Modal inferences in marked indefinites: the case of German *irgend*-indefinites

Maria Aloni and Angelika Port

Uses of unmarked indefinites can give rise to a number of pragmatic effects. Although the semantic representations of *somebody* in (1) and (2) are identical, (1) comes along with a free choice implicature (each individual is a permissible option) and (2) with an ignorance implicature (the speaker does not know who).

(1)   You may invite somebody.

(2)   Somebody arrived late.

Many languages in the world have developed marked indefinite forms, often with a restricted distribution, for which these modal inferences are no longer defeasible pragmatic effects, but have been fully integrated into the conventional meaning of the expression. Free Choice Indefinites exemplify cases for which the free choice inference has been conventionalized (Dayal, 1998; Giannakidou, 2001; Menéndez-Benito, 2005; Aloni, 2007b) Epistemic Indefinites, also known as modal or referentially vague indefinites, exemplify cases for which the ignorance inference has been conventionalized (Jayez and Tovena, 2006; Alonso-Ovalle and Menéndez-Benito, 2010; Aloni and Port, 2011; Giannakidou and Quer, 2011).

In this article, we will focus on German *irgend*-indefinites, which are sometimes classified as epistemic (e.g. Aloni and Port 2011), but also have free choice uses (Haspelmath 1997, Kratzer and Shimoyama 2002). The following examples illustrate in what sense the ignorance implicature is conventionalized in these marked indefinite forms. Sentences (3) and (4) both make an existential claim, but only (4) additionally conveys, as part of its conventional meaning, that the speaker is unable to identify the individual that satisfies this claim. Therefore, adding the continuations 'Guess who' or 'Namely John', which would contradict the ignorance inference, results in an oddity in (4), but not in (3).

(3)   *Unmarked indefinite*

    a.   **Jemand** hat angerufen. Rat   mal wer! / Nämlich Hans.
           somebody has called   guess PRT who / namely John
           'Somebody called. Guess who! / Namely John.'
    b.   Conventional meaning: Somebody called
    c.   Ignorance implicature: The speaker doesn't know who called

(4)   *Marked indefinite*

a. **Irgendjemand** hat angerufen. #Rat mal wer! / #Nämlich Hans.
   IRGEND-somebody has called guess PRT who / namely John
   'Somebody called, I don't know who.'
b. Conventional meaning: Somebody called – the speaker doesn't know who called

Example (5) from Kratzer and Shimoyama (2002) shows that *irgend*-indefinites also have free choice uses. The sentence is ambiguous between a wide scope ignorance interpretation represented in (5-a) and a lower scope free choice interpretation represented in (5-b).

(5) Mary musste irgendeinen Mann heiraten.
    Mary had-to IRGEND-one man marry
    'Mary had to marry some man.'
    a. 'There was some man Mary had to marry. The speaker doesn't know who it was.'
    b. 'Mary had to marry a man, any man was a permitted marriage option for her.'

In the first part of the article, we will present the results of a synchronic corpus study of the determiner *irgendein* and the pronoun *irgend jemand* in present day German. The goal of this study was to investigate the distribution of these expressions in naturalistic data, and compare it with the distribution of marked indefinite forms in other languages. Our results indicate that *irgend*-indefinites have a wide distribution including ignorance, negative and free choice uses, but excluding other uses typical of Negative Polarity Items (notably occurences under direct negation) or of Free Choice Items (e.g. generic interpretations). A further theoretically significant observation emerging from the corpus study was that *irgend*-indefinites, contrary to, e.g., English *any*, can display different behavior under epistemic and deontic modals. Four main uses were identified for *irgend*-indefinites as result of this research:

(6) a. **spU** (specific Unknown): ignorance effect in specific uses
    b. **epiU** (epistemic Unknown): ignorance effect under epistemic modals
    c. **NPu** (Negative Polarity use): narrow-scope existential meaning in 'negative' contexts
    d. **deoFC** (deontic Free Choice): free choice effect under deontic modals

In the second part of the article, we sketch a formal account of the distribution and meaning of *irgend*-indefinites in the framework of a Dynamic Semantics with Conceptual Covers along the lines of Aloni and Port (2011) and Aloni (2012). Our point of departure is the assumption that epistemic indefinites are existentials with two additional characteristics: (i) they induce an obligatory domain shift and (ii) they are felicitous only if the domain shift is for a reason. In this framework, differences between different indefinites are explained in terms of the different domain shifts they can induce; we propose that *irgend*-indefinites can choose between two kinds of domain shifts: shift of a method of identification, aka conceptual cover shift (CC-shift), or domain widening (DW).

Using this framework will enable us (i) to derive the obligatory ignorance effect that *irgend*-indefinites induce in specific uses (spU) and under epistemic modals (epiU) via the felicity condition for CC-shift; (ii) to account for the NPu and deoFC uses via the felicity condition of DW, and (iii) to explain the different behaviors of the indefinite under different modals. Crucial to our proposal is that we endorse different analyses for epistemic and deontic modals: the former are treated as Veltman's (1996) tests, as standard in dynamic semantics; the latter instead receive a classical static interpretation.

1   Corpus study

In this section, we present the main results of a synchronic corpus study on the German indefinite expressions *irgendein* and *irgend jemand*. In this study we classified randomly-selected occurrences of these two indefinite forms according to a number of categories. The point of departure for the identification of the relevant categories was Haspelmath's (1997) implicational map.
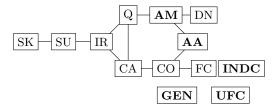
1.1   Haspelmath's implicational map

Haspelmath's (1997) typological survey identified 9 main functions for indefinite pronouns, organized in an implicational map. In our study, we assume an extended version of Haspelmath's map, motivated by a more detailed classification of negative polarity and free choice items across languages (Aguilar-Guevara et al. 2011). In Aguilar-Guevara et al.'s (2011) extended map, Haspelmath's original indirect negation (IN) function has been split into an anti-morphic (AM) and an anti-additive (AA) function (cf. Zwarts 1998); and three new functions have been introduced contiguous to the free-choice area; namely, the generic function (GEN), the universal free choice (UFC) function and the indiscriminative function (INDC) (Horn 2005).[1] The newly-introduced functions are in boldface in the following illustrations.[2]

(7)   *An extended version of Haspelmath's map*

---

[1]The precise placement on the map (i.e. connecting lines determining function contiguity) of the GEN, UFC and INDC functions is still a matter of investigation.

[2]Motivation for an extension of the original implicational map came from in more detailed cross-linguistic comparison of the items. For example, while English *any*, and, as we will see, German *irgend*-indefinites, qualify for both AA and AM, Italian *qualunque* only qualifies for AA. Furthermore, while English *any* qualifies for all the new functions contiguous to the free choice area, German *irgend*-indefinites, as reported later, qualifies only for INDC; Italian *qualunque* only for GEN and UFC; and Italian *uno qualunque* only for GEN and INDC.

Q — **AM** — DN

SK — SU — IR   **AA**

CA — CO — FC **INDC**

GEN   **UFC**

(8)   *Functions on the map*

Abbr	**Function**	**Example**
SK	specific known	*Somebody* called. Guess who?
SU	specific unknown	I heard *something*, but I couldn't tell what it was.
IR	irrealis	You must try *somewhere* else.
Q	question	Did *anybody* tell you anything about it?
CA	conditional antecedent	If you see *anybody*, tell me immediately.
CO	comparative	John is taller than *anybody*.
DN	direct negation	John didn't see *anybody*.
AM	anti-morphic	I don't think that *anybody* knows the answer.
AA	anti-additive	The bank avoided taking *any* decision.
FC	free choice	You may kiss *anybody*.
UFC	universal free choice	John kissed *any* woman with red hair.
GEN	generic	*Any* dog has four legs.
INDC	indiscriminative	I don't want to sleep with just *anybody* anymore.

