

2

QUANTIFICATION AS REFERENCE: EVIDENCE FROM Q-VERBS

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1 INTRODUCTION

Formal semantics has so far mostly focused on three categories of quantifiers (*Q*)—to wit, *Q-determiners* (e.g. *every*), *Q-adverbs* (e.g. *always*), and *Q-auxiliaries* (e.g. *would*). All three form constructions that can be analyzed in terms of tripartite logical forms (*LFs*), consisting of a quantifier, the restriction, and the nuclear scope. This view has been implemented, with varying details, by most formal theories of natural language quantification, including landmark studies by Montague (1973), Lewis (1973, 1975), Barwise and Cooper (1981), Kratzer (1981), Heim (1982), Kamp and Reyle (1993), Partee (1995), and Matthewson (2001).

Heim (1982) develops a unified dynamic semantics for *Q-determiners* (1a), *Q-adverbs* (1b), *Q-auxiliaries* (1c), as well as what she takes to be a covert universal quantifier (\square) in donkey conditionals (1d), by assigning all of these constructions parallel tripartite *LFs* (1'a–d).

- (1) a. *Every* man arrived.
 b. If a restaurant is good, it is *always* expensive.
 c. If a cat has been exposed to 2.4–D, it *must* be taken to a vet immediately.
 d. If a man owns a donkey, he beats it with a stick.

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8 Quantification: A Cross-Linguistic Perspective

(1')	<u>quantifier</u>	<u>restriction</u>	<u>nuclear scope</u>
a.	<i>every</i> ₂	[₂ man]	∃[₂ arrived]
b.	<i>always</i> ₁	[if a restaurant ₁ is good]	∃[it ₁ is _ expensive]
c.	<i>must</i> ₁	[if a cat ₁ has been exposed ...]	∃ ₂ [a vet] ₂ [it ₁ _ be taken to ₂ immed.]
d.	□ _{1,2}	[if a man ₁ owns a donkey ₂]	∃ ₃ [a stick] ₃ [he ₁ beats it ₂ with ₃]

Assuming LF-based interpretation, Heim formulates semantic rules that predict uniform semantic behavior across all of these constructions—e.g. in relation to anaphoric reference from pronouns in the nuclear scope to indefinite antecedents in the restriction, and variable, but predictable, quantificational force of indefinites in the restriction as well as the nuclear scope.

Heim's uniform and general semantics is theoretically attractive, but subsequent research has shown it to be empirically incorrect. For example, both Q-adverbs (e.g. *usually*, *mostly*) and Q-determiners (e.g. *most*) are predicted to quantify over cases (*n*-tuples of semantic objects). In fact, it has been shown that Q-determiners quantify only over individuals (the proportion problem, see e.g. Partee, 1984; Rooth, 1987; Kadmon, 1987). In view of this problem, as well as crosslinguistic evidence, Partee (1991) distinguishes *D-quantifiers* (our Q-determiners) from *A-quantifiers*, where 'A' is mnemonic for "the cluster of Adverbs, Auxiliaries, Affixes, and Argument-structure Adjusters". She hypothesizes that this binary morpho-syntactic classification has a crosslinguistic semantic correlate: D-quantifiers quantify over individuals, whereas A-quantifiers quantify over "cases, events, or situations".

Partee's hypothesis is not entirely clear because the terms *events*, *situations*, and *cases* are not synonymous in formal semantics. The phenomena that motivate these three types of semantic objects are different—e.g. temporal anaphora for events (see Kamp, 1979; Partee, 1984; Webber, 1988; etc), counterfactuals for situations (e.g. Kratzer, 1989), and Q-adverbs for cases (e.g. Lewis, 1975; Heim, 1982). It is only for Q-adverbs that all the three types of semantic objects have been used, in different analyses, to capture essentially the same facts (compare e.g. the analysis by Heim, 1982, in terms of cases, with Heim, 1990, in terms of situations, and Kamp and Reyle, 1993, in terms of events). We therefore tentatively interpret Partee's hypothesis as the following empirically testable claim: Crosslinguistically, all A-quantifiers quantify over the same type(s) of semantic objects as English Q-adverbs. That is, it should be possible to paraphrase, or translate, any A-quantifier using an English Q-adverb.

