A continuations-based approach to weak definites

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Abstract

Since their adaptation from a tool of computer science to one of linguistics, continuations have been applied to a wide variety of natural language phenomena. Here we expand upon these efforts to give an account of the class of phrases known as "weak definites:" nominals that appear with a definite article but do not set up an individual discourse referent. We draw upon Aguilar-Guevara and Zwarts' formalization of weak definites (2010) as reference to kinds to develop two operators that can be applied within the continuation-based grammar presented by Barker & Shan (2013) to produce weak readings.

1 Introduction

Weak definites have a number of interesting semantic properties. Although they are used in a similiar way to common definite phrases, they don't behave As such. Unlike common definites, weak definites: lack uniqueness; do not set up discourse referents; must occur in object position; display enriched meanings through stereotypical usage; are blocked by modification; have sloppy readings in VP ellipsis; and always take narrowest scope. Here we develop two operators, ω and DE-STRENGTHEN, that combine with Aguilar-Guevara & Zwarts' (2010) *realization relation* and *stereotypical usage predicate* within Barker & Shan's (2013) tower notation to produce correct readings for weak definites.

2 Properties of Weak Definites

2.1 Weak definites lack uniqueness

The definite article typically denotes that the nominal that appears with it is unique. However, weak definites don't appear to do this. Weak definites allow discourses like:

(1) "John is reading the newspaper."
"Which one?"
"I don't know."

Strong definites, on the other hand, do not allow such discourses:

(2) "John is reading the book."
"Which one?"
? "I don't know."

2.2 Weak definites do not establish discourse referents

Weak definites cannot be antecedents to anaphora. In (3), a weak reading is available. However, in (4), the phrase "the post office" binds a pronoun, blocking the weak reading.

(3) "Mary went to the post office."

(4) "Mary went to the post office. ?It was closed."

2.3 Weak definites must occur in object position

A definite phrase that allows for weak readings becomes a generic when it is in subject position. Generics share some of the properties of weak definites, namely they have a same abstract quality, e.g. (5). Generics display several differences from weak definites, though.

(5) "The hospital is a medical institution."

(6) "The unicorn is a magical, space-dwelling creature. It is a close relative of the narwhal."

"The unicorn" is not open to weak readings in object position, but in subject position, as in (6), it behaves as a generic. Furthermore, it binds a pronoun later in the utterance without the reading being altered. Finally, although a weak definite becomes a generic when put in subject position, the reverse does not occur. "The narwhal" is not open to weak readings, but it behaves as a generic in object position.

2.4 Weak definites have stereotypical usages

For a weak reading to be accessible, the verb of the sentence must denote an event that is stereotypical for the object.

(7) "John is reading the newspaper."

(8) "John is wearing #the newspaper."

In (7), "reading" is an event that is stereotypical for newspapers. "Wearing," on the other hand, is not stereotypical for newspapers, and so the weak reading is blocked. A related property is that weak definites are lexically restricted; that is, most nominals do not have any stereotypical events associated with them, so weak readings are never accessible.

2.5 Weak readings are blocked by modification

Modified definite phrases don't have stereotypical meaning enrichment.

(9) "Mary went to the store."

(10) "Mary went to #the glowing store."

Although "the store" has has stereotypical events assciated with it (shopping), "the glowing store" does not; it is too narrow a class to have stereotypical events. If the weak definite is modified in such a way that it yields a *subclass*, e.g. (11), a set of stereotypical events, albeit a smaller one (shopping *for candy*), remains associated with it.

(11) "Mary went to the candy store."

3 Aguilar-Guevara & Zwarts' Account

Several theories of weak definites have been developed. Here we will focus on that of Aguilar-Guevara & Zwarts (2010). They propose that weak definites are able to contain definite articles without denoting unique individuals because they instead denote instantiations of unique *kinds*, which have taxonomic rather than object-level denotations. Aguilar-Guevara & Zwarts propose two structures to account for the unique properties of weak definites: the *realization relation* and the *stereotypical usage predicate*.

