|c|} \hline w_a \\ \hline w_{ab} \\ \hline \end{array} + \begin{array}{|c|} \hline w_a \\ \hline w_b \\ \hline \end{array} = \begin{array}{|c|} \hline w_a \\ \hline \end{array}$

  $\Rightarrow$ only scalar implicature $\neg(a \wedge b)$ holds in output state

FC-implicatures in dynamic semantics

- Illustrations (Franke 2009,2011):   [assume $W = \{w_a, w_b, w_{ab}, w_\emptyset\}$]

  (38) a. $\diamond_e(a \vee b)$ [epistemic possibility]
       b. $opt(\diamond_e(a \vee b)) = \{\{w_a, w_b\}, \{w_a, w_b, w_\emptyset\}\}$
       c. pred. implicatures: $\diamond_e a \wedge \diamond_e b$, $\neg\diamond_e(a \wedge b)$, ...

  (39) a. $\Box_e(a \vee b)$ [epistemic necessity]
       b. $opt(\Box_e(a \vee b)) = \{\{w_a, w_b\}, \{w_a, w_b, w_{ab}\}\}$
       c. predicted implicatures: $\diamond_e a \wedge \diamond_e b$, $\neg\Box_e(a \wedge b)$, ...

  (40) a. $\diamond_d(a \vee b)$ [deontic possibility]
       b. $opt(\diamond_d(a \vee b)) = \{\{w \rightarrow [w_a, w_b] \mid w \in W\},$
           $\{w \rightarrow [w_a, w_b, w_\emptyset] \mid w \in W\}\}$
       c. pr. implicatures: $\diamond_d a \wedge \diamond_d b$, $\neg\diamond_d(a \wedge b)$, ...

  (41) a. $\Box_d(a \vee b)$ [deontic necessity]
       b. $opt(\Box_d(a \vee b)) = \{\{w \rightarrow [w_a, w_b] \mid w \in W\},$
           $\{w \rightarrow [w_a, w_b, w_{ab}] \mid w \in W\}\}$
       c. predicted implicatures: $\diamond_d a \wedge \diamond_d b$, $\neg\Box_d(a \wedge b)$, ...

$\Rightarrow$ FC-implicatures derived for disjunctions/existentials under epistemic and deontic modals

Implementation in a dynamic semantics: Predictions

- ▶ Our straightforward technique of implicature incorporation suitable for deontic inferences, but not for epistemic ones:

  (42) Disjunction:
  - a. Deontic: $\Box_d/\Diamond_d(a \vee b) + I \models \Diamond_d a \wedge \Diamond_d b$
  - b. Epistemic: $\Box_e/\Diamond_e(a \vee b) + I \not\models \Diamond_e a \wedge \Diamond_e b$

  (43) Existential:
  - a. Deontic: $\Box_d/\Diamond_d \exists x \phi + I \models \forall x \Diamond_d \phi$
  - b. Epistemic: $\Box_e/\Diamond_e \exists x \phi + I \not\models \forall x \Diamond_e \phi$

- ⇒ Only deontic FC-inferences can infiltrate compositional semantics!
- ▶ Potential problem: $+I$ overgenerates, if unconstrained: (b) wrongly predicted as possible inference of (44):

  (44) None of the boys may go to the beach or to the cinema.
  - a. ⤳ All of the boys are not permitted to go to either.
  - b. ⤳ All of the boys are permitted one option, but none is free to choose.

Constraints on application of $+I$

- Integration of implicatures via $+I$ comes with a high cost
- Proposal: $+I$ never applies unless
  1. it creates a stronger/more relevant statement
  2. needed to rescue polarity items
- Consequence: $+I$ does not apply in downward-entailing environments, where it would create a weaker statement:

  (45)   None of the boys may go to the beach or to the cinema.
  - a. $\rightsquigarrow$ All of the boys are not permitted to go to either.
  - b. $\not\rightsquigarrow$ All of the boys are permitted one option, but none is free to choose.

Applications: Universal free choice

▶ Only deontic FC-implicature able to penetrate composition of semantic values via $+I$

⇒ Universal free choice predicted for deontics but not for epistemics:

(46) Deontic   [$+I$ creates stronger statement]
   a. All of the boys may go to the beach or to the cinema.
   b. $\leadsto$ All of the boys may go to the beach and all of the boys may go to the cinema.
   c. $\forall x (\Diamond_d(\phi \lor \psi) + I) \models \forall x (\Diamond_d \phi \land \Diamond_d \psi)$

(47) Epistemic
   a. Every research question might be answered by a survey or an experiment.
   b. ?? $\leadsto$ Every research question might be answered by a survey, and every research question might be answered by an experiment.
   c. $\forall x (\Diamond_e(\phi \lor \psi) + I) \not\models \forall x (\Diamond_e \phi \land \Diamond_e \psi)$

▶ UFC sometimes possible for epistemics but only in contexts where epistemic info is at issue. In these cases epistemic info should be formalised as type 1 information.