On this empirically testable interpretation, Partee's hypothesis is falsified by some of the very A-quantifiers she cites (in Partee, 1995) as supporting evidence—e.g., the ASL exhaustive suffix in (2), and the Slavic distributive prefix *po-* (our example (3)).¹ In Partee's

¹ The Polish examples were observed and/or constructed by Bittner, who is a native speaker, and checked with a non-linguist consultant. In the glosses lexical categories are in lower case, while grammatical categories are in small caps. The following abbreviations are used for grammatical *tense*: NPST = non-past, PST = past; *aspect*: IPF = imperfective, PFV = perfective; *case*: ACC = accusative, DAT = dative, GEN = genitive, INS = instrumental, LOC = locative; and *gender* (indicated only when semantically significant): F = feminine, M = masculine, N = neuter.

terminology, the Slavic *po-* is an Argument-structure Adjuster because it imposes a constraint on the object NP (ACC), requiring it to be semantically plural (plural set, plurality, or the like).

(2) American Sign Language

[*woman*]_{TOP} *book* 1SG-give-**exhaustive**

I gave each woman a book. (Partee, 1995, (11g), citing Klima and Bellugi, 1979)

(3) Polish (Slavic: Poland)

[To support the whaling industry in Greenland, in the late 18th century,...]

Dania po-budowa-ła stacje wielorybnicze

Denmark [dist-build^{IPF}]^{PFV}-PST.SG stations.ACC whaling.PL.ACC

co kilka-set kilometrów wzdłuż zachodniego wybrzeża Grenlandii

dist few-hundred km.GEN along west.SG.GEN coast.GEN Greenland.GEN

Denmark established whaling stations every few hundred kilometers all along the west coast of Greenland.

In ASL (2), judging by the English translation (*each woman*), the exhaustive Q-suffix does not quantify over events, but over individuals—to wit, the topical women. ASL (2) could be rendered with an English Q-adverb, *The women were {each, all} given a book (by me)*, but this alternative translation only confirms that the quantification is over individuals, not events.

Similarly, the Slavic distributive Q-prefix *po-* does not quantify over events.² Instead, it quantifies over places, individuals or, arguably, subintervals of a bounded period (exemplified in (3), (42iii, iv) and (26b), respectively).³ In addition, the Q-prefix *po-* has an aspectual, perfectivizing effect (e.g. compare imperfective (26a) vs. perfective (26b); on (im)perfective semantics see Kamp, 1979; Kamp and Rohrer, 1983; and section 2.2 below). For example, in Polish (3) the distributive Q-prefix *po-* quantifies over a set of places located within the topical area (part of Greenland suited to support the whaling industry in the late 18th century) and specified by two optional modifiers: ‘every few hundred kilometers’ and ‘along the west coast of Greenland’. Possible English translations of the distributive effect of *po-* in (3) include a Q-adverb (*all along the west coast*) and a Q-adjective (*along the whole coast*). Both translations confirm that *po-* in (3) quantifies over places, not events.

Another counterexample comes from the polysynthetic Gunwinyguan language Bininj Gun-wok⁴ spoken in North Australia. In this language verbal Q-affixes include a pluractional

² Filip and Carlson (2001) endorse Partee’s proposal for Czech, but in the one example they explicitly analyze they quantify over individuals—as in ASL (2) and Polish (42iii, iv)—not over events.

³ (26b) contains the so-called ‘delimitative’ *po-*, which some linguists (e.g. Isachenko, 1962; Filip, 1999; Młynarczyk, 2004) analyze as another prefix, and others (e.g. Stanisławski, 1982; Swan, 2002), as another use of the same prefix *po-*.

⁴ This language has also been referred to as *Kunwinjku* (*Gunwinggu*) or *Mayali*, after two major dialects. According to Evans (2003), all of the dialects share the same grammar, including three patterns of reduplication.

reduplicative affix (forming stems glossed ‘stem+stem’), exemplified in (4i, iii, iv):

(4) Bininj Gun-wok (Gunwinyguan: North Australia)

[Today Kodjdan gathered some fish poison plants and threw them into the water.]