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 semantics that the function specifies. For example, *any* does not exhibit the specific functions SK/SU because it is ungrammatical in episodic sentences, as illustrated in (9-a); and *some* does not qualify for the comparative function CO because it does not convey the universal meaning specified by CO, as illustrated in (9-b).

(9)   a.   I heard something /# anything.
       b.   Berlin is bigger than any /# some Czech city.
             'For all Czech cities it holds that Berlin is bigger than they are.'

The functions are placed in a certain order on the implicational map in (7). Haspelmath proposed that an indefinite will always express a set of functions that are contiguous on the map (where two functions are contiguous iff they are connected by a line). This adjacency requirement excludes, for example, indefinites which exhibit the free choice function (FC) and the conditional antecedent function (CA), but not the comparative function (CO). The adjacency requirement makes not only predictions about possible indefinites in any language, but also about their diachronic development. According to Haspelmath, indefinites which acquire new functions will acquire those functions first which are adjacent to their original continuous area (Haspelmath 1997, p. 63). Having introduced the implicational map, we now turn to the corpus study of *irgendein* and *irgend jemand*.

1.2 The corpus

We constructed our annotation dataset by extracting instances of *irgendein* and *irgend jemand* from the 'Das Digitale Wörterbuch der Deutschen Sprache des 20. Jahrhunderts, DWDS'.[3] At the moment of search, the corpus contained 100 million tokens of written German language from 79.830 different files. The data covered the whole 20th century and were balanced with respect to the different genres (fiction, newspapers, science, non-fiction) and their time of appearance, except for the data from 1970-1989 and 1990-1999. In the first two decades the genre 'non-fiction' was underrepresented, in the other decade the genre 'fiction' was underrepresented.[4]

Table (10) pictures the absolute occurrences of the plain determiner *ein* 'a(n)'[5] and the plain pronoun *jemand* 'somebody' vs. their counterparts with *irgend*.

(10)   *Absolute occurences*

indefinite form	occurrences
jemand	11400
irgend jemand	823
ein	945708
irgendein	6273

The table shows two expected results. First, it was expected that the use of an indefinite determiner is much more frequent than the use of an indefinite pronoun. Second, it was expected that the use of plain indefinite forms is much more frequent than the use of complex forms with *irgend*.

In a first step, all available data were collected. Of the 6273 occurrences for *irgendein*, only 5045 occurrences were available due to copyrights, for *irgend jemand* only 610 occurrences. In a second step 300 randomly chosen examples for each indefinite form were annotated. The annotation scheme consisted of the functions in the extended Haspelmath's map presented in (7) plus an additional

---

[3]The corpus can be found online under http://www.dwds.de/. The data were collected in June 2008. New data are added continuously into the corpus.

[4]This might influence the distribution for *irgend*-indefinites. For example, it seems natural to assume that we will find less uses of *irgend*-indefinites in the specific unknown function (SU) in newspapers and scientific work than in fiction.
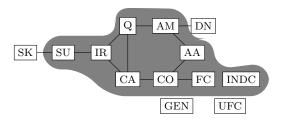
[5]German *ein* has two readings: as an indefinite determiner or numeral. Even if we assumed that half of the occurrences in the corpus exhibit the numeral reading, which is very unlikely, it would still imply that *irgendein* is the marked form. To underpin the claim that most of the occurrences for *ein* exhibit the determiner use we can compare the use of the determiner and the numeral in another language, in which these two meanings are expressed by two different lexical items. The frequencies of the indefinite determiner *a(n)* and the numeral *one* in the British National Corpus reveals what we intuitively expect: the use of the determiner is much more frequent than the use of the numeral. In the 100 million word database, the frequency for the determiner *a(n)* is 21,626 per million words, for the numeral 1,962 per million words. Assuming that there is no difference between German and English with respect to the use of these two meanings we conclude that the use of the indefinite *ein* is considerably higher than the use of the numeral. The frequencies of the BNC can be found under: `http://ucrel.lancs.ac.uk/bncfreq/`.

label UN for unclear cases. To systematically assign particular functions on the map to instances of indefinites in context, we used a set of explicit logico-semantic tests organized in a binary decision tree, see Aguilar-Guevara et al. (2011) for a detailed illustration of the tests, and Aloni et al. (2012) for an assessment of this methodology by measurement of inter-annotator agreement. We now turn to the results of the corpus study.

1.3   Results

The first result of the corpus study is that the distribution that Haspelmath (1997) proposed for *irgend*-indefinites is verified with respect to his original map. Both the determiner *irgendein* and the pronoun *irgend jemand* have a wide distribution including ignorance, negative and free choice uses, but excluding other functions typical of Negative Polarity Items (occurences under direct negation) or Free Choice Items (generic and universal free choice interpretations). Notably *irgend*-indefinites qualify for specific unknown uses, but not for specific known uses, justifying their classification as epistemic indefinites (rather than, for example, as non-specific indefinites).

(11)   Distribution of *irgendein* and *irgend jemand* on the map

(12)   Quantitative distribution of the determiner *irgendein* and of the pronoun *irgend jemand*

function	determiner	pronoun	total
SU	54 (18,0%)	57 (19,0%)	111
IR	29 (09,7%)	31 (10,3%)	60
Q	14 (04,7%)	24 (08,0%)	38
AA	37 (12,3%)	38 (12,7%)	75
AM	48 (16,0%)	58 (19,3%)	106
CA	31 (10,3%)	33 (11,0%)	64
CO	13 (04,3%)	24 (08,0%)	37
FC	38 (12,7%)	20 (06,7%)	58
INDC	19 (06,3%)	3 (01,0%)	22
unclear	17 (05,7%)	12 (04,0%)	29
total	300 (100%)	300 (100%)	600

Typical examples from the corpus of each of the attested functions for *irgend*-indefinites are given below.

Examples from the corpus

(13)   **Irgend jemand**   versetzte dem Gefangenen mit einem Stock einen so
        IRGEND somebody gave   the prisoner   with a   stick a   such
        schweren Schlag über den Kopf, daß er eine stark   blutende Wunde
        hard   blow   over the head, that he an   intense bleeding wound
        davontrug.
        carried-away.
        '*Somebody* gave the prisoner such a heavy blow on the head with a stick, that
        he came away with a heavily bleeding wound.'   [**SU**]

(14)   Manchmal hat sie auch Gelegenheit, einfach nichts   zu tun, aber wenn sie
        Sometimes has she too   opportunity, just   nothing to do, but if   she
        auch nur fünf Minuten ruht,   kommt sie sich   gleich   verdächtig
        PRT PRT five minutes resting, feels   she herself immediately suspiciously
        vor und ruft   **irgendeine** Freundin an   und schnattert idiotisches Zeug.
        PRT and phones IRGEND-one girlfriend PRT and talks   twaddle.
        'Sometimes she has the possibility just to do nothing, but if she stops only
        for five minutes, she immediately feels restless and phones *some* girlfriend and
        talks twaddle.'   [**IR**]

(15)   Hast Du **irgendeine** Tageszeitung?
        Have you IRGEND-one newspaper?
        'Do you have *any* newspaper?'   [**Q**]

