Homogeneity effects in habituals and temporal adverbs

Omar Agha (NYU)

agha@nyu.edu

May 9th, 2021

SALT 31 @ Brown

1 Introduction

- Main Claim: Habitual meanings are derived by applying a predicate of times to a discontinuous plurality of time intervals.
  - Quantificational analysis: $\forall t[P(t) \to Q(t)]$
  - Plural analysis: $Q(\bigoplus P)$
- I present novel data that is inconsistent with a quantificational analysis.
- The plural analysis explains properties of habitual sentences that are otherwise mysterious.

1.1 Homogeneity effects

- Unquantified habituals like (1a) display **homogeneity effects** (Ferreira 2005).
- Under negation, habitual sentences have a strong, negative universal reading, unlike sentences with overt adverbial quantifiers

(1) a. Connie doesn't call her mother on Saturday, # only every other Saturday.

b. Connie doesn't **always** call her mother on Saturday, ✓ only every other Saturday.

c. Connie doesn't call her mother **every** Saturday, ✓ only every other Saturday.

- Parallel to plural definites:

(2) a. I didn't eat the cupcakes, # but I ate half of them.

b. I didn't eat **all** the cupcakes, ✓ but I ate half of them.

- The unquantified plural definite sentence in (2a) receives a negative universal reading, unlike (2b).

1.2 Exception tolerance: Non-maximality

- Unquantified habituals tolerate exceptions when those exceptions are not relevant to the purposes of the conversation.
- Consider sentence (3) in two different discourse contexts.

(3) Riley drinks coffee in the morning.

(4) Current Issue *favors* a non-maximal reading

Context: Riley drinks coffee only a few mornings a week, but never in the afternoon.

Current Issue: *Does Riley drink coffee in the afternoon?*

Riley drinks coffee in the morning.

- In context (4), it isn't relevant whether Riley drinks coffee every morning, only that when he drinks coffee, he doesn't do it in the afternoon.

(5) Current Issue *blocks* a non-maximal reading

Context: Riley drinks coffee only a few mornings a week, but never in the afternoon.

Current Issue: *Does Riley drink coffee every day?*

Riley drinks coffee in the morning.

- In context (5), it *does* matter whether Riley drinks coffee every morning, and the habitual sentence (3) no longer sounds appropriate.

- What's going on here?
- In context (4), a world where Riley drinks coffee three mornings a week is **equivalent** to a world where Riley drinks coffee every morning, as long as he doesn't drink coffee in the afternoon in either world.
- In context (4), the *three-mornings* worlds are no longer equivalent to the *every-morning* worlds because the Current Issue makes different distinctions.
- This is an instance of **non-maximality**. (Malamud 2012, Križ 2015)

1.3 Non-maximality and trivalence

- Here I follow Križ's three-valued semantics.
- Sentences can be true (1), false (0), or indeterminate ($\star$).
- Habitual sentences with exceptions are indeterminate.
- Indeterminate sentences are evaluated according to the principle of Sufficient Truth:

Sufficient Truth (semi-formal version) Križ (2016)

Let I stand for the Current Issue, a partition over possible worlds. We say that a sentence S is *true enough* at w relative to the Current Issue I as long as S is true at some world u such that u and w are in the same cell of I

- The Current Issue is like the Question Under Discussion, though Križ (2015) discusses some differences. For present purposes, I will treat CI and QUD as equivalent.
- Roadmap
  - In Section 2, I will discuss the differences between bare and quantified habituals.
  - In Section 3, I will discuss some parallels between habituals and plural definites.

  - In Section 4, I present the analysis of non-maximality in habituals.
  - In Section 5, I conclude.

- Appendices A-C contain a compositional grammar fragment that derives the trivalent sentence meanings required for the analysis in Section 4.
  - There are several ways to set this up.
  - Essential components: Trivalent type theory (Križ 2015: Ch. 2, Lepage 1992), and the usual mereology over times and individuals.

- Appendix D compares the present proposal to previous work.

2 Data: Bare and quantified habituals

- Habitual sentences can be divided into two broad classes: bare habituals like (6) and sentences involving adverbial quantifiers like (7).

(6) Semantics Group meets on Friday mornings. (bare habitual)

(7) Semantics Group meets on every Friday morning. (quantified habitual)

- The adverb *on Friday mornings* does not behave like a quantifier under negation.

(8) a. Semantics Group doesn't meet on Friday mornings.
$\rightarrow$ No SG meetings on *any Friday morning*

b. Semantics Group doesn't meets on every Friday morning.
$\rightarrow$ Not every Friday morning has an SG meeting. (Maybe SG meets every other Friday.)

- The contrast becomes even clearer when we consider the felicity of various followup sentences, as we saw in the introduction.

(9) a. # SG doesn't meet on Friday mornings, only every other Friday.

b. SG doesn't meet every Friday morning, only every other Friday.

- These facts are not specific to temporal adverbs like *on Friday mornings*.
- It turns out that nothing changes when we consider bare habituals with no temporal modifiers.

(10) a. #Anya doesn't swim, but she does sometimes.

b. Anya doesn't always swim, but she does sometimes.

(11) a. #Ben doesn't bite his fingernails, but he does sometimes.

b. Ben doesn't always bite his fingernails, but he does sometimes.

- Once these facts are considered together, we can safely separate out at least two kinds of temporal modifiers:
- Quantificational adverbs, which enter into scopal ambiguities with negation, non-quantificational adverbs, which merely restrict the time reference of the main clause.
- Henceforth, I use the term **bare habituals** to refer to both sentences with no temporal modifier and sentences with only non-quantificational modifiers, whereas **quantified habituals** only refers to sentences with quantificational adverbials.

3 Parallels: Non-maximality in plural definites and bare habituals

- As we saw in (1-2), bare habituals behave like plural definites under negation.
- Adding a quantifier like *always* removes homogeneity in habituals, parallel to adding *all* to a plural definite (Section 1).

- As we will see below, even through habituals and plural definites tolerate exceptions, it is infelicitous to mention those exceptions in an explicit followup without further elaboration (Section 3.1).
- When challenging an assertion with a non-maximal habitual or plural definite, it is preferable to respond with *well* rather than deny the assertion (Section 3.2).

3.1 Unmentionability of exceptions

- We have seen that habituals tolerate exceptions.
- However, even when exceptions are possible, it is infelicitious to mention them in a followup.

(12) *Unmentionability of exceptions in habituals*

a. # Ben doesn't bite his fingernails, he only does it once a month.

b. # Ben doesn't bite his fingernails, he only does it after stressful meetings.

- This is exactly parallel to the situation with plural definites.

(13) *Unmentionability of exceptions in plural definites* Kroch 1974: 191:(5a,7a)

a. # Although the men in this room are angry, one of them isn't.

b. # Although the Jones's horses died in the barn fire, some of them didn't.