- i. *ngarri-nah+na-ng djenj dowe-ng kodjka-ng.*
 1PL-look+look-PFV.PST fish 3.PST.die-PFV.PST 3.PST-(fish)float.up-PFV.PST
 We watched as the fish died and floated up to the surface.
- ii. *Kumekke-beh mambard me-y*
 there-ABL billycan 3/3.PST-get-PFV.PST
 Afterwards she got a billycan,
- iii. *wurdurd birri-kuk-me+me-y*
 child 3PL/3.PST-body-get+get-PFV.PST
 and the children picked up all the dead bodies,
- iv. *birri-kurrmeh+kurrme-ng mambard-kah.*
 3PL/3.PST-put+put-PFV.PST billycan-LOC
 and put them in the billycan. (Evans, 2003, pp. 703–704)

Newman (1980, 1990), who coined the term *pluractional verb*, cites the following description as a paradigm example of the phenomenon:

Many languages of the Nigerian Middle Belt display plural [i.e. pluractional] verb roots, which indicate that the verbal action is characterized by one or another kind of multiplicity: it can happen habitually; it can be executed by a certain number of subjects; it can be applied to a certain number of objects; it can continue over a longer period of time; or it can be performed at different places. (Gerhardt, 1984, p. 12)

Pluractional reduplication in Bininj Gun-wok also fits this description, which suggests (at least) two formal analyses. According to Lasersohn (1995), a pluractional verb is a predicate of a plural set of events—like a plural noun, e.g. *dogs* (pace Scha, 1984; Link, 1987). On this view, a pluractional verb says that there is a plural set of such-and-such events. A competing analysis, which we propose, is that a pluractional verb quantifies over a salient plural set of semantic objects (individuals, places, times, or whatever) and maps each object from that set to a different event. On this analysis, a pluractional verb says that for each object in the plural domain set there is a different such-and-such event. This truth condition is

In Evans’s data the pluractional (his ‘iterative’) reduplication is by far the most common. There are also examples of what he calls ‘inceptive reduplication’, which involves partial reduplication and indicates partial realization (e.g. *yame-* ‘spear’ > *yah+yahme* ‘try to spear’), and ‘extended reduplication’, which involves epenthetic disyllabic reduplication and indicates spatial distribution (e.g. *wirrkme-* ‘scratch’ > *wirri+wirrkme-* ‘scratch all over’). For ease of comparison we use the same glosses as for Polish (ftn. 1) and Kalaallisut (ftn. 6). In particular, we regloss Evans’s ‘augmented’ and ‘unit-augmented’ number as ‘plural’ (PL) and ‘dual’ (DU), respectively. This correctly represents the meaning for all persons except the first person inclusive (‘me, you, and possibly others’).

stronger than Lasersohn's. Discourse (4) shows that at least some instances of pluractional verbs are quantifiers, not predicates—i.e., the pluractional affix in Bininj Gun-wok is a Q-affix.

In (4i) the pluractional affix combines with *na-* 'see, look' to derive *nah+na-* 'watch'. Given the initial context either analysis seems viable. That is, in this context, *nah+na-* could say that there is more than one looking event. Alternatively, it might partition the result time of the aforementioned event (throwing fish poison into the water) into subintervals and say that, for each subinterval, there is a different (plural set of) looking event(s).

In (4iii), on the other hand, the pluractional verb '3PL/3.PST-body-get+get-PFV.PST' quantifies over a contextually salient plural set of individuals—to wit, the set of dead fish evoked in (4i). In this context, the two analyses make different predictions, and only the stronger, quantificational, analysis correctly predicts that for *every* fish, there is an event of one or more of the children getting the body of that fish.

In (4iv) the pluractional verb '3PL/3.PST-put+put-PFV.PST' is likewise quantificational. Here the quantification might be over the contextually salient plural set of fish bodies, evoked in (4iii). Alternatively, it might be over the likewise salient plural set of body-getting events—i.e. for *each* body-getting event there is a different event of putting that body into the billycan by the same agent (one or more of the children).

None of these three instances of the pluractional Q-affix in Bininj Gun-wok corresponds to an English Q-adverb. The instance in (4i) might be rendered by the English iterative verb *keep v-ing*, while the instances in (4iii) and (4iv) seem to correspond to English Q-determiners, *all* or *each*.

Thus, (our construal of) Partee's hypothesis, that all A-quantifiers quantify over the same type(s) of semantic objects as English Q-adverbs, is empirically incorrect for Q-affixes. In general, it seems to us problematic to oppose one category (D-quantifiers) to all others (A-quantifiers). As the counterexamples in (2)–(4) illustrate, it is difficult to formulate semantic generalizations about an unnatural syntactic class. Although Partee's notion of 'A-quantifier' is often cited (e.g. Bach *et al.*, 1995; Filip, 1999; Evans, 2003; etc), it has not led to the discovery of any crosslinguistic semantic generalizations that characterize A-quantifiers—i.e. the class of Q-adverbs, Q-auxiliaries, and Q-affixes—as opposed to Q-determiners. Moreover, an unnatural syntactic class, which mixes dissimilar categories, obscures semantic generalizations that characterize each category—e.g. Q-determiners as well as other determiners, or verbal Q-affixes as well as other verbal affixes. We therefore do not use Partee's terminology, opting instead for a terminology that highlights both the morpho-syntactic category (*determiner, adjective, adverb, auxiliary, verbal affix*, etc) and the quantificational semantics (*Q-*).