(16)   ...wenn Sie **irgendeinen** Wunsch haben, Kaffee und so weiter, rufen Sie
        ...if   you IRGEND-one   wish   have,   coffee and so on,   call you
        einfach unten   an.
        just   downstairs PRT.
        '... if you have *any* wish, coffee and so on, just call downstairs' [**CA**]

(17)   Es ist nie   **irgend jemand** zu euch gekommen mit einer solchen
        It is never IRGEND somebody to you came   with a   such
        Botschaft wie wir: Jesus Christus ist auferstanden!
        message   like us: Jesus Christ   is resurrected!
        'Never came *anybody* to you with such a message like us: Jesus Christ is
        resurrected!'   [**AA**]

(18)   Ich glaube nicht, daß sie irgendetwas bewirken werden oder daß **irgend**
        I   believe not,   that you anything   effect   will   or   that IRGEND
        jemand sie glaubwürdig   findet.
        somebody you worthy-of-credit think.
        'I don't think that they will be able to have an influence on anything or that
        anybody will find them credible.'   [**AM**]

(19)   Er besaß zehn Milliarden Dollar, mehr als   **irgendein** Mensch auf der
        He owned ten   milliards   dollars, more than IRGEND-one human at   this
        Welt.
        world.
        'He owned ten billions of dollars, more than *any* human in the world' [**CO**]
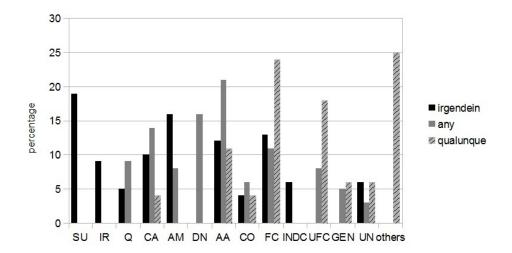
(20)   Im Notfall   kann auch ein Fahrradschlauch oder ein Hosenträger oder
           In emergency can also an inner tube   or   a pair of braces or
           auch **irgendein** Tuch benutzt werden.
           also IRGEND-one cloth used   be
           'In emergencies also an inner tube or a pair of braces or *any* cloth can be
           used.'   [**FC**]

(21)   Das ist wenn man Lust auf einen   Mann hat, Madame! Nich auf
           That is if   one desire for INDEF-ACC man   has, madam! Not for
           irgendeinen. Auf den!
           IRGEND-one.   For DEF-ACC!
           'That's when you desire a man, Madam, not just *any* man, but HIM!' [**INDC**]
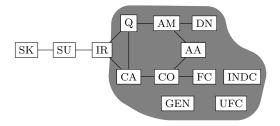
The study on *irgend*-indefinites was carried out as part of a larger study of marked indefinites across languages, including items from German, Spanish, Italian, English, Czech and Dutch (for details see Aguilar-Guevara *et al.*, 2012).[6] The following illustrations compare the attested distribution of *irgendein* with that of English *any*, which has both negative polarity and free choice uses (e.g. Horn, 2005), and of the Italian determiner *qualunque*, normally classified as a free choice item (e.g. Chierchia, 2010).

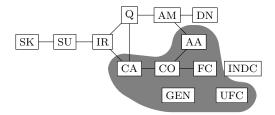(22)   Average distribution of functions for *irgendein*, *any* and *qualunque*

(23)   Distribution of *any* on the map

---

[6] All the data are accessible through an online interface that allows users to search for items annotated with particular functions and to download the dataset and/or the annotations. The online interface is accessible from: `http://staff.science.uva.nl/~{}maloni/Indefinites/corpus.html`.

Q — AM — DN
SK — SU — IR
AA
CA — CO — FC — INDC
GEN   UFC

(24)   Distribution of *qualunque* on the map

Q — AM — DN
SK — SU — IR
AA
CA — CO — FC — INDC
GEN   UFC

As illustrated in the graph in (22), *any* is most frequently used in environments which typically license negative polarity items (DN, AA, AM, CA, CO and Q), but also has significant free choice uses (FC, UFC and GEN)[7]. *Qualunque*, rather, does not qualify for negative functions (AM, DN) and is most frequently used in the functions contiguous to the free choice area (FC, UFC and GEN, but not INDC). Our indefinite *irgendein*, although it lacks DN uses, is, like *any*, most frequently used in environments which typically license negative polarity items (AA, AM, CA, CO and Q). In contrast to *any*, however, *irgendein* qualifies for the irrealis and the specific unknown functions, which puts its status as a polarity or a non-specific indefinite in doubt. Like *any* and *qualunque*, *irgendein* also has significant free choice uses, but, in contrast to the English and Italian determiners, it lacks other uses typical of genuine free choice indefinites - notably, universal free choice and generic interpretations.

The main conclusion we can draw from this cross-linguistic comparison is that, contrary to what is often assumed in the linguistic literature, it does not seem useful to classify marked indefinites in predefined categories like Free Choice Indefinites, Negative Polarity Indefinites or Non-Specific Indefinites, because these categories do not appear to form uniform classes. A more useful approach is to adopt a more fine-grained perspective and classify individual indefinite forms with respect to their distribution on a typologically motivated set of functions. The extended version of Haspelmath's map employed here has proven to be a very useful tool for this task. In the next section, we will discuss some of the German corpus data in more detail, and identify four main uses for *irgend*-indefinites.

---

[7]While INDC uses of *any* are attested in the literature (see Horn 2005), we did not identify any among the corpus tokens analyzed, likely due to the small sample size (only 80 examples).

1.4 Discussion

NPu uses The contexts specified by the functions Q, AA, AM, CA and CO typically license Negative Polarity Items (NPu) like English *ever*. Subsuming these functions as NPu uses of the indefinite, the following generalization can be made: Most of the uses of *irgendein* found in the corpus are NPu uses (47.7%), the same holds for the pronoun *irgend jemand* (59%). This is the first main use we identify for *irgend*-indefinites.

> **NPu**: narrow scope existential meaning in NPu licensing contexts.

The use of *irgend*-indefinites in comparative clauses deserves a special note. According to the distribution suggested by Haspelmath (1997) *irgend*-indefinites exhibit the CO function, i.e., they can receive a universal interpretation in comparative clauses. One example Haspelmath gave is (25), and he observed that *irgend*-indefinites in the CO function must be stressed.

(25)   Joan Baez sang besser als IRGEND JEMAND JE zuvor.
        'Joan Baez sang better than *anyone ever* before.'

Given that *irgend*-indefinites often pattern with English *some*, it might come as a surprise that the use of the existential *irgend jemand* in a comparative gets a universal interpretation. Looking closer at the given example, one might argue that the universal flavor does not come from the indefinite pronoun itself but is triggered by *je zuvor 'ever before'* instead. The following example without the additional *je zuvor* indeed seems to get an existential SU interpretation:

(26)   Joan Baez sang besser als *irgend jemand.*
        'Joan Baez sang better than *somebody*.'

Data from our corpus, however, confirmed that *irgend*-indefinites qualify for the CO function. The following example, where the indefinite appears without modification, clearly conveys a universal meaning (see also example (19) in section 1.3):

(27)   1722 führte   Preußen früher als   *irgendein*   Land   die
        1722 introduced Prussia earlier than IRGEND-one country the
        allgemeine Schulpflicht   ein.
        compulsory school attendance PRT.
        'In 1722 Prussia introduced, earlier than *any* other country, compulsory
        school attendance.'

It seems to us that the indefinite must be stressed to trigger a universal meaning here, which at least partially confirms Haspelmath's observation on the role of intonation for these cases.