- As we will see, the source of this restriction is that whether a habitual tolerates exceptions depends on the the relevance of those exceptions in the given context.

3.2 The *well*-test

- In contexts where a sentence *S* is true enough, it is not felicitous to deny *S*.

- To challenge the appropriateness of *S*, the preferred strategy is to respond with *well*, and follow it with a relevant true statement.

(14) *Context: Albert has a habit of running in the morning, especially when the weather is good. Today, he had an early meeting, so he didn't make it.*

A: When it's sunny, Albert runs in the morning.

B: Well, he didn't today.

B': ?? No, he didn't today.

- Note that the availability of a *well*-response is not sufficient to establish that the sentence being responded to is indeterminate.
- The *well*-response must be not only available, but preferred to a *no*-response.
- Plural definites behave the same way.

(15) <u>Current Issue:</u> Will we get cold?

Context: It's freezing outside, and there are five windows. If even one is open, we'll be cold. The speaker A sees one window open:

A: Oh no, the windows are open!

B: Well, only one is.

B': ?? No, only one is.

(16) <u>Current Issue:</u> Who passed?

Context: Students must read at least half the books on the reading list to pass. Morgan read most, but not all, of the reading list books, say 7/10.

A: Morgan read the books.

B: Well, they read most of them.

B': # No, they read most of them.

(17) *Context: Half of the professors smiled.* Križ 2015: 75:(14)

A: The professors smiled.

B: Well, half of them.

B': ?? No, half of them.

- While the *no*-responses in all these examples are dispreferred, they are not impossible.
- This variability in judgments results from subtle shifts in the Current Issue.
- I claim that in cases where *no*-responses are marginally acceptable, they act as a signal that speakers intend to make finer distinctions than are relevant to the Current Issue.
- Crucially, the present theory predicts that denials of S are only felicitous when the evaluation world w is equivalent to some $\neg S$-world, and is not equivalent to any S-world.

3.3 Examples of non-maximality in context

- Consider example (18).

(18) *Context: Annie and Connie are late to school almost every day, but Bonnie's attendance is generally good. Bonnie comes to school on time about on most days, but a few times a month she is late. Annie says to Connie:*

Annie: Bonnie comes to school on time. $[\star \rightsquigarrow 1]$

- The annotation $[\star \rightsquigarrow 1]$ indicates that the sentence is indeterminate, but true enough.
- Annie's assertion is perfectly natural.
- Intuitively, this is because the discourse participants' attendance is very bad, and they are comparing themselves to Bonnie, whose attendance is better.
- In this context, I assume that the Current Issue is (19).

(19) Whose attendance is generally good?
(Contains the alternative: Bonnie's attendance is generally good.)

- Further evidence: When we compare Connie's *well*-response to the denial in (20), the denial is degraded.

(20) *Context: Same as (18).*
Annie: Bonnie comes to school on time. [$\star \rightsquigarrow 1$]
Connie: Well, she does most of the time. [1]
Connie': ??No, but she does most of the time. [$\star \rightsquigarrow 0$]

- Now we impose a more stringent Current Issue, as in (21).
- In (21), all attendance is being logged on a regular basis.

(21) *Context: Stickers are being given out for perfect attendance. Bonnie comes to school on time on most days, but a few times a month she is late.*
Annie: Bonnie comes to school on time. [$\star \rightsquigarrow 0$]
Connie: No, but she does most of the time. [$\star \rightsquigarrow 1$]

- In this case, the Current Issue is (22).

(22) Who gets a sticker?
(Contains the alternative: Bonnie gets a sticker.)

- Relative to the Issue in (22), Connie's denial is true enough.
- The evaluation world (where Bonnie's attendance is imperfect) is a world where Bonnie does not get a sticker.

- In this sense, the evaluation world is equivalent to the worlds where Bonnie is never on time.
- Before moving to the formal details, we will consider a few more examples where two different Current Issues give rise to different acceptability judgments for the same sentence.

(23) *Context: The doctor is examining Ben, and sees that his fingernails look neat. The doctor doesn't want Ben to bite his fingernails because she finds that patients that bite their fingernails often end up damaging their cuticles. She knows that Ben occasionally bites his fingernails, about once a month after a stressful meeting. She writes in her notebook:*
Ben doesn't bite his fingernails. [$\star \rightsquigarrow 1$]

- In (23), the doctor's Current Issue is whether Ben has healthy habits. Excessive fingernail-biting will lead to damaged cuticles, but occasional fingernail-biting is not a medically-relevant problem.
- Even though the negated habitual (23) is semantically indeterminate in the provided context, it is true enough. Notice that the non-trivalent utterance with a negative quantifier in (24) is false in this circumstance.

(24) *Context: Same as (23).*
Ben never bites his fingernails. [0]

- Now, suppose we move to a context where even occasional fingernail-biting is a health hazard.
- During a pandemic, a person who bites their fingernails can be exposed even if they only do so once in a while.

(25) *Context: Ben occasionally bites his fingernails after stressful meetings. His friends are talking about Coronavirus prevention, and one of them says:*
Ben doesn't bite his fingernails. [$\star \rightsquigarrow 0$]

- In this case, the Current Issue is whether Ben could be exposed to the virus.
- In this context, the sentence sounds infelicitous.

3.4 Disagreement about the Current Issue

- For the last example, let us consider a short dialogue in which discourse participants have different views on the Current Issue.
- Annie and Bonnie produce apparently incompatible habitual sentences based on their divergent views.

(26) *Context: Bonnie is asking Annie about Connie's health. Bonnie thinks occasional smoking is not a significant health issue, but Annie thinks that it is.*
Annie: Connie smokes.
Bonnie: How often?
Annie: Well, only once a year, at New Years.
Bonnie: Oh, so she doesn't smoke then.

- In (26), the Current Issue is whether Connie has healthy habits.
- Annie asserts *Connie smokes* when in fact Connie only smokes very rarely.
- By making this assertion, Annie reveals that her version of the Current Issue divides the actual world (where Connie smokes rarely) from other possible worlds in which Connie never smokes.

- Bonnie's response, on the other hand, reveals that her version of the Current Issue groups these worlds together.
- The result is a dialogue that is entirely plausible, but difficult to explain unless bare habitual sentences are sensitive to subtle shifts in the Current Issue.
- (In episodic uses, Annie and Bonnie would probably use the word *smokes* in the same way, so this is not a disagreement about lexical semantics.)

4 Analysis of non-maximality

- Throughout this discussion, we have been appealing to a notion of Sufficient Truth.
- In this section, I present the formal details of the account.

(27) **Sufficient Truth (ST)** Križ (2016)

We write $\simeq_I$ for the equivalence relation that holds of two worlds u, v iff u and v are in the same cell of an issue I. A sentence S is *true enough* in world w with respect to I iff there is some world u such that $S(u) = 1$ (S is literally true in w') and $w \simeq_I u$.

