ON EPISTEMIC INDEFINITES: A NOTE ON EMPHATIC FREE CHOICE USES*

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1 Introduction

Epistemic indefinites (henceforth EIs) are existentials that when used in a positive context convey information about the speaker's epistemic state (e.g. Jayez and Tovena, 2006, Alonso-Ovalle and Menéndez-Benito, 2010): they signal that the speaker is unable to identify the individual that satisfies the existential claim. In some languages EIs can also be used in negative contexts to convey narrow scope existential meanings or in the scope of a root modal to convey emphatic free choice meanings. The following implicational map seems to emerge with respect to the possible functions for EIs cross-linguistically:

(1) ignorance function - negative function - emphatic free choice function

If we define epistemic indefinites as indefinites which exhibit the ignorance function, the map can be read as a hierarchy, which predicts that if an EI qualifies for a function, it will also qualify for the functions which are located to the left of it in the map. In particular we will never find an EI which has emphatic free choice uses, but fails to have negative ones.

Aloni and Port (2011) (henceforth A&P) proposed to model EIs as existential quantifiers triggering an obligatory domain shift. In this theory, differences between different indefinites are captured in terms of different domain shifts they can induce. One kind of domain shift (CC-shift) produces ignorance uses and is available for all EIs. Another kind of domain shift (DW), explaining negative uses, is an option only for a subset of the EIs. In this article I will extend A&P's analysis to explain the case of emphatic free choice. Emphatic free choice uses will be captured in terms of obligatory pragmatic enrichments triggered by DW under certain circumstances. The proposed analysis predicts the generalisation in (1): emphatic free choice uses presuppose the same mechanism which generates negative uses, namely DW, so whenever an emphatic free choice use is possible for an EI a negative use is also allowed. Furthermore the analysis gives rise to a number of testable predictions with respect to the acquisition and the diachronic development of EIs. For example it predicts that with respect to an EI exhibiting all three functions, e.g. the German *irgend*-series, the emphatic free choice function will be acquired/emerged only after the negative

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function. As for the diachronic perspective, this prediction has been confirmed by the historical corpus study reported in Port (2012). The article is organised as follows: section 2 summarises the data described by A&P; section 3 presents their analysis and section 4 extends it to the case of emphatic free choice.

2 Functions of epistemic indefinites

A&P identified four main functions for EIs, and discussed the distribution of German *irgendein* (Haspelmath, 1997, Kratzer and Shimoyama, 2002) and Italian *un qualche* (Zamparelli, 2007) with respect to these functions:[1]

Specific Modal Variation function (spMV) characterised by a speaker ignorance effect in specific uses and illustrated by the following examples:

(2) *Irgendein* Student hat angerufen, (#nämlich Peter).
Some student has called (#namely Peter)
'Some student called, I don't know who' **[spMV]**

(3) Maria ha sposato *un qualche* professore, (#cioè Vito).
Maria has married a some professor (#namely Vito)
'Maria married some professor, I don't know who' **[spMV]**

Epistemic Modal Variation function (epiMV) characterised by an ignorance effect under epistemic modals and illustrated by the following examples:

(4) Maria muss *irgendeinen* Arzt geheiratet haben.
Maria must some doctor married have
'Maria must have married some doctor, I don't know who' **[epiMV]**

(5) Maria deve aver sposato *un qualche* professore.
Maria must have married a some professor
'Maria must have married some professor, I don't know who' **[epiMV]**

Negative Polarity function (NPI) characterised by a narrow scope existential meaning in negative contexts and illustrated by the following examples:

(6) Niemand hat *irgendeine* Frage beantwortet.
Nobody has some question answered
'Nobody answered any question' **[NPI]**

(7) ??Non ho risposto a *una qualche* domanda.
Not I-have answered to a some question
'I didn't answer any question' **[#NPI]**

[1] The assumed notion of a function as a context-meaning pair is based on Haspelmath's (1997) typological survey. In order for an indefinite to qualify for a function, it must (i) be grammatical in the context the function specifies, and (ii) have the meaning that the function specifies. For example, *any* does not exhibit the **spMV** function, because it is ungrammatical in episodic sentences, cf. (i); and *some* does not have deontic Free Choice uses, because under a root modal, although being grammatical, it does not convey the universal free choice meaning specified by **deoFC**, cf. (ii):

(i) # Mary married *any* doctor. **[#spMV]**

(ii) You may marry *some* doctor ($\not\Rightarrow$ any doctor is a permissible option) **[#deoFC]**

Deontic Free Choice function (deoFC) characterised by a free choice inference under deontic modals and illustrated by the following examples:

(8) Maria muss *irgendeinen* Arzt heiraten.
Mary must some doctor marry
'There is some doctor Mary must marry, I don't know who' **[spMV]**
'Mary must marry a doctor, any doctor is a permissible option' **[deoFC]**

(9) Maria deve/può sposare *un qualche* dottore.
Mary must/can marry a some doctor
'There is some doctor Mary must/can marry, I don't know who' **[spMV]**
'Mary must/can marry a doctor, any doctor is a permissible option' **[#deoFC]**

As the examples show, *irgendein* has the widest distribution covering all four functions, whereas *un qualche* only exhibits the first two ignorance functions. It is important to notice that the ignorance (MV) inference in **spMV** and **epiMV** and the free choice inference in **deoFC** have different quantificational force. While the former is compatible with the exclusion of some of the epistemic possibilities, the latter implies that any individual is among the permissible options:

(10) a. Modal Variation (MV): $\neg\exists x\Box\phi$
b. Free Choice (FC): $\forall x\Diamond\phi$

One of the most puzzling aspects of these data is the different behaviour *irgendein* displays under epistemic and deontic modals. Under epsitemic modals, it gives rise to a modal variation inference, cf. example (4), under deontic modals it can give rise to a free choice inference, cf. example (8):