Specific Unknown uses Another quite frequent function of *irgend*-indefinites is the specific unknown function: 18% of the occurrences of the determiner, and

19% of the pronoun. Sentence (28), which exemplifies this function, implies that the speaker does not know what the referent of the indefinite is.

(28) Ich ging da   allein ins   Kino, *irgendein*   amerikanischer
      I   went then alone to-the cinema, IRGEND-one American
      Gagfilm,   'Beverly Hills Cop' oder so   was.
      comedy-movie, 'Beverly Hills Cop' or   the like.
      'This time I went to the cinema alone, some American comedy, 'Beverly
      Hills Cop' or the like.'

An interesting question concerns the type of modal inference *irgendein* sustains in this kind of examples. If the speaker does not know which movie he saw, does it mean that (i) *any* movie is a possibility as long as it is an American comedy (**total variation**: it might have been any comedy $\mapsto \forall x \diamond \phi$) or (ii) the example is compatible with a situation in which some of the epistemic possibilities have been excluded (**partial variation**: she does not know which comedy $\mapsto \neg \exists x \Box \phi$)? Using scenarios like (29) we can show that *irgend*-indefinites in these uses merely convey epistemic partial variation effects: example (30) can be used by Pedro in (29), where a statement like (31), employing a genuine free choice item which induces total variation, would be inappropriate (see also Lauer 2010, for similar observations).

(29) HIDE AND SEEK: María, Juan, and Pedro are playing hide-and-seek.
      Juan is hiding. Pedro is sure that Juan is inside the house. Furthermore,
      he knows that Juan is not in the bathroom or in the kitchen. (Alonso-
      Ovalle and Menéndez-Benito 2010, p. 6)

(30) Juan ist in *irgendeinem* Zimmer im   Haus.
      Juan is in IRGEND-one room   in-the house.
      'Juan is in some room of the house.'

(31) Juan might be in any room in the house.

The second use we identify for *irgend*-indefinites is the specify Unknown use:

    spU: obligatory ignorance (partial variation) effect in specific uses.

The difference between Haspelmath's original SU function and our spU use is that, in the latter, the ignorance effect is obligatory; therefore, only indefinites which lack the SK function qualify for the spU use.

Epistemic Unknown and deontic Free Choice uses   We turn now to the interaction between *irgend*-indefinites and modal contexts. We start with an example with an epistemic modal:

(32) Heute muß *irgendein*   Gedenktag   sein, ich weiß nur
      Today must IRGEND-one commemoration day be,   I   know PRT
      nicht, was   für einer.
      not,   what for one.
      'It must be some commemoration day today, I don't know which one.'

The reading *irgendein* displays under epistemic modals is very similar to the one we found in the spU use. By using *irgendein* in (32), the speaker conveys that she is unable to identify the referent of the indefinite, but it seems plausible to assume that she might be able to exclude some of the possible commemoration days due to independent evidence. The indefinite only triggers a partial variation inference. As further evidence, notice that, in the hide-and-seek-scenario introduced above, the following sentence, with *irgendein* under an epistemic 'must', would also be appropriate:

(33) 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.'

This use, which, in our annotation, was subsumed under the label IR, will be called epistemic unknown:

epiU ignorance (partial variation) effect under epistemic modals.

65,5% of the IR cases in our corpus were epiU cases for *irgendein*, and 64.5% for *irgend jemand*. For the determiner *irgendein*, 68,4% of the found epiU examples involved epistemic necessity and only 31,6% epistemic possibility.

The following sentence is most likely interpreted as a deontic statement. In this context *irgendein* gets the stronger total variation reading (any system which seems to be efficient is a possible option) and can be glossed as *any*:

(34) Natürlich können wir *irgendein* System verwenden, das   uns effizient
      Of-course may   we any   system use,   which us efficient
      erscheint.
      seems
      'Of course we may use *any* system that seems to be efficient.'

The same total variation effect can also be witnessed under deontic necessity modals, cf. example (35).[8] Since English *any* is not licensed in such contexts, the most natural translation of *irgendein* in the next case uses a partitive construction with the adposition *no matter which*:

(35) Auf den Straßen tobten sich   Revoluzzer   aus. Nun
      On the streets run   REFL revolutionists-COLLQU-riot PRT. Now
      mußte sich   *irgendeine* Regierungspartei von der Macht
      had   REFL IRGEND-one ruling party   to   the power
      verabschieden. Es traf die CDU.
      say good bye. It was the CDU.

---

[8]These uses are subsumed under the label FC, even though necessity modals are not non-negative anti-additive operators. Another possibility would have been to subsume these cases under IR as we did for the epistemic case. The different strength of the variation effect triggered under epistemic and deontic modals was the most important reason to subsume the latter uses under FC.

'The revolutionaries were rioting on the streets. Now *one of the* ruling parties (no matter which) had to relinquish power. It turned out to be the CDU.'

As it turned out, the most frequent context which gave rise to a free choice effect is deontic necessity. For *irgendein* 50% of the FC cases involved deontic necessity, for *irgend jemand* 65%, followed by deontic possibility and other root modalities like teleological or bulethic ones. For this reason we label this use deoFC:

> **deoFC** free choice (total variation) effects under deontic and other non-epistemic modals

If we subsume the INDC uses under the free choice uses, free choice is the second most frequent use for our determiner (but not for our pronoun).

(36)   Quantitative distribution of the determiner *irgendein* and of the pronoun *irgend jemand*

use	determiner	pronoun	total
spU	54 (18,0%)	57 (19,0%)	111
epiU	19 (06,3%)	20 (06,7%)	39
NPu	143 (47,7%)	177 (59,0%)	320
FC/INDC	57 (19,0%)	23 (07,7%)	80
other	27 (09,0%)	23 (07,7%)	50
total	300 (100%)	300 (100%)	600

To summarize, four uses for *irgend*-indefinites emerged from the corpus study presented in this section:

(37)   a.   **spU**: ignorance (partial variation) effect in specific uses
         b.   **epiU**: ignorance (partial variation) effect under epistemic modals
         c.   **NPu**: narrow scope existential meaning in 'negative' contexts
         d.   **deoFC**: free choice (total variation) effect under deontic modals

Table (38) illustrates the variety of marked indefinites cross-linguistically with respect to these uses:[9]

(38)   Marked indenites cross-linguistically

---

[9]The table is based on data from Alonso-Ovalle and Menéndez-Benito (2010) for Spanish *algún*, Zamparelli (2007) and Aloni and Port (2011) for Italian *un qualche*, Radek Šimík (p.c.) for Czech *-si*, and Fălăuş (2009) for Romanian *vreun*.

13

	spU	**epiU**	**NPu**	**deoFC**
irgendein	**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 (En)	no	no	**yes**	**yes**
qualunque (It)	no	no	no	**yes**

It is tempting to read (38) as an implicational map and, along the lines of Haspelmath (1997), formulate a hypothesis of function contiguity: any indefinite in any language will always express a contiguous area of the map. If we define *Epistemic Indefinites* as indefinites which exhibit at least one of the ignorance functions (spU or epiU), the map predicts that we will never find an epistemic indefinite which has free choice uses, but fails to have negative polarity uses. Although the validity of this hypothesis is still a matter of empirical investigation, in the theory sketched in the following section, it is assumed as a guide for the semantic analysis.

2   On the meaning of *irgend*-indefinites

In this section, we sketch a formal account of the meanings and distributions of German epistemic indefinites *irgendein* and *irgend jemand* in the framework of a Dynamic Semantics with Conceptual Covers along the lines of Aloni and Port (2011) and Aloni (2012). Before turning to our proposal, let us briefly mention an alternative account of the interpretation of *irgend*-indefinites.