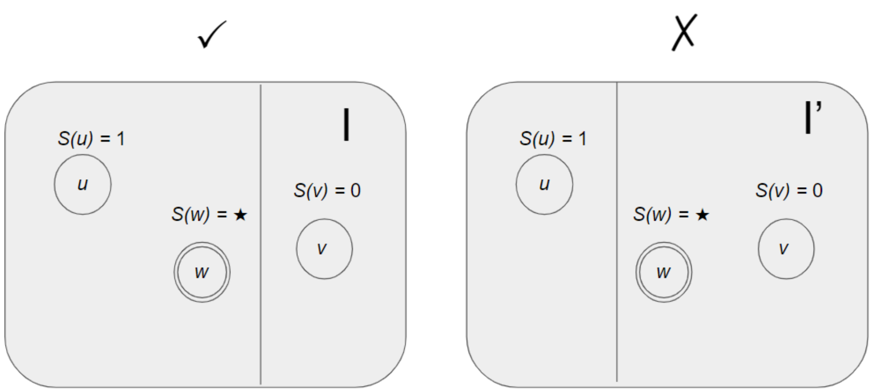

Figure 1 S is true enough at w relative to issue I, but not issue I'.

- Križ (2016) weakens the Maxim of Quality to require only Sufficient Truth.

(28) **Weak Maxim of Quality** Križ (2016)

Say only sentences which you believe to be true enough.

- Moreover, assertions must be both true enough and **relevant**, in the sense that they Address the Current Issue (this can be seen as a consequence of Grice's Maxim of Relation).

(29) **Addressing an Issue** Križ (2016)

A sentence S may be used to address an issue I only if there is no cell $i \in I$ such that i overlaps with both the positive and the negative extension of S, i.e. S is true in some worlds in i and false in others.

- I assume that sentences can have three truth values: true (1), false (0), and indeterminate ($\star$).
- As usual, time intervals are ordered by mereological parthood $\leq$ and precedence $\prec$.
- $\boxed{\text{Terminological note:}}$ Intervals can be continuous (self-connected) or discontinuous pluralities (e.g. the sum of *9am to 10am* and *2pm to 3pm*).
- We say that two intervals i and j **overlap** just in case they have a part in common.
- I assume that predicates of times are **homogeneous** in the sense of (30).

(30) **Definition: Temporal Homogeneity**

T is a **homogeneous** predicate of times if, whenever i and j overlap and $[\![T(i)]\!]^w = 1$, we have $[\![T(j)]\!]^w \neq 0$.

(Equivalently, if $[\![T(i)]\!]^w = 1$ either $[\![T(j)]\!]^w = 1$ or $[\![T(j)]\!]^w = \star$.)

- For a homogeneous predicate T (e.g. a sentence radical) the time intervals at which T is true must not overlap with the time intervals at which T is false. This is enough to derive homogeneity effects.

(31) Connie doesn't call her mother on Saturdays.

$\rightarrow$ At all times i that are on a Saturday, Connie does not call her mother at i.

- If the predicate $[\![\text{Connie doesn't call her mother}]\!]^w$ is true of the (discontinuous) interval $[\![\text{on Saturdays}]\!]^w$, then it must be either true (1) or indeterminate ($\star$) at every part of $[\![\text{on Saturdays}]\!]^w$.
- So, at any time i that lies within a Saturday, Connie does not call her mother at i.

4.1 Non-maximality derived

- Temporal Homogeneity (30) predicts a trivalent meaning for habituals like (32), which (when indeterminate) can be repaired by Sufficient Truth.
- Let w^1, w^0, and $w^\star$ be worlds where (32) is respectively true, false, and indeterminate.

(32) On school days, Bonnie comes to school on time.

True in w iff Bonnie is on time on **all** school days in w. w^1

False in w iff Bonnie is on time on **no** school days in w. w^0

Indeterminate in w otherwise. $w^\star$

- Consider the two possible Current Issues in (33), which we diagram in Figure (2).

(33) a. Is Bonnie generally on time? I^{lax}

b. Does Bonnie get a sticker for perfect attendance? I^{strict}

- In Figure 2, let I^{lax} stand for the permissive Current Issue that groups some $\star$-worlds together with true-worlds, and let I^{strict} stand for the strict Current Issue that separates all true-worlds from all $\star$-worlds.

- Then $w^\star \simeq_{I^{\text{lax}}} w^1$, but $w^\star \not\simeq_{I^{\text{strict}}} w^1$. Thus, (32) is true enough in $w^\star$ with respect to I^{lax}, but not I^{strict}.

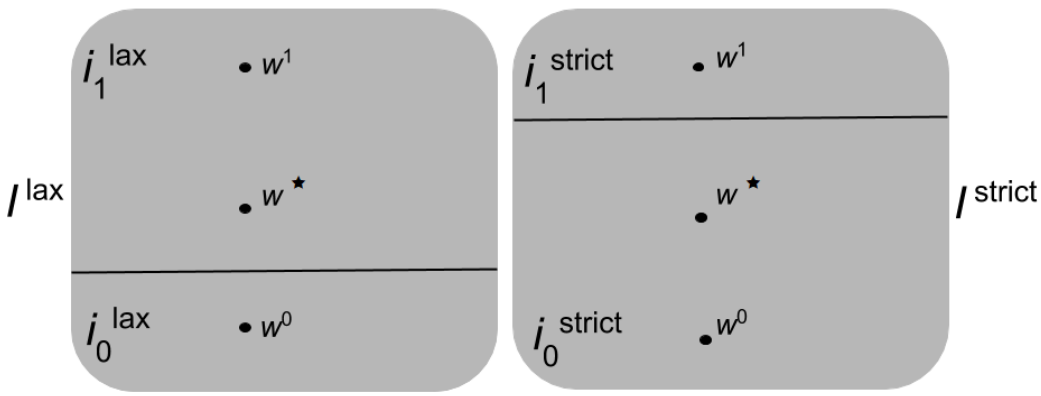

Figure 2 Is Bonnie generally on time?
$I^{\text{lax}} = \{i_1^{\text{lax}}, i_0^{\text{lax}}\}$ $\quad w^\star, w^1 \in i_1^{\text{lax}}$ $\quad w^0 \in i_0^{\text{lax}}$
Does Bonnie get a sticker for perfect attendance?
$I^{\text{strict}} = \{i_1^{\text{strict}}, i_0^{\text{strict}}\}$ $\quad w^1 \in i_1^{\text{strict}}$ $\quad w^\star, w^0 \in i_0^{\text{strict}}$

5 Conclusion

- Habitual readings in English on which they are not produced by specialized aspectual operators or silent quantifiers, but instead arise naturally from independently motivated assumptions:

  i. Tenses and temporal adverbs can denote discontinuous pluralities of time intervals.

  ii. Habitual sentences without quantifiers are derived by directly applying a sentence radical (which denotes a predicate of times) to a tense or a frame adverbial (which denotes a definite plurality of time intervals).

iii. Plural predication *in general* results in trivalent meanings.

iv. Indeterminate sentences can be true enough when their exceptions are irrelevant to the Current Issue.