In pursuit of semantic universals about categories and quantifiers, we focus on a universal category, *verb*, and the quantificational sub-category, *Q-verb*—i.e., a complex verb containing one or more Q-roots and/or Q-affixes. Paradigm examples of Q-affixes include the exhaustive affix in ASL (2), the distributive *po-* in Polish (3), the reduplicative pluractional affix in Bininj Gun-Wok (4i, iii, iv), as well as assorted derivational suffixes used to express

quantification in the polysynthetic Eskimo-Aleut language Kalaallisut⁵ of Greenland—e.g., in (5i)⁶, the *cn*\iv-suffix *-kkutaar* ‘v in units of *cn*’⁷, the *rn*\cn-suffix *-gii* ‘set of *rn*-relata’⁸, and in (5iii), the *rn*\cn-suffix *-lliq* ‘-most’⁹.

(5) Kalaallisut (Eskimo-Aleut: Greenland)

- i. *Ullumi atuartitsigama*
ulluq-mi atuar-tit-si-ga-ma
 day-SG.LOC study-cause-apass-FCT_T-1SG
 Today in my class (*lit.* when I was causing some individual(s) to study)
atuartut marlukkuutaarlutik suliqatigiipput.
atuar-tuq-t marluk-kkuutaar-llu-tik suliqat-gii-g-pu-t.
 study-iv\cn-PL two-v.in.units.of-ELA_T-3PL_T work-mate-set-cn\iv-IND.IV-3PL
 the students_T worked together (*lit.* with each other) in pairs.
- ii. *Suliqatigiit tamarmiullutik*
suliqat-gii-t tamaq-mik-u-llu-tik
 work-mate-set-PL all-pl_T-be-ELA_T-3PL_T
 The groups_T were all_T
assigiinngitsunik sammisaqarput.
assi-gii-g-nngit-tuq-nik sammi-gaq-qar-pu-t
 copy-set-cn\iv-not-iv\cn-PL.MOD work.on-tv\rn-have-IND.IV-3PL
 working on different (*lit.* unlike each other) tasks.
- iii. *Annakkut siulliullutik inirput.*
Anna-kku-t siu-lliq-u-llu-tik inir-pu-t.
 Anna-&co-PL front-most-be-ELA_T-3PL_T finish-IND.IV-3PL
 Anna’s group_T finished first.

⁵ Other designations for this language include (*West*) *Greenlandic* (e.g. Kleinschmidt, 1851; Fortescue, 1984; Dahl, 1985; Bittner, 1987; van Geenhoven, 2004), *Inuit* (Bok-Bennema, 1991; Bittner, 1994), and *Eskimo* (Bergsland, 1955; Bittner, 1995). We prefer native speakers’ own designation, *Kalaallisut*, because it highlights the political status of this language as the official language—not a regional dialect—of a country, *Kalaallit Nunaat* (Greenland), as well as the linguistic relation to Inuktitut and other languages belonging to the Inuit branch of the Eskimo-Aleut family.

⁶ The Kalaallisut examples were observed and/or constructed by Bittner and then checked or translated by Trondhjem, who is native speaker. Kalaallisut has a great deal of fusion. For clarity, line 1 is in the Kalaallisut orthography minus allophonic variants (*e, o, f* of *i, u, v*); line 2 is the morphological analysis; line 3 are the glosses; line 4 is a free English translation. Abbreviations in the glosses for *matrix moods*: IND = indicative, IMP = imperative, NEG = negative, OPT = optative, QUE = interrogative; *dependent moods*: ELA = elaborating, FCT = factual, HAB = habitual, HYP = hypothetical, NON = non-factual; *case*: ABL = ablative, EQU = equalis (‘as, like’), ERG = ergative, MOD = modalis (modifier), VIA = vialis (path); *centering*: T = topic, ⊥ = background, IV = property of topic; TV = relation of topic to background; *derivation*: prf = perfect aspect, iv = intransitive verb, tv = transitive verb, cn = common noun, rn = relational noun, a\b = suffix that attaches to category *a* to form *b*.