3.1 The realization relation R

Aguilar-Guevara & Zwarts formalize this relationship between individuals (objects) and kinds (taxonomic nouns) with the 2-place *realization relation*

$$R(x_i, y_k)$$

The relation R asserts that x_i is a realization of the kind y_k. R evaluates to `true` if the noun given as y_k refers to a kind. Otherwise, R evaluates to `false`, blocking a weak reading.

3.1.1 Strong vs. weak definites with R

Strong definites [1] can be characterized as unique realizations of kinds:

$$\exists! x_i(R(x_i, y_k))$$

Weak definties lack the uniqueness denoted by the "!" above, but simply removing it gives an indefinite reading, not a weak definite reading. Furthermore, $\exists$ establishes a discourse referent and can take wide scope, neither of which can weak definites do. To avoid these problems, we must replace $\exists$ with another operator. A temping choice for such an operator is ι; however, ι denotes uniqueness. Therefore we introduce a new operator, ω, which denotes an abstract entity:

$$\omega x_i(R(x_i, y_k))$$

This reads "the abstract x which is such that it has the property of being a realization of the kind y_k." ω combines the entity denotation of ι with the abstraction of λ. Note that the strong definite denotation returns type `t`, while the weak definite denotation returns type `e`. This has desirable consequences with regard to continuations, which we will expand upon in §4.

[1] When we discuss "strong" definites here, we are talking about kind-referring nouns whose semantics resemble those of common definite phrases. Common definite phrases that are never kind-referring will always cause R to evaluate to `false` and so are not relevant to the discussion here.

3.2 The stereotypical usage predicate U

The realization relation alone is not sufficient to produce a weak reading. In addition, it must be established that the kind being realized is being used in a stereotypical manner and therefore displays meaning enrichment. To achieve this, Aguilar-Guevava & Zwarts add to the semantics the 2-place stereotypical usage predicate:

$$U(e, y_k)$$

The predicate U asserts that event there is a stereotypical relationship between the event e and the kind y_k. The stereotypical usage predicate is the mechanism that distinguishes weak from strong definites. If e is not in the set of stereotypical usages of y_k, U evaluates to false, blocking a weak reading. this will occur if a non-stereotypical verb appears with the definite phrase, e.g. (8). It can also occur if a non-stereotypical preposition appears with the definite phrase:

(12) "Mary is going to the store."

(13) "Mary is going around #the store."

The other condition that will cause U to evaluate to false is if y_k has no stereotypical usages. This usually occurs when the y_k is too narrow a kind to have stereotypical usages, e.g. through modification. U will also evaluate to `false` if the noun in the y_k position is not kind-referring. For strong readings, R will evaluate to `false` in such a case, blocking the reading. However, for a weak reading, R is embedded in the ω expression, and a `false` evaluation would render ω `undefined`. It is therefore useful for U to also evaluate to `false` so that the weak reading is correctly blocked.

3.3 An example of a strong and a weak reading

The sentence"John went to the beach" can have both a strong and a weak reading. Using the realization relation introduced earlier, the strong reading can be represented by:

(14) $\exists! x_i(R(x_i,\text{beach}_k)\wedge(\text{go\_to } x_i \text{ john}))$

In this reading, there is a unique realization of the *beach* kind beach that John went to. The weak reading is represented by:

(15) & (go_to $\omega x_i(R(x_i, \text{beach}_k))$ john) (U(go_to, beach$_k$))

In the weak reading, there is not a unique realization of the *beach* kind, but rather an abstract realization. There is also the assertion that *going to* is stereotypical of beaches. This assertion is true, so the weak reading is available.