- On this view, the exception-tolerance of habituals and the behavior of habituals under negation follow from Križ's hypothesis that homogeneity and non-maximality are general properties of plurals in natural language.
- This theory has three important advantages over existing alternatives.

  i. First, it is conceptually simple. It does not require expanding the ontology of natural language semantics beyond the standard assumptions of algebraic semantics (Krifka 1989). As a result, the theory is modular, and can easily be extended to be compatible with event semantics and modal analyses of the imperfective (e.g. Deo 2009).

  ii. Second, it naturally accounts for the fact that exception-tolerance in habituals depends on the Current Issue.

  iii. Third, it provides a unified perspective on disparate phenomena.

- If temporal homogeneity effects exist, we might also expect homogeneity effects to arise anywhere in natural language where we find reference to nonatomic objects, be they pluralities of individuals, times, events, situations, or worlds.
- The theory of homogeneity and non-maximality makes predictions in all these domains, and further investigations of those predictions may reveal more areas in which the Current Issue has a significant impact on our acceptability judgments.
- Thank you!

Special thanks to Lucas Champollion, Sam Alxatib, and Philippe Schlenker, who advised this project at the QP stage. Thanks also to Chris Barker, Justin Bledin, Ashwini Deo, Marcelo Ferreira, Manuel Križ, Matt Mandelkern, and Anna Szabolcsi, and the audience at NYU Semantics Group. All errors are my own.

Appendix A: Trivalent Type Theory

In this section I provide the formal details of the trivalent type theory used by Križ (2015), which I adapt for this work. I will not repeat Križ's presentation here. Instead I will review the most important ideas, and direct the reader to Križ (2015: Chapter 2) and Lepage (1992) for further details. The key idea is that partial functions—functions that are indeterminate for some values—can be ordered according to their indeterminacy, and this ordering follows from an ordering on the domain of truth values $D_{\mathtt{t}}$.

Let $D_{\mathtt{t}} = \{0, 1, \star\}$ and let $\leq_{\mathtt{t}}$ be a partial order on $D_{\mathtt{t}}$. Intuitively, $x \leq_{\mathtt{t}} y$ should be read as *x is at most as indeterminate as y*. The relation $\leq_{\mathtt{t}}$ is given by (i) $x \leq_{\mathtt{t}} x$ and (ii) $0, 1 \leq_{\mathtt{t}} \star$. This gives a join semilattice in which (crucially) $\star$ overlaps with both 0 and 1, but 0 and 1 do not overlap. We will now extend this ordering to all functions.

The set of **types** $\mathscr{T}$ is the smallest set $\mathscr{T}$ such that $\mathtt{e}, \mathtt{i}, \mathtt{t} \in \mathscr{T}$, and if $\sigma, \tau \in \mathscr{T}$, then $\langle \sigma\tau \rangle \in \mathscr{T}$. I abbreviate types right-associatively, so that $\langle \sigma\tau \rangle \equiv \sigma\tau$, $\langle \rho \langle \sigma\tau \rangle \rangle \equiv \rho\sigma\tau$, and $\langle \langle \rho\sigma \rangle \tau \rangle \equiv (\rho\sigma)\tau$. Let the ordering $\leq_{\mathtt{t}}$ be as before, and let $\leq_{\mathtt{e}}$ and $\leq_{\mathtt{i}}$ stand for the usual mereological parthood relation on individuals $D_{\mathtt{e}}$ and time intervals $D_{\mathtt{i}}$ respectively.

By induction on types $\tau \in \mathscr{T}$, we can recursively extend the orderings on these basic domains to an ordering on an arbitrary domain D_τ in the following way. Let ρ be any basic type, i.e. $\rho \in \{\mathtt{e}, \mathtt{i}, \mathtt{t}\}$, so that $\leq_\rho$ is already defined. Thus, in the base case, where $\tau = \rho$, we have already defined the relation $\leq_\rho$. Now, suppose $\tau = \sigma\rho$, where $\sigma \in \mathscr{T}$ is an arbitrary type. In this case, for functions $f, g \in D_{\sigma\rho}$, we say that $f \leq_{\sigma\rho} g$ if and only if $f(x) \leq_\rho g(x)$ for all $x \in D_\sigma$. For the most general case, suppose $\sigma_0, \sigma_1, ..., \sigma_n \in \mathscr{T}$ are arbitrary types, and $\tau = \sigma_0\sigma_1...\sigma_n\rho$, where $\rho \in \{\mathtt{e}, \mathtt{i}, \mathtt{t}\}$ as before. For functions $f, g \in D_{\sigma_0\sigma_1...\sigma_n\rho}$, we say that $f \leq_{\sigma_0\sigma_1...\sigma_n\rho} g$ if and only if $f(x) \leq_{\sigma_1...\sigma_n\rho} g(x)$ for all $x \in D_{\sigma_0}$.

The implementation is complex, but the idea is simple. For example, consider two functions $f, g \in D_{\mathtt{et}}$ (imagine that f and g are the denotations of two intransitive verbs). Suppose $f(x)$ is determinate (1 or 0) on all individuals $x \in D_{\mathtt{e}}$, but $g(a) = \star$ for some particular individual $a \in D_{\mathtt{e}}$, and suppose further that $g(x) = f(x)$ for all $x \neq a$. In this case, $f \leq_{\mathtt{et}} g$, because $f(x) \leq_{\mathtt{t}} g(x)$ for all $x \in D_{\mathtt{e}}$. However, for example, (i) if f and g are indeterminate for *distinct* inputs, or (ii) if they assign 0 and 1 respectively to the same individual, then they will not be ordered by $\leq_{\mathtt{et}}$.

Given orderings $\leq_\tau$ for each type τ, we can also define a general notion of overlap. This notion of overlap is the key ingredient in Križ's formalization of homogeneity, given below in (34).

(34) Definition of Homogeneity — Križ 2015: 53:Def. 2.9

For any type $\sigma \in \mathscr{T}$, let $\circ_\sigma$ denote **overlap** with respect to the ordering $\leq_\sigma$ on the domain D_σ; that is to say, $x \circ_\sigma y$ if and only if there is a $z \in D_\sigma$ such that $z \leq_\sigma x$ and $z \leq_\sigma y$.

A function $f : D_\sigma \to D_\tau$ is **homogeneous** iff for all $x, y \in D_\sigma$, $(x \circ_\sigma y) \to f(x) \circ_\tau f(y)$.