(11) a. Epistemic: $\Box_{\mathrm{e}}$ (…irgend …) $\Rightarrow$ MV: $\neg\exists x\Box_{\mathrm{e}}\phi$
b. Deontic: $\Box_{\mathrm{d}}$ (…irgend …) $\Rightarrow$ FC: $\forall x\Diamond_{\mathrm{d}}\phi$

The following table illustrates the variety of (epistemic) indefinites cross-linguistically:[2]

(12)

	spMV	**epiMV**	**NPI**	**deoFC**
irgendein	yes	yes	yes	yes
algún (Sp)	yes	yes	yes	no
un qualche	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

As we mentioned in the introduction, it is tempting to read (12) as an implicational map and formulate a hypothesis of function contiguity: any indefinite in any language will always express a contiguous area of the map. The following two would be examples of impossible distributions:

(13)

	spMV	**epiMV**	**NPI**	**deoFC**
#	yes	no	yes	yes
#	no	yes	no	yes

Although the validity of this hypothesis is still a matter of empirical investigation, we will assume it as a guide for our formalisation.

[2]The table is based on data from Alonso-Ovalle and Menéndez-Benito (2010) for *algún*, Falaus (2009) for *vreun*, and Radek Šimík (p.c.) for Czech *-si*.

3 Epistemic indefinites and conceptual covers

Along the lines of Kadmon and Landman's (1993) analysis of *any*, A&P assume that EIs are existentials with two additional characteristics: (i) they induce an obligatory **domain shift**; and (ii) they express conditions that must be satisfied for the indefinite to be felicitous (**felicity conditions**). Differences between different indefinites are accounted for in terms of different domain shifts they can induce. Crucially, A&P assume that there are at least two ways in which contexts can determine a quantificational domain.

The first way is the standard contextual domain restriction illustrated by (14). When using (14) we don't mean to quantify over the whole universe, but only over a salient set of individuals:

(14) Everybody passed the exam. [e.g. everybody in my class]

In this case the shift induced by an EI is the well-known **domain widening** (henceforth DW).

The second way is the selection of a method of identification discussed in Aloni (2001). The domain shift induced by an EI in this case is called a **conceptual cover shift** (henceforth CC-shift). As an illustration consider the following scenario. In front of you lie two face-down cards, one is the Ace of Hearts, the other is the Ace of Spades. You know that the winning card is the Ace of Hearts, but you don't know whether it's the card on the left or the one on the right. Consider (15):

(15) You know which card is the winning card.

Would sentence (15) be true or false in the described scenario? Intuitively, there are two different ways in which the cards can be identified here: by their position (the card on the left, the card on the right) or by their suit (the Ace of Hearts, the Ace of Spades). Our evaluation of (15) seems to depend on which of these identification methods is adopted. Aloni (2001) formalised identification methods in terms of conceptual covers. A conceptual cover is a set of individual concepts which exclusively and exhaustively covers the domain of individuals.

Definition 1 [Conceptual covers] Given a set of possible worlds W and a domain of individuals D, a *conceptual cover* CC based on (W,D) is a set of functions $W \to D$ such that:

$$\forall w \in W : \forall d \in D : \exists! c \in CC : c(w) = d$$

In the card scenario there are at least three salient covers representing ways of identifying the cards: (16-a) representing identification by ostension, (16-b) representing identification by name, and (16-c) representing identification by description. The set of concepts in (16-d) is not an example of a conceptual cover because it does not satisfy the conditions formulated in definition 1.

(16) a. {on-the-left, on-the-right} [ostension]
b. {ace-of-spades, ace-of-hearts} [naming]
c. {the-winning-card, the-losing-card} [description]
d. # {on-the-left, ace-of-spades}

In the semantics for knowing-wh constructions proposed in Aloni (2001), the evaluation of (17) depends on which of these covers is adopted. Technically this dependence is captured by letting the wh-phrase range over concepts in a conceptual cover rather than over plain individuals. Cover indices n are added to logical form, their value is contextually supplied.

(17) You know which$_n$ card is the winning card.
a. False, if $n \mapsto$ {on-the-left, on-the-right}
b. True, if $n \mapsto$ {ace-of-spades, ace-of-hearts}
c. Trivial, if $n \mapsto$ {the-winning-card, the-losing-card}

To understand how conceptual covers relate to EIs consider example (18) (Ebert et al., 2009):

(18) Ich muss **irgendeinen bestimmten** Professor treffen.
I must some certain professor meet
'I must meet a certain professor, but I don't know who he is'

Why is this example puzzling? On the one hand, the indefinite is used specifically (German *bestimmt* is a specificity marker). Traditionally, this means that the speaker has someone in mind, i.e. she can identify the referent of the indefinite. On the other hand, the use of an EI conveys that the speaker doesn't know who the referent is, i.e. she cannot identify the referent of the indefinite.

One natural way out of this puzzle is to recognize that two identification methods are at play here: the speaker can identify on one method (for example by description) but not on another (for example naming). The main intuition of A&P's proposal is that referents of EIs are typically identified via a method different from the one required for knowledge. Technically this intuition is formalised by the notion of a CC-shift. Suppose m is the cover contextually required for knowledge. Then EIs signal an obligatory shift to a cover n different from m. In the formalization in dynamic semantics, this means that EIs introduce as discourse referents elements of $n \neq m$. If such a CC-shift is not trivial, then the use of an EI implies that the speaker doesn't know who the referent is.

A&P's proposal can be summarised as follows. EIs are existentials with two characteristics:

1. they induce an obligatory domain-shift ($D \rightarrow D'$): *un qualche* only allows for CC-shift, *irgendein* allows for CC-shift and DW;
2. are felicitous in context σ iff the domain-shift they induce is for a reason:
   (i) CC-shift is justified only if otherwise speaker's state would not support the statement

   (19) $\sigma \models \ldots \exists x_{D'} \ldots$, but $\sigma \not\models \ldots \exists x_{D} \ldots$ [NECESSARY WEAKENING]

   (ii) DW is justified only if it creates a stronger statement

   (20) $\ldots \exists x_{D'} \ldots \models \ldots \exists x_{D} \ldots$ [STRENGTHENING]

The analysis is implemented in a Dynamic Semantics with Conceptual Covers (Aloni, 2001). In such framework, meanings are relations over information states (sets of world-assignment pairs), relativised to conceptual perspectives $\wp$ (functions from CC-indices to conceptual covers). See Appendix for details. Table (21) summarises A&P's predictions.