4 Continuations

4.1 Deriving a strong reading

The tower notation for a sentence with a common definite phrase would typically look like this:

$$\frac{\frac{s \mid s}{np}}{\begin{array}{c}\text{Mary}\\ \frac{[\,]}{\text{mary}}\end{array}} \left(\begin{array}{cc} \frac{s \mid s}{(np\backslash s)/np} & \frac{s \mid s}{np} \\ \begin{array}{c}\text{is listening to}\\ \frac{[\,]}{\text{listen\_to}}\end{array} & \begin{array}{c}\text{the radio}\\ \frac{\exists!x((\text{radio } x)\wedge[\,])}{x}\end{array} \end{array} \right)$$

But because strong definites here are unique instances of kinds, we alter the semantics of the definite phrase to the realization relation:

$$\frac{\frac{s \mid s}{np}}{\begin{array}{c}\text{Mary}\\ \frac{[\,]}{\text{mary}}\end{array}} \left(\begin{array}{cc} \frac{s \mid s}{(np\backslash s)/np} & \frac{s \mid s}{np} \\ \begin{array}{c}\text{is listening to}\\ \frac{[\,]}{\text{listen\_to}}\end{array} & \begin{array}{c}\text{the radio}\\ \frac{\exists!x_i(R(x_i,\text{radio}_k)\wedge[\,])}{x_i}\end{array} \end{array} \right)$$

MERGEing and LOWERing in the usual fashion produces the strong reading:

(16) $\exists!x_i(R(x_i,\text{radio}_k)\wedge(\text{listen\_to } x_i \text{ mary}))$

4.2 Deriving a weak reading

Recall that to achieve a weak reading, we replace existential quantification with the ω-operator:

$$\exists!x_i(R(x_i, y_k)) \implies \omega x_i(R(x_i, y_k))$$

The semantics of "the radio" no longer has a scope-taking element, and the realization relation is now contained in the denotation of the entity x_i, so the tower notation becomes:

$$\frac{\frac{s \mid s}{np}}{\begin{array}{c}\text{Mary}\\ \frac{[\,]}{\text{mary}}\end{array}} \left(\begin{array}{cc} \frac{s \mid s}{(np\backslash s)/np} & \frac{s \mid s}{np} \\ \begin{array}{c}\text{is listening to}\\ \frac{[\,]}{\text{listen\_to}}\end{array} & \begin{array}{c}\text{the radio}\\ \frac{[\,]}{\omega x_i(R(x_i,\text{radio}_k))}\end{array} \end{array} \right)$$

The semantics of weak definites also must include the stereotypical usage predicate $U(e, y_k)$. To introduce this predicate into the tower notation, we apply a 2-step DE-STRENGTHEN operator.

4.2.1 Applying the de-strengthen operator

Step 1: λ-abstract the terms in the predicate:

$$\frac{\frac{s \mid s}{np}}{\begin{array}{c}\text{Mary}\\ \frac{[\,]}{\text{mary}}\end{array}} \left(\begin{array}{cc} \frac{s \mid s}{(np\backslash s)/np} & \frac{s \mid s}{np} \\ \begin{array}{c}\text{is listening to}\\ \frac{\lambda e([\,])\ \text{listen\_to}}{e}\end{array} & \begin{array}{c}\text{the radio}\\ \frac{\lambda y_k([\,])\ \text{radio}_k}{\omega x_i(R(x_i, y_k))}\end{array} \end{array} \right)$$

This λ-abstraction will allow the stereotypical usage predicate to access the event and kind variables.

Step 2: Add the stereotypical usage predicate as a sentence-like gap. To connect it to the rest of the sentence, we must add with it a conjunction-like gap:

$$\left(\begin{array}{c} \frac{s \mid s}{np} \\ \text{Mary} \\ \frac{[\,]}{\text{mary}} \end{array} \quad \left(\begin{array}{c} \frac{s \mid s}{(np\backslash s)/np} \quad \frac{s \mid s}{np} \\ \text{is listening to} \quad \text{the radio} \\ \frac{\lambda e([\,])\ \text{listen\_to}}{e} \quad \frac{\lambda y_k([\,])\ \text{radio}_k}{\omega x_i(R(x_i, y_k))} \end{array}\right)\right) \left(\begin{array}{c} \frac{s \mid s}{(s\backslash s)/s} \quad \frac{s \mid s}{s} \\ \_ \quad \_ \\ \frac{[\,]}{\&} \quad \frac{[\,]}{U(e, y_k)} \end{array}\right)$$

This yields the weak reading:

$$\&(\text{listen\_to}\ \omega x_i(R(x_i, \text{radio}_k))\ \text{mary})(U(\text{listen\_to,radio}_k))$$

5 Some Examples

To test whether the ω and DE-STRENGTHEN operators always produce the desired weak readings, we will apply them to sentences with VP ellipsis and scope-taking quantifiers. Weak definites behave differently in these kinds of sentences than do strong definites.