For a simple example, suppose $f \in D_{\mathtt{et}}$ is a *homogeneous* function, and $a, b, c \in D_{\mathtt{e}}$ are individuals. Recall that $0 \circ_{\mathtt{t}} \star$ and $1 \circ_{\mathtt{t}} \star$, but $\neg(0 \circ_{\mathtt{t}} 1)$. According to the homogeneity generalization, if $f(a \oplus b) = 1$, then any $x \in D_{\mathtt{e}}$ that overlaps with $a \oplus b$ will be mapped to either 1 or $\star$ by f. Formally, if $x \circ_{\mathtt{e}} (a \oplus b)$, then homogeneity forces either $f(x) = 1$ or $f(x) = \star$; $f(x)$ may not be 0. In particular, $f(a)$ must be 1 or $\star$ and $f(a \oplus b \oplus c)$ must be 1 or $\star$. But, since c does not overlap with $a \oplus b$, $f(c) = 0$ is possible (as long as $f(a \oplus b \oplus c) \neq 1$).

Before moving on, let me comment on some differences between the presentation here and the presentation in Križ (2015: Ch. 2). First, Križ only uses types $\mathtt{e}$ and $\mathtt{t}$, and he only defines the ordering $\leq_\tau$ for types ending in $\mathtt{t}$. I instead extend $\leq_\tau$ to the whole type hierarchy, treating the mereological parthood relations $\leq_{\mathtt{e}}$ and $\leq_{\mathtt{i}}$ on a par with the indeterminacy ordering $\leq_{\mathtt{t}}$.[1] More importantly, Križ discusses extensions of the trivalent type theory to cover collective predicates, non-homogeneous predicates, and non-monotonic quantifiers. I do not adopt these extensions here, so as not to obscure my key points, but it would certainly be possible to implement them.

Appendix B: The Language $\mathscr{L}$

I use a typed λ-calculus $\mathscr{L}$ with three types, truth values, entities, and times. The **syntax** of the λ-language $\mathscr{L}$ is entirely standard, so I will review it only briefly. In what follows, ρ, σ, τ are metavariables over types, and $\alpha, \beta, \mathsf{a}, \mathsf{b}, p, q, s, t, x, y$ are all metavariables over terms. For each type $\tau \in \mathscr{T}$, let $\mathscr{L}_\tau$ stand for the set of terms of type τ in $\mathscr{L}$. Let Var_τ stand for the set of variables of type τ, and let Con_τ stand for the set of constants of

1 One could, using the definitions in this Appendix, define homogeneous functions to individuals or times, but the applications are not clear. This is just a convenience for me, since both Križ and I only force homogeneity for types ending in $\mathtt{t}$ anyway (see (39) in Appendix B).

type τ. Then, $\mathscr{L}$ is the smallest set satisfying rules (i-x): (i) [Variables and Constants] $Var_\tau \cup Con_\tau \subseteq \mathscr{L}_\tau$, (ii) [Application] If $\alpha \in \mathscr{L}_{\sigma\tau}$ and $\beta \in \mathscr{L}_\sigma$, then $\alpha(\beta) \in \mathscr{L}_\tau$, (iii) [Abstraction] if $x \in Var_\sigma$ and $\alpha \in \mathscr{L}_\tau$, then $(\lambda x.\alpha) \in \mathscr{L}_{\sigma\tau}$.

We have the usual **logical symbols**: (iv) [Negation] If $p \in \mathscr{L}_{\mathtt{t}}$, then $(\neg p) \in \mathscr{L}_{\mathtt{t}}$, (v) [Disjunction, Conjunction, Implication] If $p, q \in \mathscr{L}_{\mathtt{t}}$, then $(p \wedge q), (p \vee q), (p \to q) \in \mathscr{L}_{\mathtt{t}}$, (vi) [Quantifiers] If $x \in Var_\tau$ and $p \in \mathscr{L}_{\mathtt{t}}$, then $(\forall x[p]), (\exists x[p]) \in \mathscr{L}_{\mathtt{t}}$.

We also have the following **non-logical symbols**: (vii) [Equality] if $\alpha, \beta \in \mathscr{L}_\tau$, then $(\alpha = \beta) \in \mathscr{L}_{\mathtt{t}}$, (viii) [Parthood, Overlap] if $\sigma \in \{\mathtt{e}, \mathtt{i}\}$ and $\alpha, \beta \in \mathscr{L}_\sigma$, then $(\alpha \preceq \beta), (\alpha \circ \beta) \in \mathscr{L}_{\mathtt{t}}$, (ix) [Sum] if $\sigma \in \{\mathtt{e}, \mathtt{i}\}$ and $\alpha \in \mathscr{L}_{\sigma\mathtt{t}}$, then $\bigoplus \alpha \in \mathscr{L}_\sigma$, and (x) [Precedence] if $s, t \in \mathscr{L}_{\mathtt{i}}$, then $(s \ll t) \in \mathscr{L}_{\mathtt{t}}$.

Now we define the **semantics** of $\mathscr{L}$. Let $\mathscr{M}$ be the set of all models. M is a **model** if $M = \langle \mathscr{I}_M, D_{\mathtt{e}}, \leq_{\mathtt{e}}, D_{\mathtt{i}}, \leq_{\mathtt{i}}, \ll_{\mathtt{i}}, W \rangle$, where (i) $\mathscr{I}_M$ is an interpretation function, (ii) $\langle D_{\mathtt{e}}, \leq_{\mathtt{e}} \rangle$, is an atomic join semilattice of individuals, (iii) $\langle D_{\mathtt{i}}, \leq_{\mathtt{i}} \rangle$ is a non-atomic join semilattice of times, (iv) $\langle D_{\mathtt{i}}, \ll_{\mathtt{i}} \rangle$ is a partially-ordered set of times (where $\ll_{\mathtt{i}}$ is the precedence ordering), and (v) W is a set of possible worlds. Independently of the choice of model M, the domain of **truth values** is always defined as $D_{\mathtt{t}} = \{0, 1, \star\}$, and is always ordered by $\leq_{\mathtt{t}}$ (defined in Appendix A). For any types $\sigma, \tau \in \mathscr{T}$, the functional domain $D_{\sigma\tau}$ is a set of functions from D_σ to D_τ.

The **denotation** function $[\![\cdot]\!]^w_{M,g}$ maps terms in $\mathscr{L}_\tau$ to model-theoretic objects (functions) in D_τ, for any type $\tau \in \mathscr{T}$, according to the rules in (35,36,37).