(21)

	spMV	**epiMV**	**NPI**	**deoFC**
un qualche	yes	yes	no	no
irgendein	yes	yes	yes	no (wrong!)

The analysis makes the right predictions with respect to the meaning and distribution of Italian *un qualche*, but fails to predict the availability of the deontic free choice use for German *irgendein*. These predictions follow from the following facts concerning CC-shift and DW:

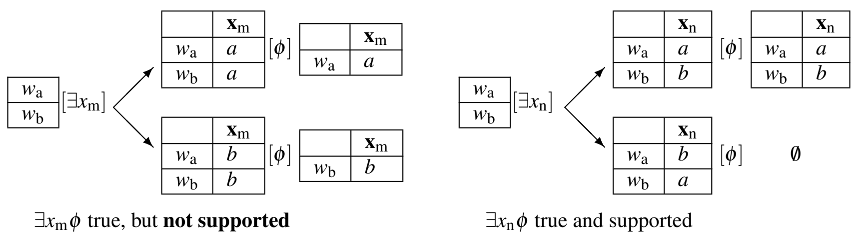
1. CC-shifts, when justified, yield an ignorance (MV) effect;
   a. CC-shifts are not trivial (therefore can be justified) in specific uses and under epistemic modals;
   b. CC-shift are trivial (never justified) under negation and under deontic modals.

2. DW is justified only if it creates a stronger statement
   a. DW creates stronger statements (justified) in negative contexts;
   b. DW creates weaker statements (unjustified) in specific uses, under epistemic modals, but also under deontic modals.

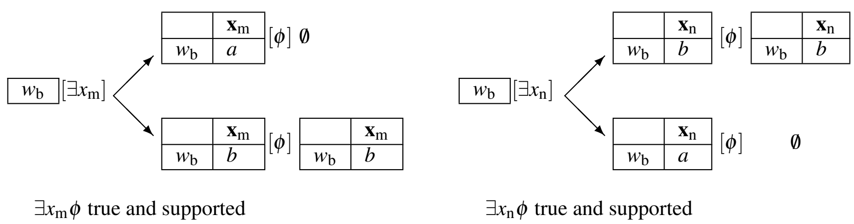
[1a] explains why **spMV** & **epiMV** uses are predicted for both EIs; [1b] explains why *un qualche*, which only allows for CC-shifts, does not qualify for **NPI** or **deoFC** uses; [2a] explains **NPI** uses for *irgendein*; [2b] is problematic because it implies the unavailability of **deoFC** uses for *irgendein*, and this is contrary to the facts. Henceforth we will refer to this problem as the **deoFC** problem.

Before addressing the problem, let me illustrate why the facts in [1] hold. Consider the following pictures. Assume that $D = \{a, b\}$ and that w_x is a world in which only x is s.t. ϕ.

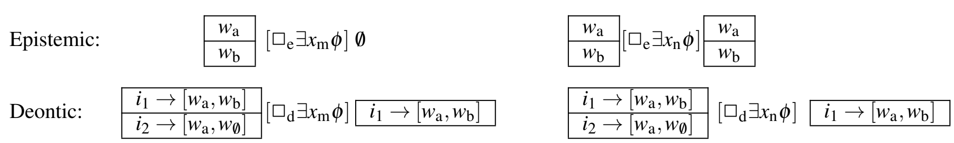
(A) A justified CC-shift from m to n:



(B) An unjustified CC-shift:



(C) CC-shifts can be justified under epistemic $\Box_e$ but not under deontic $\Box_d$:



In Dynamic Semantics with CC, specific uses of indefinites, represented by existential sentences, introduce as discourse referents elements of a contextually supplied CC. The pictures in (A) represent this operation with respect to the rigid cover m (on the left) and a non-rigid cover n (on the right). As we saw, CC-shifts are justified only if otherwise the input state (speaker's state) would not support the statement. A state σ *supports* ψ iff all possibilities in σ survive simultaneously in one and the same output state after update with ψ. In (A), $\exists x_m \phi$, although classically true, is not supported by the input state, while $\exists x_n \phi$ (the same existential sentence but now interpreted wrt a non-rigid cover) is true and supported. Hence a CC-shift from m to n is here justified. In (B), instead, the shift from m to n would be unjustified: since we start from a state of total information, the existential sentence is true and supported no matter what method of identification we assume. Intuitively, an existential sentence $\exists x_{cc} \phi$ interpreted under a method of identification cc is supported in a state σ only if in σ we are able to identify the witness of the existential claim under *cc*. Hence, given necessary weakening, a CC-shift from *m* to *n* is justified only if the relevant referent can be identified under *n*, but not under *m*. But then an ignorance effect (not knowing who with respect to *m*) is derived whenever a CC-shift is for a reason. In (A), but not in (B), we are able to identify the witness of the existential claim under *n*, but not under *m*. Only in the first case where indeed we don't know who_{m} the witness of the existential sentence is, the shift from *m* to *n* is justified.

As illustrated in (C), CC-shifts can be justified under epistemic modals, but not under deontic modals. Crucial here is the different analysis of epistemic $\Box_e$ and deontic $\Box_d$ that A&P endorse: $\Box_e$ is analysed as in Veltman (1996): $\Box_e\psi$ tests the input state σ: if ψ is supported, it returns σ; otherwise it returns the absurd state $\emptyset$. $\Box_d$ instead receives a classical interpretation: $\Box_d\psi$ keeps a possibility i only if ψ is true in every world deontically accessible from i (e.g., in (C) i_2 is eliminated because it can access $w_\emptyset$). Crucially epistemic modals are defined in terms of support, which is a CC-sensible notion, whereas deontic modals are defined in terms of truth. This explains why CC-shifts are trivial under $\Box_d$. Another essential difference between the two interpretations is that while epistemic modals operate directly on the input state, deontic modals operate on embedded states. This difference will be crucial for our solution to the **deoFC** problem.