Pragmatic theories   On a pragmatic account of marked indefinites, modal inferences are derived as conversational implicatures (e.g. Kratzer and Shimoyama 2002, Aloni 2007a, Aloni and van Rooij 2007, Chierchia 2010, Alonso-Ovalle and Menéndez-Benito 2010). Pragmatic approaches are quite attractive because they are parsimonious: ignorance and free choice inferences triggered by *irgend*-indefinites are derived in terms of independently-motivated Gricean mechanisms. There are, however, a number of problems.

First of all, there are serious doubts about the defeasibility of modal inferences in *irgend*- and other marked indefinites. We need to account for the conventionalization of ignorance and free choice effects in marked forms, but, with the exception of Chierchia (2010), these theories fail to address this issue and, for example, have no explanation of the contrast between unmarked *jemand* and marked *irgend jemand*, as illustrated in examples (3) and (4).

A second and perhaps more serious problem is that, at least in their present form, all these pragmatic approaches fail to account for the different kind of inferences triggered by *irgend*-indefinites under epistemic and deontic modals. *Irgend*-indefinites give rise to partial variation under epistemic modals (epiSU) and total variation under deontic modals (deoFC), but Gricean mechanisms, and therefore, all these pragmatic theories, are blind towards the difference

between epistemic and deontic modals and so fail to account for either the epiSU or the deoFC uses of these indefinites. In what follows, we will present an analysis which predicts all four uses of *irgend*-indefinites introduced in the previous section. For reasons of space, we will mostly focus on the derivation of the two ignorance uses (spU and epiSU), and only give the main ideas of the treatment of negative and free choice uses (see Aloni 2012, for details).

Epistemic indefinites under conceptual covers The point of departure of a conceptual cover analysis of Epistemic Indefinites (henceforth EIs) (Aloni and Port 2011, Aloni 2012) is the assumption that EIs are existentials with two additional characteristics: (i) they induce an obligatory domain shift; and (ii) they are licensed only if such a shift is for a reason. Differences between different EIs can be captured in terms of the different kinds of domain shift they can induce. We propose that German *irgend*-indefinites are able to shift the domain of quantification in two different ways: they can either shift method of identification (conceptual-cover shift, henceforth, CC-shift), or they can widen the domain (domain widening, henceforth DW). CC-shifts are justified only if the speaker would not otherwise have been able to identify the witness of the existential claim (*necessary weakening condition*). DW is justified only if it does not create a weaker statement (*non-weakening condition*).

The operation of DW has been well-known since Kadmon and Landman (1993). The intuition behind the notion of a CC-shift is best illustrated by an example.

Assume you know that Professor Jane Black is the Academic Director of the National Graduate School of Linguistics (GSL), but you have never seen the professor and therefore you would not be able to point her out. Consider now sentence (39), used in the two contexts in (40):

(39)   You know who the president of GSL is.

(40)   a.   In your office, you want to invite the director of GSL for a work-
              shop;
        b.   At a workshop, you need to find the director of GSL for an inter-
              view.

Intuitively, in context (40-a), sentence (39) would be judged true – you know that Jane Black is the director of GSL, so you know who the director of GSL is. In context (40-b), on the other hand, the sentence would be judged false – as far as you know, this person could be the director of GSL, or it could be 'that woman over there', so you don't know who the director of GSL is. As this example illustrates, individuals can be identified in various ways: by name, by ostension or by description. Our evaluation of knowledge attributions seems to depend on what identification method is at play in the context of use. In context (40-a), where identification by name is relevant, sentence (39) is judged true; in context (40-b), where identification by ostension is relevant, (39) is judged false.

Aloni (2001) tried to account for these intuitions by formalizing 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. For example, in the workshop scenario described in (40-b) there are at least three salient covers representing ways of identifying the relevant individuals: (41-a) representing identification by ostension, (41-b) representing identification by name, and (41-c) representing identification by description.

(41) a. {this person, that person, ...}   [ostension]
      b. {Black, White, ...}   [naming]
      c. {the-director-of-GSL, the-director-of-PSL, ...}   [description]
      d. #{that person, Black}

The set of concepts in (41-d) is not an example of a conceptual cover because it does not represent a proper perspective over the relevant domain of individuals: as far as we know, that person over there might be Jane Black. If so: (i) one individual (Black) would be counted twice; and (ii) another individual (White) would not be identified at all.

In the semantics for knowing-wh constructions proposed in Aloni (2001), the evaluation of sentences like (39) depends on which of these covers is adopted. As illustrated in (42), this dependence is captured by letting the wh-pronoun 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.

(42) You know who$_n$ the director of GSL is.
      a. False, if $n \mapsto$ {this person, that person, ...}
      b. True, if $n \mapsto$ {Black, White, ...} , Trivial, if $n \mapsto$ {the-director-of-GSL, the-director-of-PSL, ...}

To understand how conceptual covers relate to EIs, consider now the following example, in which *irgendein* occurs together with the German specificity marker *bestimmt*.

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

This example is puzzling in the following sense. On the one hand, the use of *bestimmt* indicates that the indefinite is used specifically. Traditionally, this means that the speaker must have someone in mind; i.e., she can identify the referent of the indefinite. On the other hand, the use of *irgendein* conveys that the speaker doesn't know who she has to meet; 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, and that the speaker can identify on one method, but not on the other. For example, a typical situation in which *irgend*-indefinites are used is one in which the speaker can identify the referent by description, but not by name. Another quite typical situation is one in which she can identify by name, but not by ostension. Both cases are illustrated in

16

the following examples.

(44)   a.   Ich muss irgendeinen Professor treffen. Er ist der Direktor vom
              GSL, aber ich weiss nicht wie er heisst.
              'I have to meet some professor. He is the director of GSL, but I
              don't know his name.'
        b.   Speaker can identify by description, but not by name

(45)   a.   Ich muss irgendeinen Professor treffen. Er heisst John Smith, aber
              ich weiss nicht wie er aussieht.
              'I have to meet some professor. His name is John Smith, but I
              don't know what he looks like.'
        b.   Speaker can identify by name, but not by ostension

The main intuition behind Aloni and Port (2011) is that referents of EIs, like *irgend*-indefinites, are typically identified via a method different from the one required for knowledge. The notion of a cc-shift is the technical counterpart of this intuition. Let us have a closer look.

In our framework, indefinites existentially quantify over elements of a contextually selected conceptual cover.[10] For example, a sentence like (46-a) is analysed as (46-b) which can be paraphrased as (46-c), where the value of the cover index n is contextually supplied. In this case we say that a speaker uttering (46-a) uses the indefinite under cover n.

(46)   a.   John met a_n professor.
        b. $\exists x_n (Px \wedge Mjx)$
        c.   There is a professor, identifiable by method n, who John met.

It is natural to assume that, in order to felicitously assert a sentence with a specific occurrence of an indefinite, a speaker must be able to identify the referent of the indefinite. On a conceptual cover approach, which acknowledges the availability of different identification methods, this principle can be formulated as follows:[11]

(47)   Speaker S can use a specific indefinite under a cover cc iff S can identify
        the referent of the indefinite under cc.

Suppose now that a speaker S wants to use a specific indefinite in a context in which the referent is not identifiable by the most prominent method of identi-

---

[10]The analysis is implemented in a dynamic semantics with conceptual covers where meanings are relations between information states (sets of world-assignment pairs) relativized to a conceptual perspective (a function from cover indices to conceptual covers) (Aloni, 2001). See Appendix for details.