(35) Basic Semantic Rules

a. (Variables) If $x \in Var$, then $[\![x]\!]^w_{M,g} = g(x)$.

b. (Constants) If $\mathbf{a} \in Con$, $[\![x]\!]^w_{M,g} = \mathscr{I}_M(\mathbf{a})$.

c. (Application) If $\alpha \in \mathscr{L}_{\sigma\tau}$ and $\beta \in \mathscr{L}_\sigma$, then $[\![\alpha(\beta)]\!]^w_{M,g} = [\![\alpha]\!]^w_{M,g}([\![\beta]\!]^w_{M,g})$.

d. (Abstraction) If $\lambda x.\alpha \in \mathscr{L}_{\sigma\tau}$, then $[\![\lambda x.\alpha]\!]^w_{M,g}$ is a function from $D_\sigma \to D_\tau$, given by $u \mapsto [\![\alpha]\!]^w_{M,g[x/u]}$.

(36) Rules for Logical Symbols

a. (Negation) If $p \in \mathscr{L}_{\mathtt{t}}$, then $[\![\neg p]\!]^w_{M,g} = \begin{cases} 1 & [\![p]\!]^w_{M,g} = 0 \\ 0 & [\![p]\!]^w_{M,g} = 1 \\ \star & \text{otherwise} \end{cases}$

b. (Conjunction) If $p, q \in \mathscr{L}_{\mathtt{t}}$, then $[\![p \wedge q]\!]^w_{M,g} = \begin{cases} 1 & [\![p]\!]^w_{M,g} = [\![q]\!]_{M,g} = 1 \\ 0 & [\![p]\!]^w_{M,g} = 0 \text{ or } [\![q]\!]^w_{M,g} = 0 \\ \star & \text{otherwise} \end{cases}$

c. (Disjunction) If $p, q \in \mathscr{L}_{\mathtt{t}}$, then $[\![p \vee q]\!]^w_{M,g} = \begin{cases} 1 & [\![p]\!]^w_{M,g} = 1 \text{ or } [\![q]\!]^w_{M,g} = 1 \\ 0 & [\![p]\!]^w_{M,g} = [\![q]\!]_{M,g} = 0 \\ \star & \text{otherwise} \end{cases}$

d. (Implication) If $p, q \in \mathscr{L}_{\mathtt{t}}$, then $[\![p \rightarrow q]\!]^w_{M,g} = [\![(\neg p) \vee q]\!]^w_{M,g}$

(37) Rules for Non-Logical Symbols

a. (Equality) $[\![\alpha = \beta]\!]^w_{M,g} = 1$ iff $[\![\alpha]\!]^w_{M,g} = [\![\beta]\!]^w_{M,g}$, and 0 otherwise.

b. (Precedence) For $s, t \in \mathscr{L}_{\mathtt{i}}$, $[\![\alpha \ll \beta]\!]^w_{M,g} = 1$ iff $[\![s]\!]^w_{M,g} \ll_{\mathtt{i}} [\![t]\!]^w_{M,g}$, and is 0 otherwise.

c. (Parthood) For $\sigma \in \{\mathtt{e}, \mathtt{i}\}$, and $\alpha, \beta \in L_\sigma$, $[\![\alpha \leq \beta]\!]^w_{M,g} = 1$ iff $[\![\alpha]\!]^w_{M,g} \leq_\sigma [\![\beta]\!]^w_{M,g}$, and equals 0 otherwise.[2]

d. (Overlap) For $\sigma \in \{\mathtt{e}, \mathtt{i}\}$, and $\alpha, \beta \in L_\sigma$, $[\![\alpha \circ \beta]\!]^w_{M,g} = 1$ iff $[\![\alpha]\!]^w_{M,g} \circ_\sigma [\![\beta]\!]^w_{M,g}$, i.e. there exists some $z \in D_\sigma$ such that $z \leq_\sigma [\![\alpha]\!]^w_{M,g}$ and $z \leq_\sigma [\![\beta]\!]^w_{M,g}$, and equals 0 otherwise.

e. (Sum) For $\sigma \in \{\mathtt{e}, \mathtt{i}\}$, and $\alpha \in L_{\sigma\mathtt{t}}$, $[\![\bigoplus \alpha]\!]^w_{M,g}$ is the unique sum of the set $\left\{ x \in D_\sigma \;\middle|\; [\![\alpha]\!]^w_{M,g}(x) = 1 \right\}$.

We impose the following constraints on admissible models:

(38) $M = \langle \mathscr{I}_M, D_{\mathtt{e}}, \leq_{\mathtt{e}}, D_{\mathtt{i}}, \leq_{\mathtt{i}}, \ll_{\mathtt{i}}, W \rangle$ is an admissible model iff:

a. (CEM) Both individuals $\langle D_{\mathtt{e}}, \leq_{\mathtt{e}} \rangle$ and times $\langle D_{\mathtt{i}}, \leq_{\mathtt{i}} \rangle$ satisfy all the axioms of Classical Extensional Mereology (Champollion 2017: 13-17).

2 Though I define $\leq_\tau$ for all types τ in Appendix A, I assume that the symbol $\leq$ in $\mathscr{L}$ only denotes mereological parthood.

b. (Precedence and Overlap) All and only non-overlapping pairs of time intervals are in the precedence relation, i.e. $\forall x, y \in D_{\mathtt{i}}[(x \ll_{\mathtt{i}} y) \vee (y \ll_{\mathtt{i}} x) \leftrightarrow \neg(x \circ y)]$.

With all this in place, we can formally state the homogeneity constraint, where *homogeneous* is defined in (34) in Appendix A. This constraint requires that functions of all types ending in $\mathtt{t}$ are homogeneous.[3]

(39) Homogeneity Constraint

For all $\sigma_1, .., \sigma_n \in \mathscr{T}$, the domain $D_{\sigma_1 \ldots \sigma_n \mathtt{t}}$ must be a set of homogeneous functions.

Appendix C: A Formal Fragment

This appendix contains an explicit fragment with derivations for a few interesting sentences. $\langle \cdot \rangle$ is a function from object language expressions (parsed English phrases) to terms in $\mathscr{L}$. The compositional order is given by the syntactic parse in the following way: If ε and δ are object-language expressions, then $\langle\ [\ \varepsilon\ [\ \delta\ ]\ ]\ \rangle = \langle\ [\ [\ \delta\ ]\ \varepsilon\ ]\ \rangle = \langle \varepsilon \rangle(\langle \delta \rangle)$.