Before turning to our solution let me mention an important observation due to Haspelmath (1997) with respect to free choice uses of *irgend*-indefinites. In these uses, *irgend*-indefinites are typically stressed (stress is here represented by small capitals):

(22) Dieses Problem kann IRGEND JEMAND lösen. [**deoFC**]
'This problem can be solved by anyone' [from Haspelmath 1997]

Stressed *irgend* displays a quite interesting distribution. It is licensed in negative contexts and in comparative clauses where it appears to convey universal meanings:

(23) Niemand hat IRGENDEINE Frage beantwortet. [**NPI**]
'Nobody answered any question'

(24) Joan Baez sang besser als IRGEND JEMAND JE zuvor. [**CO**]
'Joan Baez sang better than anyone ever before' [from Haspelmath 1997]

However it is infelicitous in episodic sentences and under epistemic modals (unless stress is justified by independent contextual factors):

(25) # IRGENDJEMAND hat angerufen. [**#spMV**]
'Someone called, I don't know who'

(26) # Maria muss IRGENDEINEN Dokter geheiratet haben. [**#epiMV**]
'Maria must have married some doctor, I don't know who'

This distribution motivates the following hypothesis. We conjecture that stress in EIs signals domain widening. We have then the following predictions:

(27)

	spMV	**epiMV**	**NPI**	**CO**	**deoFC**
un qualche (only CC)	yes	yes	no	no	no
irgendein (CC+DW)	yes	yes	yes	yes	no [problem!]
IRGENDEIN (only DW)	no	no	yes	yes	no [problem!]

In the next section we first explain how the predictions with respect to the comparative function originate and then propose a solution to the **deoFC** problem.

4 Emphatic uses of EIs

4.1 EIs in comparatives

Irgendein and *un qualche* display a different behaviour in comparative clauses. Example (28) is ambiguous between a universal and an existential ignorance reading. Example (29) only has the existential ignorance meaning:

(28) Hans ist größer als irgendein Mitschüler in seiner Klasse.
a. 'Hans is taller than any of his classmates' **[CO]**
b. 'Hans is taller than some of his classmates, I don't know who' **[spMV]**

(29) Gianni è più alto di un qualche suo compagno di classe.
a. # 'Gianni is taller than any of his classmates' **[#CO]**
b.'Gianni is taller than some of his classmates, I don't know who' **[spMV]**

In what follows we will show that these data are easily accounted for if we extend A&P's dynamic semantics with a 'NOT/PI analysis' of comparatives. NOT/PI analyses of comparatives place a scoping DE operator ($\neg$ or Π) within the comparative clause (e.g., Seuren, 1978, Heim, 2006). As an illustration consider Seuren (1978). On Seuren's account, the plain comparative in (30) is true if there is a degree *d* of tallness that John reaches and Mary doesn't reach.

(30) a. John is taller than Mary is.
b. $\exists d[T(j,d) \wedge \neg T(m,d)]$
c. there is a degree *d* of tallness that John reaches and Mary doesn't reach

Ordinary quantifiers are assumed to always scope over the DE operator:

(31) a. John is taller than every girl is.
b. $\exists d[T(j,d) \wedge \forall x[G(x) \to \neg T(x,d)]]$
c. there is a *d* of tallness that John reaches and no girl reaches

Universal meanings are predicted when an indefinite scopes under the DE operator; existential meanings when an indefinite scopes over the DE operator:

(32) a. John is taller than any girl is.
b. $\exists d[T(j,d) \wedge \neg \exists x[G(x) \wedge T(x,d)]]$
c. there is a *d* of tallness that John reaches and no girl reaches

(33) a. John is taller than some girl is.
b. $\exists d[T(j,d) \wedge \exists x[G(x) \wedge \neg T(x,d)]]$
c. there is a *d* of tallness that John reaches and some girl doesn't reach

As it is easy to see, if we extend A&P's analysis of EIs with such an analysis for comparatives, universal (**CO**) and existential (**spMV**) readings are predicted for *irgend*-indefinites in comparatives, whereas for *un qualche*, which disallows DW, only existential meanings arise:[3]

(34) Hans ist größer als irgendein Mitschüler in seiner Klasse.
a. $\exists d[T(h,d) \wedge \neg \exists x_{\mathrm{n}}[C(x) \wedge T(x,d)]]$ **[CO]**
'Hans is taller than any of his classmates' (via DW+STRENGTHENING)
b. $\exists d[T(h,d) \wedge \exists x_{\mathrm{n}}[C(x) \wedge \neg T(x,d)]]$ **[spMV]**
'Hans is taller than some of his classmates, I don't know who' (via CC-shift+NEC WEAKENING)

[3] In (34-a) we have to assume that *irgend* scopes under $\neg$, however, as it is well known, *irgend*-indefinites are ungrammatical under sentential negation. This could be considered an argument favoring Heim's PI-theory of comparatives over a NOT-theory like that of Seuren (1978). See Aloni and Roelofsen (2011) for further discussion.