⁷ E.g. *marluk-* ‘two’ > *marlukkuutaar-* ‘v in pairs’; *ilaqutarii-* ‘family’ > *ilaqutariikkutaar-* ‘v in family groups’; *suliqatigii-* ‘team’ > *suliqatigiikkutaar-* ‘v in teams’.

⁸ E.g. *suliqat-* ‘work mate of’ > *suliqatigii-* ‘work mates’, *nuliat-* ‘wife of’ > *nuliarit-* ‘husband and wife’.

⁹ E.g. *siu-* ‘front of’ > *siulliq* ‘first’; *at-* ‘bottom of’ > *alliq* ‘lowest’; *iluq-* ‘inside of’ > *ilurliq-* ‘innermost’.

In general, a Kalaallisut verb consists of a base—root plus any number of derivational suffixes (all in lower case)—followed by the mood inflection (e.g. ‘FCT_T’, for a familiar fact about the topical subject), verbal agreement (e.g. ‘1SG’), and any number of clitics (e.g. =*lu* ‘and’ in (22a)). Thus, in addition to any number of derivational Q-suffixes, Kalaallisut Q-verbs may contain Q-roots (e.g. *tamaq-* ‘all-’ in (5ii)).

English—an isolating language with few affixes—does not have Q-verbs. Since most current theories of discourse dynamics are based on English, the dynamics of Q-verbs has so far received little attention, although we now have formally precise theories of the dynamics of English Q-determiners (e.g., Kamp and Reyle, 1993; van den Berg, 1994; Dekker, 2003; Nouwen, 2003), English modals and attitude reports (e.g. Kibble, 1994; Frank, 1996; Stone, 1997; Geurts, 1999; Brasoveanu, 2007), as well as temporal anaphora by English verbs (e.g. Kamp and Reyle, 1993; Stone, 1997).¹⁰

The research on the dynamics of English Q-categories and English verbs illuminates the crosslinguistic dynamics of Q-verbs and vice versa. The present paper is an in-depth study of the dynamics of Q-verbs in Kalaallisut discourse, with supplementary evidence from Bininj Gun-wok and Polish. Unlike Partee (1991, 1995), we do not think that semantic generalizations are best stated in structural terms. So instead of LF-based semantics, we opt for direct surface-based interpretation. This is possible using the tools of recent dynamic theories, especially anaphoric presupposition (van der Sandt, 1992; Geurts, 1999; etc.), centering (e.g. Stone and Hardt, 1999; Bittner, 2001; Nouwen, 2003), incremental update (Bittner, 2003, 2007a), and quantification as discourse reference (e.g. van den Berg, 1994; Stone, 1997; Bittner, 2007a).

The basic idea of quantification as reference can be traced to Carlson (1977), who analyzes English bare plurals as reference to a (*global*) *kind*—technically an individual, but in one-one correspondence with a function from all worlds and times to the set of all instantiating objects. Van den Berg (1994) assimilates English Q-determiners (e.g. *every*) to collective transitive predicates (e.g. *jointly collect*), by modeling information states as plural sets of assignments. A Q-determiner relates two discourse referents, each assigned a set of individuals by the set of assignments that constitute the input state of information. Both discourse referents are available for anaphora in subsequent discourse. Brasoveanu (2007) extends van den Berg’s approach to quantification and anaphora by English modals. An alternative discourse referential approach has been developed by Stone (1997), who instead of plural information states uses discourse referents for functional dependencies—e.g. modals evoke functions from worlds to various types of objects. Extending Stone’s approach, Bittner (2007a) analyzes habitual quantification in Kalaallisut discourses like (6) in terms of reference to modally and spatio-temporally localized habits and kinds. Formally, a (*local*) *habit* is a function that sends each instantiation world and time to the instantiating episode. Similarly, a (*local*) *kind* sends

¹⁰ All of these authors claim to theorize about ‘(natural) language’, but they only present evidence from English—an oddly parochial view of natural language semantics.

each instantiation world and episode to the instantiating nominal object (individual, time, place, or proposition).