(40) a. $\langle \text{PAST} \rangle = \lambda T_{\mathtt{it}} \lambda s_{\mathtt{i}}.T(s) \wedge \partial(r \leq s) \wedge \partial(r \ll u)$

b. $\langle \text{PRES} \rangle = \lambda T_{\mathtt{it}} \lambda s_{\mathtt{i}}.T(s) \wedge \partial(r \leq s) \wedge \partial(r \leq u)$

(41) $\langle \text{Annie runs} \rangle = \langle [[[\text{Annie}]\ \text{run}]\ \text{-s}] \rangle = \langle \text{PRES} \rangle(\langle \text{run} \rangle(\langle \text{Annie} \rangle)) = \lambda t_{\mathtt{it}}.\partial^{g,r}_{\text{PRES}}(t) \wedge \mathsf{run}(\mathsf{a})(t)$

(42) $\langle \text{on} \rangle = \lambda A_{(\mathtt{it})\mathtt{t}} \lambda T_{\mathtt{it}}.\mathsf{match}(M) \wedge A(\lambda u_{\mathtt{i}}.T(M(u)))$

(43) $\langle \text{every Saturday} \rangle = \lambda R_{\mathtt{it}}.\forall s_{\mathtt{i}}[\mathsf{saturday}(s) \to R(s)]$

(44) $\langle [\text{on [every Saturday]}] \rangle = \langle \text{on} \rangle(\langle \text{every Saturday} \rangle) = \lambda T_{\mathtt{it}}.\mathsf{match}(M) \wedge \forall s_{\mathtt{i}}[\mathsf{saturday}(s) \to T(M(s))]$

(45) $\langle [[\text{Annie runs}]\ [\text{on [every Saturday]}]] \rangle = \mathsf{match}(M) \wedge \forall s_{\mathtt{i}}[\mathsf{saturday}(s) \to \partial^{g,r}_{\text{PRES}}(M(s)) \wedge \mathsf{run}(\mathsf{a})(M(s))]$

(46) $\langle \text{Saturdays} \rangle = \lambda R_{\mathtt{it}}.R[\bigoplus(\mathsf{saturday})]$

3 Križ (2015) discusses how to account for non-homogeneous functions as well, but introducing them further complicates the logic, so I set them aside.

(47) $\langle$[on [Saturdays]]$\rangle = \lambda T_{\texttt{it}}.\mathsf{match}(M) \wedge T(M[\bigoplus(\mathsf{saturday})])$

(48) $\langle$[[Annie runs] [on [Saturdays]]]$\rangle = \mathsf{match}(M) \wedge \partial^{g,r}_{\text{PRES}}[M(\bigoplus(\mathsf{saturday}))] \wedge \mathsf{run}(\mathsf{a})[M(\bigoplus(\mathsf{saturday}))]$

Appendix D: Comparison to previous work

The idea that bare habituals involve plural predication of events has been around since at least Ferreira (2005), but the present work gives the first account of exception-tolerance in habitual sentences that captures its context-sensitivity. The non-maximality account has the distinct advantage that its predictions can be tested by manipulating the Current Issue. What we find is that bare habituals are not exception-tolerant across the board, but only when their exceptions are not relevant to resolving the Current Issue.

In this section I discuss previous approaches to exception tolerance in habitual sentences. In many cases, authors have noted that habituals tolerate exceptions, but none have systematically connected these exceptions to particular contextual parameters such as the Current Issue. As a result, they make no predictions about contexts in which exceptions matter, which I have called the strict contexts.

Ferreira (2005)

Ferreira (2005) first proposed that bare habituals should be analyzed using plural event predication. He uses a version of event semantics in which events are atomic. This allows him to analyze *when*-clauses in sentences like (49) using the semantics in (50).

(49) When John writes a romantic song, he goes to the Irish pub. Ferreira 2005: 63:(87)

The meaning for *when John writes a song* is true of those pluralities whose proper parts satisfy the event description $\lambda e.\exists y[\mathsf{song}(y) \wedge \mathsf{write}(e, j, y)]$.

(50) Ferreira's analysis of distributive *when*-clauses

$[\![$when John writes a song$]\!] = \lambda E.\forall e[e < E \rightarrow \exists y[\mathsf{song}(y) \wedge \mathsf{write}(e, j, y)]]$

(True of a plurality of events E if every proper part of e is a John-writes-a-song event.)

Ferreira then applies a definite determiner to (50) before composing it with the main clause. The result is that (49) is true if the unique plurality of events whose proper parts are songwriting-events is plurality of pub-going events. If such a definite plurality exists, this gloss does not seem to tolerate any exceptions. If it does tolerate exceptions, then those exceptions are explained by auxiliary assumptions about the domain of events, and exception-tolerance is not expected to be context-dependent.

One difference between the present work and Ferreira's analysis is that Ferreira focuses on the modal properties of habitual sentences, which he sees as parallel to the modal properties of the progressive (Dowty 1979, Landman 1992, Portner 1998). One of the primary goals of the dissertation is to account for the common modal imperfective core of habitual and progressive readings across languages. Ferreira (2005: 57-59) suggests that the exception-tolerance of habitual sentences can be explained via the modal semantics, but once the modal semantics is introduced in Chapter 4, there is no explicit discussion of exceptions. Thus, Ferreira's predictions about exceptions are not clear, and to the extent that exceptions can be accommodated, there is no expectation that they should depend on the Current Issue.

Deo (2009)

Deo (2009), like Ferreira, aims to account for the shared modal properties of imperfective verbs, whether read progressively or habitually. Deo (2009: 483-484) argues against an event-quantification analysis, observing that even explicitly domain-restricted habituals like (49) are exception-tolerant. She concludes that a quantificational account cannot easily build in exception-tolerance via implicit quantifier domain restriction.

Deo's habitual semantics has two components. First, she implements a Dowty-style modal semantics using a branching-time framework. Second, she assumes that the imperfective aspect quantifies over a partition of the restrictor-times (e.g. the *when*-clause times in (49), or a contextually-provided temporal restriction). Thus, (49) roughly means that the song-writing times are contained in a possible history which is regularly partitioned into intervals, each of which includes a pub-going time. Deo (2009: 493-494) ultimately explains the exception-tolerance of habituals using the flexibility introduced by the contextually-specified partition. For example, the partition in example (49) could group together certain song-writing events and separate others, leading to an imperfect match between song-writings and pub-goings.

Though this solution is extremely interesting in its own right, and is backed up by a sophisticated and precise analysis, it does not quite fit the novel data I present here. First, Deo requires that the partition that provides the modal quantifier domain must be *regular*. In other words, the intervals in the partition must be of equal measure. Assuming each song-writing takes around the same amount of time, Deo derives a result for (49) where either every song-writing corresponds to a pub-going (no exceptions), or every n song-writings correspond to a pub-going, for some context-dependent number n (regularly-grouped exceptions). The size of the partition determines which of these two kinds of readings is actually predicted. However, it seems that exceptions to habitual sentences can be quite irregular in general. For example, Bonnie's absences in Section **??** example (18) could be spaced out or clustered together. Moreover, the predicted reading, where every n song-writings correspond to a pub-going, does not seem like a natural reading of (49).