[11]In the dynamic implementation, the condition formulated in principle (47) is formalized via the notion of support. A state σ supports a formula ψ iff all possibilities in σ survive simultaneously in one and the same output state after an update with ψ. An existential sentence interpreted under cc, $\exists x_{cc}\phi$, is supported in a state σ only if in σ we are able to identify the witness of the existential claim under cc. In this sense, we say that support is a cc-sensitive notion. Which identification method is adopted matters for support, while it doesn't for classical truth.

fication. For example, suppose that naming is the contextually relevant method of identification, but the speaker can only identify by description, as in our example (44). In such context, in order to comply with (47), S will have to shift method of identification and let the indefinite quantify over a descriptive cover rather than over a cover representing identification by name. Our proposal is that *irgend*-indefinites signal precisely such a shift of a method of identification (aka CC-shift). In other words, suppose *cc* is the conceptual cover representing the most salient method of identification (i.e. the identification method contextually required for knowledge). Then *irgend*-indefinites, at least in their specific uses, signal an obligatory shift to a cover *cc′* different from *cc*; i.e., they existentially quantify over a cover which represents a method of identification that is not the one at play in the relevant context.

As a further illustration, consider now the workshop scenario described in (40-b), in which the cover at play was ostension. A specific use of an *irgend*-indefinite in such context would then signal a shift to a method of identification different from ostension. For example, sentence (43), used in such context, would say that there is a professor, identified by the new method, which I have to meet. Suppose now that the relevant professor were also identifiable by ostension. Such CC-shift would have been without reason in this case: no shift of a method of identification would have been necessary in order to comply with (47). By assuming that only non-vacuous CC-shifts are justified (*necessary weakening condition*), we derive cover-dependent partial variation effects for specific uses of *irgend*-indefinites; namely, that the witness of the existential claim cannot be identified by the identification method at play, e.g., in context (40-b), by ostension (see Appendix for a rigorous definition of the notions used in (48-b), by $\exists x_m^{\mathrm{CC}}$ we denote an existential triggering a CC-shift).[12]

(48) a. Ich muss irgendeinen$_m$ bestimmten Professor treffen.   [**spU**]
         $\Rightarrow$ speaker doesn't know who$_n$
      b. $\exists x_m^{\mathrm{CC}} \phi \models_P \neg \exists y_n \Box_e \phi$
      c. $n \mapsto$ cover at play in context
      d. $m \mapsto$ cover used to identify referent of EI
      e. CC-shift $\mapsto m \neq n$

Other spU uses of *irgend*-indefinites are analyzed in a similar fashion. For example, our corpus example (28), here rewritten as (49), is predicted to be felicitous only in a context in which the speaker cannot identify the relevant movie by a contextually salient method of identification; otherwise, if she could,

---

[12]Technically, epistemic partial variation effects obtain as what we call a pragmatic entailment, $\models_P$. As reported in the Appendix, pragmatic entailment is defined in terms of a universal quantification over states in which all relevant sentences are felicitous (cf. von Fintel's (1999) notion of a Strawson entailment). Epistemic pragmatic effects are then predicted to be more similar to presupposition than to implicatures, for example, they are not cancelable since a failure to satisfy the necessary weakening condition would result in infelicity. Epistemic pragmatic effects, however, are different from presupposition because, for example, they do not project under negation. The latter fact is derived in this framework as explained in the following paragraph.

the cc-shift triggered by the indefinite would have been unjustified:

(49)   Ich ging da   allein ins   Kino,   *irgendein*   amerikanischer
         I   went then alone to-the cinema, IRGEND-one American
         Gagfilm,   'Beverly Hills Cop' oder so   was.
         comedy-movie, 'Beverly Hills Cop' or   the like.
         'This time I went to the cinema alone, some American comedy, 'Beverly
         Hills Cop' or the like.'

Intuitively, a cc-shift can be justified only when a question of identification is at issue. For example, sentence (48) raises the issue of which professor the speaker has to meet. In (49), the issue raised is of which movie the speaker saw. In NPu uses of *irgend*-indefinites such as (50) no question of identification is raised. cc-shift can indeed be proven to be vacuous in negative environments (see Aloni and Port, 2011, for details). These uses must then be explained via DW in this framework. Building on Kadmon and Landman (1993), we assume that DW is justified only if it does not create a weaker statement (*non-weakening condition*). If the indefinite occurs in a downward entailing context, DW creates a stronger statement, and, therefore, can be justified. This explains the NPu uses of *irgend*-indefinites, as in (50) (by $\exists y_{DW}$ we denote an existential triggering DW).[13]

(50)   a.   Nobody called irgend-someone.   [**NPu**]
         b. $\#\neg\exists x \exists y_m^{CC} \phi$ [cc-shift unjustified]
         c. $\neg\exists x \exists y_{DW} \phi$ [DW justified]
         d.   Predicted meaning: 'Nobody called anybody'

We turn now to the two modal uses for *irgend*-indefinites; namely epiU and deoFC (see examples (32) and (35) respectively). One of the most striking aspects of the data discussed in this article is the distance between these two modal uses. As illustrated in (38), epiU and deoFC are not contiguous on the implicational map which emerged after crosslinguistic comparison. Taking the map as our guide, we propose a uniform analysis of the contiguous spU and epiU uses in terms of cc-shift, but derive deoFC uses in terms of DW. Since free choice uses presuppose the same mechanism which generates negative polarity uses (DW) we will predict, in accordance with our map, that, whenever a deoFC use is possible for an EI, an NPu use is also allowed. Let us have a closer look.

Marked indefinites, notably *irgend*-indefinites, but also Romanian *vreun* (see Fălăuş, 2009), appear to display different behaviours under epistemic and deontic modals. Crucial for our account of these facts is the analysis we endorse for epistemic and deontic modality. As in standard dynamic accounts (Veltman, 1996), epistemic modals are analyzed here as non-eliminative updates which test whether the currently accumulated information *supports* or is compatible with some piece of further information. In contrast, deontic modal statements that

---

[13]This explanation extends also to the CO uses, assuming any analysis of comparatives which places a scoping downward entailing operator within the comparative clause (e.g., Seuren, 1978; Heim, 2006; Gajewski, 2008; Beck, 2010).

provide directly useful information about practically relevant permissions and obligations are treated as being base-level informative, on a par with propositional information. Being defined in terms of support, which is a CC-sensitive notion (see footnote 11), epistemic necessity modals license CC-shift in their scope. In contrast, deontic modals are defined in terms of classical truth, which is not a CC-sensitive notion, and, therefore, CC-shifts are trivialized in their scope. Intuitively, the use of an indefinite can indeed raise an issue of identification under the former, but not under the latter. Compare the dialogues in (51) and (52), for which the continuation 'One with a lot of money' is added to force a scopally non-specific interpretation for the indefinite:

(51)   a.   John must have married a Norwegian. One with a lot of money.
        b.   Who?
        c.   We still don't know.

(52)   a.   To be eligible for Norwegian citizenship, John must be married to a Norwegian. One with a lot of money.
        b.   #Who?

While asking 'who?' can make sense after (51-a), it doesn't after (52-a). Intuitively, the reason behind this contrast seems to be the following: while we can infer from (51-a) that there exists a Norwegian that John must have married, and therefore a question of identification can arise, no such question can arise after (52-a) because no conclusions about a specific Norwegian can be drawn.