- (6) i. *Ataataga skakkirtarpuq.*
ataata-ga skakki-r-tar-pu-q.
 dad-1SG.SG chess-do-habit-IND.IV-3SG
 My dad^T plays chess.
- ii. *Aqaguani uqarajuttarpuq:* iii. “*Ajugaa-simavunga.*”
aqagu-a-ni uqar-gajut-tar-pu-q “*ajugaa-sima-pu-nga*”
 next.day-3SG_L.SG-LOC say-often-habit-IND.IV-3SG “win-prf-IND.IV-1SG”
 The next day he_T often says: “I won.”
- iv. *Siullirmik uanga tamanna qularaara.*
siu-lliq-mik uanga tamanna qulari-pa-ra
 front-most-SG.MOD I that doubt-IND.TV-1SG.3SG
 The first time I^T doubted it_L.

Bittner (2007a) interprets the Kalaallisut discourse (6) directly, by incremental update. More precisely, sentence (6i) *evokes*—i.e. introduces a discourse referent for—a habit instantiated by processes where the currently topical individual (the speaker’s father) plays chess. The indicative mood (IND) presupposes current verifiability. To satisfy this, the habit must be instantiated in the speech reality by the time of the speech act. In addition, the evoked habit is required to be current at the *topic time* (aka *reference time*)—here, the speech time, by discourse-initial default.

Sentence (6ii) evokes a real (IND) reporting habit of the topical individual. The reporting events which instantiate this habit occur at times of the currently topical kind. What this amounts to depends on how we resolve the anaphoric presupposition of the quantifier *-gajut* ‘often’. On one reading, for many chess games the topical kind of time is instantiated once during the day after the game. On another reading, for each chess game the topical kind of time is instantiated many times during the day after the game. (The English translation is similarly ambiguous.) In either case, in each reporting event the agent expresses a certain kind of proposition. The discourse referent for this propositional kind is elaborated by the direct quote (6iii). In every world where the proposition expressed in the current reporting event is true, the reporting agent at the time of the reporting event is in the result state (evoked by perfect aspect, pace Moens and Steedman, 1988) of winning the previous day’s chess game.

Referents for habits and kinds support instantiating anaphora. Thus, in (6iv) the initial NP (‘front-most-SG.MOD’) evokes the first event that instantiates the aforementioned reporting habit and updates the topic time to the result time of this event. The subject NP ‘I’ updates the topical individual to the speaker, while the object NP ‘that’, a modal instantiating anaphor, updates the background to the proposition expressed in this first reporting event (i.e. the

proposition that instantiates the aforementioned kind of proposition in this event). Finally, the verb relates all of these discourse referents: it evokes a real (IND) state of doubt experienced, at the current topic time (the result time of the first reporting event), by the topical individual (the speaker of (6)) in relation to the background modality (the reported proposition).

We propose that not only habituais, but all Q-verbs involve discourse reference to *distributive verbal dependencies*—i.e. functions that send each element of a plural domain set to a different episode. The analysis we outlined for the Bininj Gun-wok discourse (4) could be implemented in these terms. For Kalaallisut (5) this basic idea can be spelled out as follows.

In sentence (5i) the chain of Q-verbs, jointly equivalent to ‘work together in pairs’, sets up a discourse referent for a pair-dependent process. First, the topic-elaborating Q-verb (ELA_T) sets up a discourse referent for a pair-dependent episode. The domain of this distributive verbal dependency is a set of pairs that cover the currently topical students. The matrix Q-verb (IND) further specifies this dependency: each pair is mapped to a real (IND) process in which the members of the pair work with each other as team mates.

In sentence (5ii) the subject NP updates the individual topic to the set of the teams. The topic-elaborating Q-verb (ELA_T) evokes a team-dependent state that all the teams experience at the same time. The matrix verb (IND) specifies this dependency: each team is mapped to a state of the team working on a task that differs from the task of any other team.

The instantiating anaphora in (5iii) can then be analyzed along the same lines as in (6iv). The subject NP updates the individual topic to Anna’s group. The topic-elaborating Q-verb (ELA_T) presupposes an ordered set of states. In (6iv) this anaphoric presupposition can be linked to final sub-states of the aforementioned team-dependent states of the teams working on their respective problems. The Q-verb evokes the first of these final sub-states and updates the topic time to its duration. It also identifies the experiencer of this state as the currently topical (plural) individual—Anna’s group. This, in turn, requires Anna’s group to be in the domain of the presupposed team-dependent final sub-states. The matrix verb (IND) further specifies this state of the topical group as the time when the group finishes its work. The overall effect is similar to the English *be the first to finish*, except that the syntactic dependency is reversed.