(35) Gianni è più alto di un qualche suo compagno di classe.
a. # $\exists d[T(g,d) \wedge \neg\exists x_n[C(x) \wedge T(x,d)]]$ **[#CO]**
'Gianni is taller than any of his classmates' (CC-shift unjustified)
b. $\exists d[T(g,d) \wedge \exists x_n[C(x) \wedge \neg T(x,d)]]$ **[spMV]**
'Gianni is taller than some of his classmates, I don't know who' (via CC-shift+NEC WEAKENING)

Heim (2006) conjectured that the scope of $\neg/\Pi$ is partly 'determined by the need for negative polarity items to be licensed' (Heim, 2006:p.21). By default, indefinites and quantifiers take scope over $\neg/\Pi$. Only negative polarity items violate this default rule in order to be licensed. In the previous section we observed that stressed *irgend*-indefinites behave like negative polarity items (licensed in negative contexts, odd in positive ones), unstressed *irgend*-indefinites don't. This fact, together with Heim's conjecture, might explain why *irgend*-indefinites seem to need stress to convey universal meaning in comparative clauses (Haspelmath, 1997):

(36) a. Hans ist größer als IRGENDEIN Mitschüler in seiner Klasse.
b. $\exists d[T(h,d) \wedge \neg\exists x_n[C(x) \wedge T(x,d)]]$ **[CO]**
'Hans is taller than any of his classmates' (via DW+ST)

(37) a. Hans ist größer als irgendein Mitschüler in seiner Klasse.
b. $\exists d[T(h,d) \wedge \exists x_n[C(x) \wedge \neg T(x,d)]]$ **[spMV]**
'Hans is taller than some of his classmates, I don't know who' (via CC-shift+NECWE)

4.2 A solution to the deoFC problem

It is tempting to try to derive **deoFC** uses of *irgend*-indefinites as an extension of their ignorance meaning, in terms of a properly refined notion of a CC-shift. However, the implicational map introduced in section 1 and the distribution of stressed *irgend* discussed at the end of section 3 strongly suggest to solve the **deoFC** problem via the notion of domain widening. There are a number of possible strategies we could follow.

The first adopts Chierchia's (2010) notion of an obligatory implicature. FC inferences could be derived for modal existential sentences as obligatory higher order implicatures (Fox, 2006):

(38) a. Sentence: $\Box\exists x\phi$
b. Universal free choice implicature: $\forall x\Diamond\phi$

The felicity of *irgendein* in these uses would then follow by adopting the following NON-WEAKENING condition for DW rather than the previously discussed strengthening condition:

(39) DW justified only if it doesn't create a weaker statement: $\ldots\exists x\ldots \not\models \ldots\exists x_{\mathrm{DW}}\ldots$

As it is easy to see, extending the domain of an existential under a modal does no longer lead to a weaker statement if we incorporate its universal free choice implicature:

(40) $\Box\exists x\phi(+\forall x\Diamond\phi) \not\models \Box\exists x_{\mathrm{DW}}\phi + \forall x_{\mathrm{DW}}\Diamond\phi$

There is a serious problem however with this solution. On Chierchia's account obligatory FC effects would be wrongly predicted for *irgendein* under epistemic modals as well. Alonso-Ovalle and Menéndez-Benito (2010) have shown that weaker MV effects can be derived using Chierchia/Fox' algorithm if we adopt singleton domain alternatives, rather than full domain alternatives. We could then try to manipulate the alternatives accordingly. But why would *irgend*-indefinites select different sets of alternatives under different types of modals?

A different strategy consists in adopting a performative analysis of deontic modals as in Lewis (1979): FC inferences under deontic modals (but not under epistemic modals) would then be derived as semantic entailments. The felicity of *irgendein* in deontic free choice uses would then follow by DW + NON-WEAKENING as in (40). A first problem of this strategy is that it does not explain non-performative cases (at least not without stipulations). A second maybe more serious problem is that **deoFC** uses would be wrongly predicted for all indefinites even unmarked ones as in “John must marry someone" which clearly does not entail that any person is a permissible marriage option for John.[4]

In what follow we will present a different solution to the **deoFC** problem. Building on Chierchia and others, emphatic free choice inferences will be derived as obligatory pragmatic effects. However, to account for the different behaviour of EIs under epistemic and deontic modals we will propose a genuinely dynamic mechanism to generate and incorporate pragmatic inferences which is sensitive to the differences between $\Box_{\mathrm{e}}$ and $\Box_{\mathrm{d}}$.

Here is our strategy in a nutshell. We will weaken the strengthening condition into a non-weakening condition as described above. Furthermore we will extend A&P's dynamic semantics with a novel operation of implicature uptake $+I$. In A&P's semantics, extending the domain of an existential leads to a weaker statement both under epistemic and deontic modals:

(41) a. $\Box_{\mathrm{e}}\exists x\phi \models \Box_{\mathrm{e}}\exists x_{\mathrm{DW}}\phi$ [epistemic]
b. $\Box_{\mathrm{d}}\exists x\phi \models \Box_{\mathrm{d}}\exists x_{\mathrm{DW}}\phi$ [deontic]

As we will see, if we uptake FC implicatures via the novel operation $+I$, this fact will only hold for the epistemic case:

(42) a. $\Box_{\mathrm{e}}\exists x\phi + I \models \Box_{\mathrm{e}}\exists x_{\mathrm{DW}}\phi + I$ [epistemic]
b. $\Box_{\mathrm{d}}\exists x\phi + I \not\models \Box_{\mathrm{d}}\exists x_{\mathrm{DW}}\phi + I$ [deontic]

We will then be able to conclude that (i) DW can never be justified in the epistemic case, hence CC-shift must apply: ignorance (MV) effects are then predicted for *irgendein* under epistemic modals; (ii) DW is justified in the deontic case only if we uptake FC implicatures. It follows that FC implicatures are predicted to be ‘obligatory’ for *irgendein* under deontic modals, otherwise DW would be unjustified.

We turn now to the definition of $+I$. We first have to say how implicatures can be generated in a dynamic setting. A natural dynamic strategy to derive implicatures defines the implicatures of an utterance of ϕ as what is supported by any optimal state for ϕ. Recently a number of algorithms have been proposed to compute optimal states based on Gricean principles and game theoretical concepts (Schulz, 2005, Aloni, 2007a, Franke, 2009). As an illustration, we will only consider Aloni (2007a).[5] In Aloni (2007a), Grice's conversational maxims, and an additional principle expressing preferences for minimal models, are formulated as violable constraints and used to select optimal candidates out of a set of alternative sentence-state pairs. Let $opt(\phi)$ be the set of

[4] Aloni (2007b) provides a potential way out of this difficulty by allowing two different representations for indefinites: an alternative-inducing and a flat representation. Only the former gives rise to free choice entailments in modal environments. In this theory, unmarked indefinites can be required to adopt flat representations.