Since shifts of a method of identification are not trivial and can therefore be justified under epistemic modals, cover-dependent partial variation effects in epiU uses of *irgend*-indefinites can be explained by CC-shift in a fashion similar to the specific unknown cases discussed above (see Aloni and Port, 2011, for details). One can felicitously utter sentences like (53-a) only if one is unable to identify the referent of the indefinite by the contextually relevant method of identification; otherwise, the CC-shift triggered by the EI would have been unjustified:

(53)   a.   Maria must have married irgend-one$_m$ doctor   [**epiU**]
              $\Rightarrow$ speaker doesn't know who$_n$
        b. $\Box_e \exists x_m^{\mathrm{CC}} \phi \models_P \neg \exists y_n \Box_e \phi$
        c. $n \mapsto$ cover at play in context
        d. $m \mapsto$ cover used to identify referent of EI
        e.   CC-shift $\mapsto m \neq n$

Deontic free choice uses of *irgend*-indefinites, instead, constitute a potential problem for this approach. Under the assumed analysis of deontic modals, neither CC-shift nor DW is justified. The latter fact is shown in (54-a): extending the domain of an existential under a modal leads to a weaker statement, and so the non-weakening condition cannot be satisfied. Therefore, Aloni and Port's (2011) analysis wrongly predicts that *irgend*-indefinites are infelicitous under deontic modals. There are various strategies one can pursue to solve this

problem. Ignorance uses of *irgend*-indefinites have been explained in terms of CC-shifts. One could try to account for their free choice use also in terms of (a modified version of) such shift. Our map in (38), however, implies that an EI displays deoFC uses only if it also has NPu uses, and therefore strongly suggests that free choice uses should rather be explained in terms of DW. Aloni (2012) proposes a solution in this direction, which we are only going to sketch here.

As we illustrated in example (1), existentials give rise to free choice (FC) inferences in deontic contexts, but this inference is normally defeasible. Aloni (2012) proposes that, in the case of *irgend*-indefinites, we obligatorily uptake this implicature in order to satisfy the requirements of DW (its non-weakening condition). As illustrated in (54), once FC-inferences are adopted, DW no longer leads to a weaker statement in a modal context:

(54)   a. $\Box_d \exists x \phi \models \Box_d \exists x_{DW} \phi$ without FC-inference
       b. $\Box_d \exists x \phi \land \forall x \Diamond_d \phi \not\models \Box_d \exists x_{DW} \phi \land \forall x_{DW} \Diamond_d \phi$ with FC-inference

We have then explained (i) why *irgend*-indefinites are felicitous in deontic contexts and (ii) why the FC-implicature cannot be canceled there: the requirements of DW can be satisfied in these contexts only after adopting the FC-inference. Cancellation of the latter would lead to infelicity, since, without FC-inference the non-weakening condition cannot be satisfied (by $+I$ we denote the operation of implicature incorporation as defined in Aloni (2012), see Appendix for details):

(55)   Mary musste irgendeinen Mann heiraten   [**deoFC**]
       Mary had-to IRGEND-one man   marry
       'Mary had to marry a man.' (Any man was a permitted marriage option for her.)
       a. $\#\Box_d \exists x_n^{CC} \phi / \Box_d \exists x_{DW} \phi$ [neither CC-shift nor DW can apply]
       b. $\Box_d \exists x_{DW} \phi \ +I$ [with incorporation, FC-inference DW can apply]

Crucially, the straightforward method of implicature incorporation, defined in Aloni (2012) via the $+I$ operation, works for deontic free choice implicatures, but not for epistemic ones. The reason is that the operation $+I$, defined in terms of state intersection, can only incorporate persistent inferences; i.e., inferences that can survive information growth, and, while deontic free choice inferences are persistent (e.g., if you have been granted the permission to kiss any girl, gaining new information will not change this fact), epistemic free choice inferences are not (e.g., after discovering who is the culprit, one stops believing that anyone might be responsible). The intuition behind this analysis is that, while implicatures can be non-persistent, the incorporation of implicatures into the process of interpretation should never lead to a loss of information. On a Gricean view, interpretation is an information-accumulation process, the incorporation of non-persistent information would be an irrational move on this view (see Aloni and Franke, 2013, for more motivation). The non-persistent nature of epistemic free choice inferences prevents the possibility of their incorporation in order to rescue DW uses of *irgend*-indefinites as was done for the deontic case in (55-b). But then, since DW cannot apply, CC-shift must apply under epis-

temic modals and a cover-dependent partial variation effect is generated, as was illustrated in (53).

3 Conclusion

In the first part of the article, we presented the results of a corpus study on the German epistemic indefinites *irgendein* and *irgend jemand*. The main goal of the study was to verify the distribution of these items synchronically and compare it to that of other marked indefinites in other languages. The methodology used was a form of functional labeling which combines both context (syntax) and meaning (semantics). An extended version of Haspelmath's (1997) functional map was adopted for the identification of the relevant categories.

Four uses emerged for *irgend*-indefinites as a result of our corpus study: specific unknown uses, epistemic unknown uses, negative polarity uses and deontic free choice uses. In the second part, we sketch a formal account of these uses in the framework of a Dynamic Semantics with Conceptual Covers. Our point of departure was the assumption that epistemic indefinites are existentials with two additional characteristics: (i) they induce an obligatory domain shift, and (ii) they are felicitous only if such shift is for a reason. We proposed that *irgend*-indefinites can choose between two kinds of domain shifts: shift of a method of identification (CC-shift) or domain widening (DW). Ignorance uses of *irgendein* (specific or under epistemic modals) were explained by CC-shift, and occurrences in downward entailing environments were explained by DW. Deontic free choice uses were explained in terms of obligatory pragmatic enrichments triggered by DW under certain circumstances. The proposed analysis predicts the generalization expressed in the implicational map (38), which emerged after cross-linguistic comparison. On this account, free choice uses presuppose the same mechanism which generates negative polarity uses; namely, DW. As a result, whenever a deoFC use is possible for an EI, we predict that NPu uses are also allowed.

Appendix Let $\mathcal{L}$ be a predicate logical *language* with CC-indexed variables x_n, y_m, ..., and two modal operators, epistemic $\square_e$ and deontic $\square_d$. A *model M* for $\mathcal{L}$ is a quadruple $\langle W, D, R, C \rangle$ where W is a set of interpretation functions for the non-logical constants in $\mathcal{L}$, 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 $\mathcal{L}$, and $\mathcal{V}$ be the set of variables in $\mathcal{L}$. The set Σ_M of *information states* based on M is defined as: $\Sigma_M = \bigcup_{X \subseteq \mathcal{V}} \mathcal{P}((D^W)^X \times W)$. Let $i = \langle g, w \rangle$ be a possibility in a state $\sigma \in \Sigma_M$, 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

$$\sigma[Rt_1, ..., t_n]^{\wp} \sigma' \quad \text{iff} \quad \sigma' = \{i \in \sigma \mid \langle i(t_1), ..., i(t_n) \rangle \in i(R)\}$$

$$\sigma[\neg\phi]^{\wp} \sigma' \quad \text{iff} \quad \sigma' = \{i \in \sigma \mid \neg\exists\sigma'' : \sigma[\phi]^{\wp}\sigma'' \ \& \ i \prec \sigma''\}$$

$$\sigma[\phi \wedge \psi]^{\wp} \sigma' \quad \text{iff} \quad \exists\sigma'' : \sigma[\phi]^{\wp}\sigma''[\psi]^{\wp}\sigma'$$

$$\sigma[\exists x_n \phi]^\wp \sigma' \quad \text{iff} \quad \sigma[x_n/c][\phi]^\wp \sigma' \text{ for some } c \in \wp(n)$$
$$\sigma[\Box_e \phi]^\wp \sigma' \quad \text{iff} \quad \sigma' = \{i \in \sigma \mid \sigma \models^\wp \phi\}$$
$$\sigma[\Box_d \phi]^\wp \sigma' \quad \text{iff} \quad \sigma' = \{i \in \sigma \mid \{\langle g_i, v\rangle \mid w_i R v\} \vdash^\wp \phi\}$$
$$\sigma[\phi + I]^\wp \sigma' \quad \text{iff} \quad \exists \sigma'' : \sigma[\phi]^\wp \sigma'' \ \& \ \sigma' = \sigma'' + opt(\phi)$$