5.1 Sloppy readings in VP ellipsis

We will derive a strong and a weak reading for the VP ellipsis:

(17) John went to the beach and Mary did, too.

Weak definites display sloppy readings in VP ellipsis. Strong definites take wide scope, resulting in Mary and John going to the same unique beach. Weak definites, on the other hand, always take narrow scope, allowing Mary and John to go to different instances of the *beach* kind. First, we derive the strong reading:

$$\left(\begin{array}{c} \frac{s \mid s}{np} \\ \text{John} \\ \frac{[\,]}{\text{john}} \end{array} \quad \left(\begin{array}{c} \frac{s \mid (np\backslash s) \rhd s}{np\backslash s} \\ \text{went to the beach} \\ \frac{\exists! x_i(R(x_i,\text{beach}_k)\wedge[\,]\ (\text{go\_to}\ x_i))}{\text{go\_to}\ x_i} \end{array}\right)\right) \left(\begin{array}{c} \frac{(np\backslash s) \rhd s \mid (np\backslash s) \rhd s}{(s\backslash s)/s} \\ \text{and} \\ \frac{[\,]}{\&} \end{array} \quad \left(\begin{array}{c} \frac{(np\backslash s) \rhd s \mid (np\backslash s) \rhd s}{np} \quad \frac{(np\backslash s) \rhd s \mid s}{np\backslash s} \\ \text{Mary} \quad \text{did \_, too} \\ \frac{[\,]}{\text{mary}} \quad \frac{\lambda Q([\,])}{Q} \end{array}\right)\right)$$

$$\exists! x_i(R(x_i, \text{beach}_k) \wedge \lambda Q(\&(\text{go\_to}\ x_i\ \text{john})(Q\ \text{mary}))(\text{go\_to}\ x_i))$$

$$\rightsquigarrow \beta$$

$$\exists! x_i(R(x_i, \text{beach}_k) \wedge (\&(\text{go\_to}\ x_i\ \text{john})(\text{go\_to}\ x_i\ \text{mary})))$$

Next, we derive the weak reading by using ω and DE-STRENGTHEN. Here, VP is used as a shorthand for $(\lambda e(\lambda y_k([\,]\ (e\ \omega x_i(R(x_i, y_k))))\ \text{beach}_k)\ \text{go\_to})$, and $\rhd$ is used as a shorthand for $((np\backslash s) \rhd s)$:

$$\left(\left(\begin{array}{c} \frac{s \mid s}{np} \\ \text{John} \\ \frac{[\,]}{\text{john}} \end{array} \quad \left(\begin{array}{c} \frac{s \mid \rhd}{np\backslash s} \\ \text{went to the beach} \\ \text{VP} \\ \frac{e\ \omega x_i(R(x_i, y_k))}{} \end{array}\right)\right) \left(\begin{array}{c} \frac{\rhd \mid \rhd}{(s\backslash s)/s} \\ \text{and} \\ \frac{[\,]}{\&} \end{array} \quad \left(\begin{array}{c} \frac{\rhd \mid \rhd}{np} \quad \frac{\rhd \mid s}{np\backslash s} \\ \text{Mary} \quad \text{did \_, too} \\ \frac{[\,]}{\text{mary}} \quad \frac{\lambda Q([\,])}{Q} \end{array}\right)\right)\right) \left(\begin{array}{c} \frac{s \mid s}{(s\backslash s)/s} \quad \frac{s \mid s}{s} \\ \_ \quad \_ \\ \frac{[\,]}{\&} \quad \frac{[\,]}{U(e, y_k)} \end{array}\right)$$

$$\lambda e(\lambda y_k(\&(\lambda Q(\&(e\ \omega x_i(R(x_i, y_k))\ \text{john})(Q\ \text{mary}))\ (e\ \omega x_i(R(x_i, y_k)))))(U(e, y_k))\ \text{beach}_k)\ \text{go\_to}$$

$\rightsquigarrow \beta$

$$\&(\&(\text{go\_to}\ \omega x_i(R(x_i, \text{beach}_k))\ \text{john})(\text{go\_to}\ \omega x_i(R(x_i, \text{beach}_k))\ \text{mary})))(U(\text{go\_to},\ \text{beach}_k))$$

In this reading, unlike in the strong one, Mary and John are going to independent abstract instances of the *beach* kind. This is the sloppy reading we expect for weak definites.