In general, we propose that Q-verbs are a natural semantic sub-class of verbs. In terms of discourse reference, what characterizes verbs is that they evoke episode(-valued function)s (Bittner, 2003, 2007a, b). Q-verbs are the sub-class of verbs that evoke *distributive* episode-valued functions—i.e. functions that send each element of a plural domain set to a different episode. In terms of tripartite structures, our domain set corresponds to the restriction (domain of quantification). This need not consist of episodes, but can be of any type (contra Partee, 1991, 1995). Our range set corresponds to the set of verbal episodes that get existentially bound (\exists) in the nuclear scope. In Heim’s dynamics there is no discourse referent for this set. Therefore, it cannot be correlated with the domain set or anaphorically referred to in any way in subsequent discourse. In our dynamics it can be (as in Stone, 1997, and related work).

The paper is structured as follows. In section 2 we present a crosslinguistic discourse referential theory of verbs (extending Bittner, 2007b). In section 3 we apply this theory to Q-verbs, by factoring in distributivity. We then show that discourse anaphora to distributive verbal dependencies explains some otherwise puzzling characteristics of Q-verbs—to wit, scope behavior (section 4), quantificational domain and force (section 5), and instantiating anaphora (section 6). Section 7 presents our conclusions and predictions for other Q-categories.

2 DISCOURSE REFERENTS FOR VERBS

Of the three languages in our sample, Kalaallisut, which has no grammatical tense (Shaer, 2003; Bittner, 2003, 2005, 2007a, b), has the most explicit aspectual system. In addition to *events* and *states*—basic aspectual types, familiar from binary perfective/imperfective systems (see Kamp, 1979; Kamp and Rohrer, 1983)—the aspectual system of Kalaallisut distinguishes two functional types, *processes* and *habits*. Processes are complex episodes that support stage-anaphors (e.g. *next*).¹¹ To represent this, we model processes as functions that send each discourse-transparent stage (event), except the end, to the next stage. Habits support predictions and instantiating anaphors (e.g. *the first time*). To capture these phenomena, we model habits as functions that send each instantiation world and time to the instantiating episode. In Kalaallisut, discourse anaphora aligns these four aspectual types with corresponding nominal types—*events* with *atomic animates*; *states* with *atomic inanimates*; *processes* with *pluralities*; and *habits* with *kinds* (contra e.g. Mourelatos, 1978; Bach, 1986). Section 2.1 briefly introduces this discourse-referential theory of Kalaallisut verbs, which is developed more fully in Bittner (2003, 2005, 2007a, b).

In section 2.2 we use centering—i.e. prominence-ranking of discourse referents (Grosz *et al.*, 1995; Stone and Hardt, 1999; Bittner, 2001, 2007a)—to extend this theory to Polish and Gun-wok, both of which have a binary perfective/imperfective system.¹² In Polish this grammaticalized aspectual system does not distinguish *episodes* from *habits* (Klimek, 2006). Moreover, in episodic contexts it gives primary prominence to the two basic aspectual types, *events* (perfective) and *states* (imperfective) (cf. Kamp and Rohrer, 1983, on French), and only secondary prominence to functional types, such as *processes*. A semantic universal that holds across this linguistic diversity is that the most prominent discourse referent of a verb is an episode (event, state, or process) or an episode-valued function (pace Bittner, 2003, 2007a).

¹¹ In Aristotelian/Vendlerian theories the term *process* is restricted to atelic activities (e.g. Mourelatos, 1978; Bach, 1986; Parsons, 1990). We follow ordinary English, where *process* implies stages but not (a)telicity.

¹² The terminology *perfective/imperfective* was originally introduced for Slavic (by Miklosich, 1926–73, reprinted from 1868–1875) but has since been used for a variety of other aspectual contrasts (see Dahl, 1985, for a sample). We analyze Polish as a paradigm example (Bininj Gun-wok seems similar) and leave other varieties of (im)perfective systems for future research.

2.1 Kalaallisut

The inflectional system of Kalaallisut distinguishes three categories of words: *nouns*, which inflect for case and nominal agreement (for possessor and number, e.g. *-ga* ‘1SG.SG’ in (6i)); *verbs*, which inflect for mood and verbal agreement (for subject and object, e.g. *-ra* ‘1SG.3SG’ in (6iv)); and *particles*, which do not inflect. In the theory of incremental update developed by Bittner (2003, 2007a) the categories *noun* and *verb*—distinguished by all languages at the sentence level, albeit not necessarily the word level (see Jelinek, 1995)—have semantic import. The most prominent discourse referent of a verb is of a verbal type: an episode or episode-valued function (e.g. a habit). Analogously, the most prominent discourse referent of a noun is of a nominal type: a nominal object (individual, time, place, or proposition) or nominal object-valued function (e.g. a kind). Verbal inflections presuppose that the most prominent referent of the base is of a verbal type, while nominal inflections presuppose that it is of a nominal type.