Applications: Concessive scalar particles

⇒ The possibility of adding $+I$ can rescue *magari* under deontic, but not under epistemic modals:

(48)   a.   You must win *magari a bronze$_F$ medal.
       b. $\text{EVEN}_{C'}[\Box_d[\text{AT LEAST}_C[\text{you win bronze}_F]] + I]$
       c.   Scalar presupposition triggered by EVEN:
           $\Box_d(b \vee s \vee g) \wedge (\Diamond_d b \wedge \Diamond_d s \wedge \Diamond_d g) <_c$
           $\Box_d(s \vee g) \wedge (\Diamond_d s \wedge \Diamond_d g), \Box_d g \wedge \Diamond_d g$ [with FC-inference]

(49)   a. #You must have won *magari a bronze$_F$ medal.
       b. $\text{EVEN}_{C'}[\Box_e[\text{AT LEAST}_C[\text{you have won bronze}_F]] + I]$
       c.   Scalar presupposition triggered by EVEN:
           $\Box_e(b \vee s \vee g) <_c \Box_e(s \vee g), \Box_e g$ [without FC-inference]

The scalar presupposition triggered by EVEN in the deontic case is plausible while in the epistemic case is contradictory

Applications: Epistemic indefinites

- Four functions (context/meaning) for epistemic indefinites:
    - **SU**: ignorance (partial variation) effect in specific uses
    - **epiU**: ignorance (partial variation) effect under epistemic modals
    - **NPI**: narrow scope existential meaning in negative contexts
    - **deoFC**: free choice (total variation) effect under deontic modals
- Marked indefinites cross-linguistically:

	SU	epiU	NPI	deoFC
irgendein (Ge)	yes	yes	yes	yes
algún (Sp)	yes	yes	yes	no
un qualche (It)	yes	yes	no	no
-si (Cz)	yes	no	no	no
vreun (Ro)	no	yes	yes	no
any	no	no	yes	yes
qualunque (It)	no	no	no	yes

- Hypothesis: function contiguity. Examples of impossible combinations:

	SU	epiU	NPI	deoFC
#	yes	no	yes	yes
#	no	yes	no	yes

Our proposal

- ▶ Epistemic indefinites (EIs) ↦ existentials with two characteristics
  1. **Domain Shift**: induce an obligatory domain shift
     - ▶ Conceptual cover shift [CC-shift]
     - ▶ Domain widening [DW]
  2. **Felicity Condition**: express conditions that must be satisfied for the indefinite to be felicitous
     - ▶ CC-shifts are justified only if otherwise, the speaker would not have been able to identify the witness of the existential claim;
     - ▶ DW is justified only if it does not create a weaker statement.
- ▶ Predictions of implementation in Dynamic Semantics:
  - ▶ CC-shift ⇒ epistemic partial variation uses   **[SU and epiU]**
  - ▶ DW ⇒ negative polarity uses   **[NPI]**
  - ▶ DW+I ⇒ deontic total variation uses   **[deoFC]**
- ▶ Different modalities of conventionalization for epistemic and deontic effects:
  - ▶ Deontic total variation inference   via DW+I
    derived via Gricean implicature incorporation (fossilization)
  - ▶ Epistemic partial variation inference   via CC-shift
    as result of lexically encoded felicity condition rather than Gricean reasoning (cf. dynamics of presupposition)

EIs under modals

- ▶ EIs under deontics:
  - ▶ Obligatory total variation effects predicted for *irgendein*:

    (50) Mary musste irgendeinen Mann heiraten.
          Mary had-to IRGEND-ONE man marry
          "Mary had to marry a man, any man was a permitted
          marriage option for her."

          a. $\#\Box_d\exists x\phi$ neither CC-shift, nor DW can apply
          b. $\Box_d\exists x\phi + I$ with FC-inference: DW can apply

  - ▶ *Vreun* excluded under deontics:

    (51) #Trebuie să citesc vreo carte până mâine.
          must SUBJ read.1sg VREUN book by tomorrow
          "I must read some book by tomorrow."

          a. $\#\Box_d\exists x\phi$ neither CC-shift, nor DW can apply
          b. $\#\Box_d\exists x\phi + I$ clashes with anti-total variation

- ▶ EIs under epistemics: partial variation effects predicted for both

  (52) a. Juan must be in *irgendeinem/vreun* room of the house.
        b. $\Box_e\exists x\phi\ (+\ I)$ only CC-shift can apply

Conclusion

- Epistemic and deontic modals differ in many ways:
  - we focused on differences in relevance and persistence
  - discussed their possible link to differences in fossilization of epistemic and deontic FC-inferences
- Insights implemented in a dynamic semantics
- Applications in the domain of polarity items