[5] Eventually we should adopt a dynamic first-order version of Franke (2009) for better predictions.

states s such that (ϕ, s) is optimal. The implicatures of an utterance of ϕ are then defined as what is supported in any state in $opt(\phi)$ but is not entailed by ϕ itself. To simplify we only look at the propositional case, and assume $W = \{w_{\mathrm{a}}, w_{\mathrm{b}}, w_{\mathrm{ab}}, w_{\emptyset}\}$ as our logical space, where w_{x} stands for a possible world where only x holds. For example, in w_{a}, a is true and b is false, whereas in $w_{\emptyset}$ both a and b are false. For the case of a plain disjunction like (43-a), Aloni (2007a) predicts as unique optimal state the state in (43-b) (assuming a and b are both relevant). An agent in such a state knows that only one out of a and b is true and wonders which one. $a \vee b$ is predicted to be an optimal sentence to say for a speaker in such a state – other forms like a or $(a \vee b) \wedge \neg(a \wedge b)$ are ruled out by quality and manner respectively. On the other hand, state $\{w_{\mathrm{a}}, w_{\mathrm{b}}\}$ is predicted to provide the optimal interpretation for $a \vee b$ – more informative states, like $\{w_{\mathrm{a}}\}$, are ruled out by quantity and other states like $\{w_{\mathrm{a}}, w_{\mathrm{ab}}\}$ are ruled out by preference for minimal models. As it is easy to see both $\Diamond_{\mathrm{e}} a \wedge \Diamond_{\mathrm{e}} b$ and $\neg(a \wedge b)$ are supported by the optimal state $\{w_{\mathrm{a}}, w_{\mathrm{b}}\}$, so both clausal and scalar implicatures are derived for plain disjunction in this theory.

(43) a. $a \vee b$ [plain disjunction]
b. $opt(a \vee b) = \{\{w_{\mathrm{a}}, w_{\mathrm{b}}\}\}$
c. predicted implicatures: $\Diamond_{\mathrm{e}} a \wedge \Diamond_{\mathrm{e}} b$, $\neg(a \wedge b)$

Examples (44) and (45) illustrate the predictions of Aloni (2007a) for disjunction under epistemic modals. FC implicatures are derived for both the possibility and the necessity case.[6]

(44) a. $\Diamond_{\mathrm{e}}(a \vee b)$ [epistemic possibility]
b. $opt(\Diamond_{\mathrm{e}}(a \vee b)) = \{\{w_{\mathrm{a}}, w_{\mathrm{b}}, w_{\emptyset}\}\}$
c. predicted implicatures: $\Diamond_{\mathrm{e}} a \wedge \Diamond_{\mathrm{e}} b$, $\neg\Diamond_{\mathrm{e}}(a \wedge b)$, $\neg\Box_{\mathrm{e}}(a \vee b)$, ...

(45) a. $\Box_{\mathrm{e}}(a \vee b)$ [epistemic necessity]
b. $opt(\Box_{\mathrm{e}}(a \vee b)) = \{\{w_{\mathrm{a}}, w_{\mathrm{b}}, w_{\mathrm{ab}}\}\}$
c. predicted implicatures: $\Diamond_{\mathrm{e}} a \wedge \Diamond_{\mathrm{e}} b$, $\neg\Box_{\mathrm{e}}(a \wedge b)$, ...

Consider now Aloni's (2007a) predictions for the case of deontic necessity:

(46) a. $\Box_{\mathrm{d}}(a \vee b)$ [deontic necessity]
b. $opt(\Box_{\mathrm{d}}(a \vee b)) = \{w \to [w_{\mathrm{a}}] \mid w \in W\} \cup \{w \to [w_{\mathrm{b}}] \mid w \in W\}$
c. predicted implicatures: $\Diamond_{\mathrm{e}} \Box_{\mathrm{d}} a \wedge \Diamond_{\mathrm{e}} \Box_{\mathrm{d}} b$, ...

This interpretation represents ignorance readings that can be paraphrased as "You must do a or b, I don't know which". As Aloni (2007a) shows, however, if we assume that the speaker is *competent* about what is permissible or obligatory (Zimmermann, 2000, Schulz, 2005), i.e. we restrict our competition to states satisfying the principles $\neg\Box_{\mathrm{e}}\Box_{\mathrm{d}}\phi \to \neg\Box_{\mathrm{d}}\phi$ and $\neg\Box_{\mathrm{e}}\Diamond_{\mathrm{d}}\phi \to \neg\Diamond_{\mathrm{d}}\phi$, then FC implicatures are predicted also for deontic interpretations of the modal operators:

(47) a. $\Box_{\mathrm{d}}(a \vee b)$ [deontic necessity + competence]
b. $opt^{\mathrm{C}}(\Box_{\mathrm{d}}(a \vee b)) = \{w \to [w_{\mathrm{a}}, w_{\mathrm{b}}] \mid w \in W\}$
c. predicted implicatures: $\Diamond_{\mathrm{d}} a \wedge \Diamond_{\mathrm{d}} b$, ...

(48) a. $\Diamond_{\mathrm{d}}(a \vee b)$ [deontic possibility + competence]
b. $opt^{\mathrm{C}}(\Diamond_{\mathrm{d}}(a \vee b)) = \{w \to [w_{\mathrm{a}}, w_{\mathrm{b}}, w_{\emptyset}] \mid w \in W\}$
c. predicted implicatures: $\Diamond_{\mathrm{d}} a \wedge \Diamond_{\mathrm{d}} b$, ...

[6] To be able to distinguish between MV and FC inferences we would need at least three alternatives. For $\Diamond/\Box(a \vee b \vee c)$ Aloni (2007a) does indeed predict the FC implicature $\Diamond a \wedge \Diamond b \wedge \Diamond c$.