5.2 Narrow scope interpretations

Next, we will derive a strong and a weak reading for a sentence with a universal quantifier:

(18) Everyone went to the cinema.

In the strong reading, the definite phrase has an existential quantifier which takes wide scope, yielding a reading in which "everyone" went to the same unique instance of the *cinema* kind:

$$\begin{array}{c} \dfrac{\dfrac{s \mid s}{s \mid s}}{np} \\ \text{Everyone} \\ \dfrac{[\,]}{\dfrac{\forall z([\,])}{z}} \end{array} \left(\begin{array}{c} \dfrac{\dfrac{s \mid s}{s \mid s}}{(np\backslash s)/np} \\ \text{went to} \\ \dfrac{[\,]}{\dfrac{[\,]}{\text{go\_to}}} \end{array} \quad \begin{array}{c} \dfrac{s \mid s}{s \mid s} \\ np \\ \text{the cinema} \\ \dfrac{\exists!x_i(R(x_i,\text{cinema}_k)\wedge[\,])}{\dfrac{[\,]}{x_i}} \end{array} \right)$$

$$\exists!x_i(R(x_i, \text{cinema}_k) \wedge \forall z(\text{go\_to}\ x_i\ z))$$

Because weak definites take narrow scope, we expect to see an effect similar to that in §5.1—that is, "everyone" is able to go to an independent instance of the *cinema* kind:

$$\left(\begin{array}{c} \dfrac{s \mid s}{np} \\ \text{Everyone} \\ \forall z([\,]) \\ \hline z \end{array} \quad \left(\begin{array}{c} \dfrac{s \mid s}{(np\backslash s)/np} \\ \text{went to} \\ \lambda e([\,])\ \text{go\_to} \\ \hline e \end{array} \quad \begin{array}{c} \dfrac{s \mid s}{np} \\ \text{the cinema} \\ \lambda y_k([\,])\ \text{cinema}_k \\ \hline \omega x_i(R(x_i, y_k)) \end{array} \right) \right) \left(\begin{array}{c} \dfrac{s \mid s}{(s\backslash s)/s} \\ \_ \\ [\,] \\ \hline \& \end{array} \quad \begin{array}{c} \dfrac{s \mid s}{s} \\ \_ \\ [\,] \\ \hline U(e, y_k) \end{array} \right)$$

$$\&(\forall z(\text{go\_to}\ \omega x_i(R(x_i, y_k))\ \text{cinema}_k))(U(e, y_k))$$

6 Conclusions

Here we have demonstrated how to derive correct readings for weak definites within a continuations framework. Aguilar-Guevara & Zwarts' realization relation distonguishes kind-referring nouns from nouns with object denotations, accounting for the lexical restriction of weak definites. The ω and DE-STRENGTHEN operators further distinguish weak from strong readings for kind-referring nouns. ω enables the expression several of the properties of weak definites. It eliminates

the need for an existential quantifier, preventing the weak definite from establishing discourse referents. It allows x_i to remain abstract, accounting for weak definites' lack of uniqueness. It encapsulates the realization relation in the denotation of x_i, allowing the verb to operate directly on the abstract variable and forcing x_i to maintain narrowest scope. The remaining properties express themselves through U, appended to the tower representation with DE-STRENGTHEN. It blocks weak readings when the event in the sentence is non-stereotypical for the definite phrase, or when the definite phrase is modified in a manner that does not yield a subkind. Together, these elements allow for the derivation of correct readings for weak and strong definites.

7 References

References

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