Second, and most importantly, on Deo's analysis there is no expectation that exception-tolerance should vary with the Current Issue. It may be possible to relate the Current Issue to the size of the partition via a pragmatic mechanism, but the required mechanism is not obvious, and pursuing such a fix is outside the scope of this paper. On the other hand, the Sufficient Truth account correctly predicts that exceptions are possibly irregular and dependent on the Current Issue. Moreover, no special pragmatic mechanisms are required except those independently needed to account for definite plurals (Križ 2015).

Carlson (2008)

While Deo (2009) builds exception-tolerance into the theory of habituals by setting up a contextually-provided partition over times, and requiring that this partition match the times in the extension of the sentence radical, other approaches have attempted to weaken the truth-conditions of habituals by evaluating them with respect to primitive objects other than times and events.

Carlson (2008) analyzes both habitual and generic sentences using *patterns*. For Carlson, patterns are a primitive of the theory, and habituals and generics are true if and only if they are satisfied by a pattern. Patterns capture the non-accidental cooccurrence of events, and they naturally tolerate exceptions, unlike a restricted universal quantifier over times. Similarly, Bittner (2008) assumes the existence of *habits*, which are kinds at the event level. Habits, like patterns, are exception-tolerant by nature. These ideas are implemented very differently, and a detailed comparison would go far beyond the scope of the present study. However, both approaches assume that there are some semantic primitives that are exception-tolerant by definition, and that these special objects serve as the truth-makers for habitual sentences, rather than more familiar objects such as times or events.

Though there may be independent reasons to include objects such as patterns or event-kinds in our models, neither account mentioned above is equipped to deal with the particular context-dependence of habitual sentences. As we have seen, exceptions to habitual sentences are tolerated only if those exceptions are irrelevant to resolving the Current Issue. This dimension of variation is unexpected on any analysis that attempts to weaken the truth conditions of habitual sentences by adding structured objects such as partitions, patterns, or habits.

Greenberg (2007)

Finally, a different approach, taken by Greenberg (2007), is to treat exception-tolerance in bare plural generics as a species of vagueness. The idea behind this approach is that generics are quantifiers, but their quantificational domain is vague. Thus, generics do not contain an exception-tolerant quantifier GEN, but instead contain a universal quantifier over a vague domain. Though Greenberg does not explicitly address habitual sentences like (49), one could imagine an extension of the vague quantifier domain theory to habituals.

In fact, Križ (2015: 40-42) notes that a unification of homogeneity and vagueness may be possible. However, there are two obstacles to such an approach. First, in borderline cases, vague predicates such as *tall* in (51) can be affirmed and denied of the same individual (Alxatib & Pelletier 2011, Ripley 2011). However, homogeneous predicates cannot be both affirmed and denied of the same plurality, even in cases like (52) when the predicate is true of a sizable proper subpart of that plurality.

(51) Bill is both tall and not tall. Križ 2015: 41:(137a)

(52) *Context: Half the books are in Dutch.* Križ 2015: 41:(137b)

The books are both in Dutch and not in Dutch.

Analogous examples with habitual sentences such as (53) are infelicitous, and therefore pattern with plural definites, rather than vague predicates.

(53) *Context: Ben shaves once a year.*

\# Ben both shaves and doesn't shave.

Second, Križ (2015: 42) notes that homogeneous predicates do not reproduce the Sorites paradox, though I omit the relevant examples for space reasons.

Most importantly, I will add that the vagueness approach to exception-tolerance does not straightforwardly explain the sensitivity of exceptions to the Current Issue. Despite these arguments, a closer comparison of homogeneity and vagueness might be illuminating, especially since the origins of homogeneity and non-maximality are still not well-understood. Ultimately, a reductionist theory of homogeneity effects may be possible, but I leave such attempts to future work.

References

Alxatib, Sam & Francis Jeffry Pelletier. 2011. The Psychology of Vagueness: Borderline Cases and Contradictions. *Mind and Language* 26(3). 287–326. https://doi.org/10.1111/j.1468-0017.2011.01419.x.

Bittner, M. 2008. Aspectual universals of temporal anaphora. /paper/Aspectual-universals-of-temporal-anaphora-Bittner/dac948229f3df5a43433357df2e8c468d489bffc.

Carlson, Greg. 2008. Patterns in the Semantics of Generic Sentences. In Jacqueline Guéron & Jacqueline Lecarme (eds.), *Time and Modality* Studies in Natural Language and Linguistic Theory, 17–38. Dordrecht: Springer Netherlands. https://doi.org/10.1007/978-1-4020-8354-9_2.

Champollion, Lucas. 2017. *Parts of a Whole: Distributivity as a Bridge between Aspect and Measurement* Oxford Studies in Theoretical Linguistics. Oxford, New York: Oxford University Press.

Deo, Ashwini. 2009. Unifying the imperfective and the progressive: Partitions as quantificational domains. *Linguistics and Philosophy* 32(5). 475–521. https://doi.org/10.1007/s10988-010-9068-z.

Dowty, David R. 1979. Interval Semantics and the Progressive Tense. In David R. Dowty (ed.), *Word Meaning and Montague Grammar: The Semantics of Verbs and Times in Generative Semantics and in Montague's PTQ* Studies in Linguistics and Philosophy, 133–192. Dordrecht: Springer Netherlands. https://doi.org/10.1007/978-94-009-9473-7_3.

Ferreira, Marcelo. 2005. *Event quantification and plurality*: Massachusetts Institute of Technology dissertation.

Greenberg, Yael. 2007. Exceptions to Generics: Where Vagueness, Context Dependence and Modality Interact. *Journal of Semantics* 24(2). 131–167. https://doi.org/10.1093/jos/ffm002.

Krifka, Manfred. 1989. Nominal Reference, Temporal Constitution and Quantification in Event Semantics 21.

Križ, Manuel. 2015. *Aspects of Homogeneity in the Semantics of Natural Language*: dissertation.

Križ, Manuel. 2016. Homogeneity, Non-Maximality, and all. *Journal of Semantics* 33(3). 493–539. https://doi.org/10.1093/jos/ffv006.

Kroch, Anthony. 1974. *The semantics of scope in English*: Massachusetts Institute of Technology dissertation.

Landman, Fred. 1992. The progressive. *Natural Language Semantics* 1(1). 1–32. https://doi.org/10.1007/BF02342615.

Lepage, François. 1992. Partial functions in type theory. *Notre Dame Journal of Formal Logic* 33(4). 493–516. https://doi.org/10.1305/ndjfl/1093634483.

Malamud, Sophia A. 2012. The meaning of plural definites: A decision-theoretic approach. *Semantics and Pragmatics* 5(0). 3–1–58. https://doi.org/10.3765/sp.5.3.

Portner, Paul. 1998. The Progressive in Modal Semantics. *Language* 74(4). 760–87.

Ripley, David. 2011. Contradictions at the Borders. In Rick Nouwen, Robert van Rooij, Uli Sauerland & Hans-Christian Schmitz (eds.), *Vagueness in Communication*, 169–188. Springer.