Now that we have a way to derive implicatures we can extend our dynamic semantics with an operation of implicature uptake. Again, to simplify, we only consider the propositional case (see appendix for extension to the first-order case):

Definition 2 [Implicature uptake] $\sigma[\phi + I] = \sigma[\phi] \cap \bigcup(opt(\phi))$

As a first illustration consider the uptaking of the implicatures of plain disjunction:

(49) $\{w_{\mathrm{a}}, w_{\mathrm{b}}, w_{\mathrm{ab}}, w_{\emptyset}\}[(a \vee b) + I] = \{w_{\mathrm{a}}, w_{\mathrm{b}}, w_{\mathrm{ab}}\} \cap \{w_{\mathrm{a}}, w_{\mathrm{b}}\} = \{w_{\mathrm{a}}, w_{\mathrm{b}}\}$

Starting from $\{w_{\mathrm{a}}, w_{\mathrm{b}}, w_{\mathrm{ab}}, w_{\emptyset}\}$, we first update with $a \vee b$, which eliminates $w_{\emptyset}$, and then intersect the output state with the optimal state for $a \vee b$. The resulting state supports both the scalar implicature $\neg(a \wedge b)$, and the clausal implicature $\Diamond_{\mathrm{e}} a \wedge \Diamond_{\mathrm{e}} b$. There is a crucial difference between these two inferences, the first one is persistent, the second is anti-persistent:

(50) a. ϕ is persistent iff if $\sigma \models \phi$ and τ is at least as strong as σ then $\tau \models \phi$
b. ϕ is anti-persistent iff if $\sigma \models \phi$ and σ is at least as strong as τ then $\tau \models \phi$

In a propositional system, σ is at least as strong as τ iff $\sigma \subseteq \tau$. Negative sentences like $\neg(a \wedge b)$ are persistent because they assert the unavailability of a possibility, namely the possibility that a and b are both true. Eliminating possibilities (going to a smaller state) will never make that possibility available. Epistemic possibility sentences like $\Diamond_{\mathrm{e}} a \wedge \Diamond_{\mathrm{e}} b$ instead are not persistent because they express the availability of two epistemic possibilities that might fail to be available as soon as more information is achieved (if the state gets smaller). Actually $\Diamond_{\mathrm{e}} a \wedge \Diamond_{\mathrm{e}} b$ is anti-persistent because if an epistemic possibility is available, it will stay available if we enlarge our state.

Since $\sigma[\phi + I] \subseteq \sigma[\phi]$ (by definition of $+I$ in terms of intersection), uptaking anti-persistent implicatures is vacuous in this system: if ψ is anti-persistent: $\sigma[\phi + I] \models \psi \Rightarrow \sigma[\phi] \models \psi$. As we saw, epistemic free choice implicatures are anti-persistent. Deontic free choice implicatures instead are persistent: $\Diamond_{\mathrm{d}} a \wedge \Diamond_{\mathrm{d}} b$ expresses a property of all available possibilities, namely that they can deontically access both a-worlds and b-worlds. Adding possibilities might affect the validity of this universal property, but eliminating possibilities will not. But then uptaking epistemic free choice implicatures is vacuous, while uptaking deontic free choice implicature is not:

(51) $\sigma[\phi + I] \models \Diamond_{\mathrm{e}} a \wedge \Diamond_{\mathrm{e}} b \;\Rightarrow\; \sigma[\phi] \models \Diamond_{\mathrm{e}} a \wedge \Diamond_{\mathrm{e}} b$ $\quad [\Rightarrow \Box_{\mathrm{e}}(a \vee b) + I \not\models \Diamond_{\mathrm{e}} a \wedge \Diamond_{\mathrm{e}} b]$

(52) $\sigma[\phi + I] \models \Diamond_{\mathrm{d}} a \wedge \Diamond_{\mathrm{d}} b \;\not\Rightarrow\; \sigma[\phi] \models \Diamond_{\mathrm{d}} a \wedge \Diamond_{\mathrm{d}} b$ $\quad [\Box_{\mathrm{d}}(a \vee b) + I \models \Diamond_{\mathrm{d}} a \wedge \Diamond_{\mathrm{d}} b]$

Examples (53) and (54) illustrate these facts:

(53) $\{w_{\mathrm{a}}\}[\Box_{\mathrm{e}}(a \vee b) + I] = \{w_{\mathrm{a}}\} \cap \{w_{\mathrm{a}}, w_{\mathrm{b}}, w_{\mathrm{ab}}\} = \{w_{\mathrm{a}}\}$

(54) $\{w_{\emptyset} \to [w_{\mathrm{a}}], w_{\emptyset} \to [w_{\mathrm{a}}, w_{\mathrm{b}}]\}[\Box_{\mathrm{d}}(a \vee b) + I] =$
$\{w_{\emptyset} \to [w_{\mathrm{a}}], w_{\emptyset} \to [w_{\mathrm{a}}, w_{\mathrm{b}}]\} \cap \{w_{\emptyset} \to [w_{\mathrm{a}}, w_{\mathrm{b}}], \ldots\} = \{w_{\emptyset} \to [w_{\mathrm{a}}, w_{\mathrm{b}}]\}$

Extending the analysis to the first-order case, it follows that when uptaking FC implicatures, DW can be justified in the *deontic* case, see (40), but not in the *epistemic* case:

(55) $\Box_{\mathrm{e}} \exists x \phi + I \models \Box_{\mathrm{e}} \exists x_{\mathrm{DW}} \phi + I$

(56) $\Box_{\mathrm{d}} \exists x \phi + I \not\models \Box_{\mathrm{d}} \exists x_{\mathrm{DW}} \phi + I$

Normally optional, $+I$ becomes then obligatory in **deoFC** uses of *irgendein*, without implicature uptake DW would have been unjustified.