Auxiliary notions

$$\sigma[x_n/c] \quad = \quad \{i[x/c] \mid i \in \sigma\}$$
$$i[x/c] \quad = \quad \langle g_i \cup \{\langle x, c\rangle\}, w_i\rangle \quad (\text{if } x \notin dom(g), \text{undefined otherwise})$$
$$i \prec \sigma \quad \text{iff} \quad \exists j \in \sigma : w_i = w_j \ \& \ g_i \subseteq g_j$$

$Support:$
$$\sigma \models^\wp \phi \quad \text{iff} \quad \exists \sigma' : \sigma[\phi]^\wp \sigma' \ \& \ \forall i \in \sigma : i \prec \sigma'$$
$$\sigma \models^\wp_P \phi \quad \text{iff} \quad \sigma \models^\wp \phi \ \& \ \phi \text{ felicitous in } \sigma$$

$Truth:$
$$\sigma \vdash^\wp \phi \quad \text{iff} \quad \forall i \in \sigma : \exists \sigma' : \sigma[\phi]^\wp \sigma' \ \& \ i \prec \sigma'$$
$$\phi \models \psi \quad \text{iff} \quad \forall \sigma, \wp : \sigma \models^\wp \phi \Rightarrow \sigma \models^\wp \psi$$

$P\text{-}Entailment:$
$$\phi \models_P \psi \quad \text{iff} \quad \forall \sigma, \wp : \phi \ \& \ \psi \text{ felicitous in } \sigma : \sigma \models^\wp \phi \Rightarrow \sigma \models^\wp \psi$$
$$\sigma + \tau \quad = \quad \{i \in \sigma \mid \exists j \in \tau : w_i = w_j\}$$

By $opt(\phi)$ we mean the set of optimal states for ϕ as defined in Aloni (2007a). The implicatures of an utterance of φ are defined as what is supported by any state in $opt(\phi)$. Implicature incorporation, $+I$, is then straightforwardly defined as simply adding the information that is contained in *all* the optimal states in $opt(\varphi)$ after updating with φ.

References

Aguilar-Guevara, A., Aloni, M., Port, A., Šimík, R., de Vos, M., and Zeijlstra, H. (2011). Semantics and pragmatics of indefinites: methodology for a synchronic and diachronic corpus study. In *Proceedings of the DGfS Workshop "Beyond Semantics: corpus-based investigations of pragmatic and discourse phenomena"*. BLA.

Aguilar-Guevara, A., Aloni, M., de Jager, T., Port, A., Šimík, R., Solt, S., and de Vos, M. (2012). A corpus of indefinite uses annotated with semantic functions: A corpus of inde nite uses annotated with semantic functions: Documentation. Technical report, University of Amsterdam.

Aloni, M. (2001). *Quantification under Conceptual Covers*. Ph.D. thesis, University of Amsterdam.

Aloni, M. (2007a). Expressing ignorance or indifference. Modal implicatures in BiOT. In B. ten Cate and H. Zeevat, editors, *Proceedings of the Sixth International Tbilisi Symposium on Language, Logic and Computation*, pages 1–20.

Aloni, M. (2007b). Free choice, modals and imperatives. *Natural Language Semantics*, **15**, 65–94.

Aloni, M. (2012). On epistemic indefinites: a note on emphatic free choice uses. In *Proceedings of Sinn und Bedeutung 16*.

Aloni, M. and Franke, M. (2013). On the free choice potential of epistemic and deontic modals. In I. Caponigro and C. Cecchetto, editors, *From Grammar to Meaning: The spontaneous logicality of language*. Cambridge University Press.

Aloni, M. and Port, A. (2011). Epistemic indefinites crosslinguistically. In *Proceedings of NELS 41*.

Aloni, M. and van Rooij, R. (2007). Free choice items and alternatives. In G. Bouma, I. Kraemer, and J. Zwarts, editors, *Proceeding of the KNAW Academy Colloquium: Cognitive Foundations of Interpretaion*, pages 5–26. Edita KNAW.

Aloni, M., van Cranenburgh, A., Fernandez, R., and Sznajder, M. (2012). Building a corpus of indefinite uses annotated with fine-grained semantic functions. In *Proceedings of LREC*.

Alonso-Ovalle, L. and Menéndez-Benito, P. (2010). Modal indefinites. *Natural Language Semantics*, **18**, 1–31.

Beck, S. (2010). Quantifiers in than-clauses. *Semantics and Pragmatics*, **3**, 1–72.

Chierchia, G. (2010). Meaning as an Inferential System: Polarity and Free Choice Phenomena. Draft.

Dayal, V. (1998). *Any* as inherently modal. *Linguistics and Philosophy*, **21**, 433–476.

Fălăuş, A. (2009). *Polarity items and dependent indefinites in Romanian*. Ph.D. thesis, University of Nantes.

Gajewski, J. (2008). More on quantifiers in comparative clauses. In T. Friedman and S. Ito, editors, *Proceedings of Semantics and Linguistic Theory XVIII*, pages 340–357.

Giannakidou, A. (2001). The meaning of free choice. *Linguistics and Philosophy*, **24**, 659–735.

Giannakidou, A. and Quer, J. (2011). Against universal free choice: free choice and referentially vague indefinites in Greek, Catalan, and Spanish. ms.

Haspelmath, M. (1997). *Indefinite pronouns*. Oxford University Press, Oxford.

Heim, I. (2006). Remarks on comparative clauses as generalized quantifiers. ms.

Horn, L. R. (2005). Airport '68 revisited: Toward a unified indefinite any. In G. N. Carlson and F. J. Pelletier, editors, *The Partee effect*, pages 179–205. CSLI, Stanford.

Jayez, J. and Tovena, L. (2006). Epistemic determiners. *Journal of Semantics*, **23**, 217–250.

Kadmon, N. and Landman, F. (1993). Any. *Linguistics and Philosophy*, **16**, 353–422.

Kratzer, A. and Shimoyama, J. (2002). Indeterminate pronouns: The view from Japanese. In Y. Otsu, editor, *The proceedings of the Third Tokyo Conference on Psycholinguistics*, pages 1–25, Tokyo. Hituzi Syobo.

Lauer, S. (2010). Some news on *irgendein* and *algún*. Talk given at the workshop 'Epistemic Indefinites', University of Goettingen.

Menéndez-Benito, P. (2005). *The grammar of choice*. Ph.D. thesis, University of Massachusetts, Amherst.

Seuren, P. (1978). The structure and selection of positive and negative gradable adjectives. In *Papers from the Parasession on the Lexicon*. Chicago Linguistic Society.

Veltman, F. (1996). Defaults in Update Semantics. *Journal of Philosophical Logic*, **25**, 221–261.

Zamparelli, R. (2007). On singular existential quantifiers in Italian. In I. Comorovski and K. von Heusinger, editors, *Existence: Semantics and Syntax*, pages 293–328. Springer.