5 Conclusion

We have proposed an account of EIs as existentials triggering an obligatory domain shift. One kind of domain shift (CC-shift) produces ignorance uses and is available for all EIs. Another kind of domain shift (DW), producing negative uses, is an option only for a subset of the EIs. Emphatic free choice uses have been explained as obligatory pragmatic enrichments triggered by DW under certain circumstances. According to the described model, emphatic free choice uses come with a high cost for the interpreter who in order to arrive at the intended interpretation needs to calculate pragmatic implicatures and consequently integrate them in the conveyed meaning. Economy then explains why the emphatic free choice function occurs at the right end of our implicational map and why many languages eventually develop specialized morphology to express free choice meaning (e.g. Romance). Typically in these languages emphatic free choice uses of EIs are blocked by the availability of an easier to process specialized free choice indefinite form.

Appendix Let $\mathscr{L}$ be a predicate logical *language* with CC-indexed variables $x_{\mathrm{n}}, y_{\mathrm{m}}, \ldots$, and two modal operators, epistemic $\Box_{\mathrm{e}}$ and deontic $\Box_{\mathrm{d}}$. A *model M* for $\mathscr{L}$ is a quadruple $\langle W, D, R, C\rangle$ where W is a set of interpretation functions for the non-logical constants in $\mathscr{L}$, D is a non-empty set of individuals, R is an accessibility relation over W, and C is a set of conceptual covers based on (W, D). Let $M = \langle D, W, R, C\rangle$ be a model for $\mathscr{L}$ and $\mathscr{V}$ be the set of variables in $\mathscr{L}$. The set Σ_{M} of *information states* based on M is defined as: $\Sigma_{\mathrm{M}} = \bigcup_{\mathrm{X}\subseteq\mathscr{V}} \mathscr{P}((D^{\mathrm{W}})^{\mathrm{X}} \times W)$. Let $i = \langle g, w\rangle$ be a possibility in a state $\sigma \in \Sigma_{\mathrm{M}}$, then (i) $i(\alpha) = w(\alpha)$, if α is a non-logical constant; (ii) $i(\alpha) = g(\alpha)(w)$, if α is a variable in $dom(g)$, undefined otherwise. Updates are defined wrt a conceptual perspective $\wp$, which maps every CC-index $n \in N$ to some cover in C.

Semantics

$$
\begin{array}{rcl}
\sigma[Rt_1,...,t_{\mathrm{n}}]^{\wp}\sigma' & \text{iff} & \sigma' = \{i \in \sigma \mid \langle i(t_1),...,i(t_{\mathrm{n}})\rangle \in i(R)\} \\
\sigma[\neg\phi]^{\wp}\sigma' & \text{iff} & \sigma' = \{i \in \sigma \mid \neg\exists\sigma'' : \sigma[\phi]^{\wp}\sigma'' \;\&\; i \prec \sigma''\} \\
\sigma[\phi \wedge \psi]^{\wp}\sigma' & \text{iff} & \exists\sigma'' : \sigma[\phi]^{\wp}\sigma''[\psi]^{\wp}\sigma' \\
\sigma[\exists x_{\mathrm{n}}\phi]^{\wp}\sigma' & \text{iff} & \sigma[x_{\mathrm{n}}/c][\phi]^{\wp}\sigma' \text{ for some } c \in \wp(n) \\
\sigma[\Box_{\mathrm{e}}\phi]^{\wp}\sigma' & \text{iff} & \sigma' = \{i \in \sigma \mid \sigma \models^{\wp}\phi\} \\
\sigma[\Box_{\mathrm{d}}\phi]^{\wp}\sigma' & \text{iff} & \sigma' = \{i \in \sigma \mid \{\langle g_{\mathrm{i}}, v\rangle \mid w_{\mathrm{i}}Rv\} \vdash^{\wp}\phi\} \\
\sigma[\phi + I]^{\wp}\sigma' & \text{iff} & \exists\sigma'' : \sigma[\phi]^{\wp}\sigma'' \;\&\; \sigma' = \sigma'' + opt(\phi)
\end{array}
$$

Auxiliary notions

$$
\begin{array}{rcl}
\textit{c-extension:}\quad \sigma[x_{\mathrm{n}}/c] & = & \{i[x/c] \mid i \in \sigma\} \\
i[x/c] & = & \langle g_{\mathrm{i}} \cup \{\langle x, c\rangle\}, w_{\mathrm{i}}\rangle \quad (\text{if } x \notin dom(g), \text{undefined otherwise}) \\
\textit{Survival:}\ i \prec \sigma & \text{iff} & \exists j \in \sigma : w_{\mathrm{i}} = w_{\mathrm{j}} \;\&\; g_{\mathrm{i}} \subseteq g_{\mathrm{j}} \\
\textit{Support:}\quad \sigma \models^{\wp}\phi & \text{iff} & \exists\sigma' :\ \sigma[\phi]^{\wp}\sigma' \;\&\; \forall i \in \sigma : i \prec \sigma' \\
\sigma \models^{\wp}{}_{\mathrm{P}}\phi & \text{iff} & \sigma \models^{\wp}\phi \;\&\; \phi \text{ felicitous in } \sigma \\
\textit{Truth:}\quad \sigma \vdash^{\wp}\phi & \text{iff} & \forall i \in \sigma : \exists\sigma' :\ \sigma[\phi]^{\wp}\sigma' \;\&\; i \prec \sigma' \\
\textit{Entailment:}\quad \phi \models \psi & \text{iff} & \forall\sigma, \wp :\ \sigma \models^{\wp}\phi \Rightarrow \sigma \models^{\wp}\psi \\
\phi \models_{\mathrm{P}} \psi & \text{iff} & \forall\sigma, \wp : \phi \;\&\; \psi \text{ felicitous in } \sigma :\ \sigma \models^{\wp}\phi \Rightarrow \sigma \models^{\wp}\psi \\
\textit{Merging:}\quad \sigma + \tau & = & \{i \in \sigma \mid \exists j \in \tau : w_{\mathrm{i}} = w_{\mathrm{j}}\}
\end{array}
$$

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