As already mentioned, Kalaallisut does not have any grammatical tense. Instead, verbs are lexically typed for aspectual type—the type of the most prominent referent of the verbal base—which can be a *state*(-valued function), *event*(-valued function), *process*(-valued function) or *habit*(-valued function). Verbal inflections relate the topmost referent of the verbal base, in accordance with its aspectual type, to the currently topical referents—individual, modal, and temporal. Of these, individual and modal topics are constrained by the anaphoric presuppositions of the verbal inflections for agreement and mood. In effect, not only individual and modal reference, but also temporal reference, is as precise as in English (see Bittner 2003, 2005, 2007a, b, for detailed evidence and analysis).

We now turn to describe the Kalaallisut system of verbal inflection (section 2.1.1) and lexical aspect (2.1.2), and outline an analysis of both in terms of discourse reference.

2.1.1 Verbal inflection. Kalaallisut verbs inflect for mood and agreement with the subject as well as the object. There are two separate mood paradigms, one for matrix verbs and another for dependent verbs. Matrix moods relate the speech event—more precisely, the current perspective point—to the topical modality. The *indicative* mood (7a) identifies the speech event as a report of a fact; the *negative* mood (7b) identifies it as a report of a non-fact; and the *interrogative* mood (7c), as an act of asking a question. The topical modality for all of these epistemic moods is the speech reality. In contrast, future-oriented moods concern the speaker’s desires rather than beliefs. The *optative* mood (7d) identifies the speech event as an expression of a wish, while the *imperative* mood (7e) identifies it as a request that the addressee realize the topical modality the speaker desires during the result state of this speech act. In each case the subject agreement identifies the currently topical individual (T), while the object agreement identifies the most prominent individual in the background (\perp).¹³

¹³ In the English translations, the introduction of a new topic or background is marked with the superscript \top or \perp ,

- (7) a. *Juunap asavaanga.*
Juuna-p asa-pa-anga
 Juuna-SG.ERG love-IND.TV-3SG.1SG
 Juuna^τ loves me_⊥.
- b. *Juunap asanngilaanga.*
Juuna-p asa-nngit-la-anga
 Juuna-SG.ERG love-not-NEG-3SG.1SG
 Juuna^τ doesn't love me_⊥.
- c. *Juuna, asavinga?*
Juuna asa-pi-nga.
 Juuna love-QUE-2SG.1SG
 Juuna^τ, do you_τ love me_⊥?
- d. *Juuna sinilli.*
Juuna sinig-li-Ø
 Juuna be.asleep-OPT-3SG
 Let Juuna^τ sleep.
- e. *Juuna, sinilluarit!*
Juuna sinig-lluar-Ø-t
 Juuna be.asleep-well-IMP-2SG
 Juuna^τ, sleep well!

The dependent moods classify the background circumstances of the matrix situation as *factual* (8a, b), *non-factual* (9), *hypothetical* (10a, b), *habitual* (11a, b), or *elaborating* (12a, b). In addition, dependent mood inflections encode the centering status of the dependent subject, which can be either topical (_τ)—i.e. anaphoric to the matrix subject—or backgrounded (_⊥).

- (8) a. *Ole angirlarami ulapilirpuq*
Ole angirlar-ga-Ni ulapig-lir-pu-q
 Ole come.home-FCT_τ-3SG_τ be.busy-begin-IND.IV-3SG
 When/because Ole^τ came home he_τ got busy.
- b. *Ataata angirlarmat Ole ulapilirpuq.*
ataata angirlar-mm-at Ole ulapig-lir-pu-q
 dad come.home-FCT_⊥-3SG_⊥ Ole be.busy-begin-IND.IV-3SG
 When/because Dad[⊥] came home Ole^τ got busy.
- (9) *Ole itissanani sinippuq.*
Ole itir-ssa-na-Ni sinig-pu-q
 Ole wake.up-prospect-NON_τ-3SG_τ be.asleep-IND.IV-3SG
 Ole^τ is fast asleep. (lit. without prospect of waking up)
- (10) a. *Ole angirlaruni ulapilirumaarpuq.*
Ole angirlar-gu-Ni ulapig-lir-jumaar-pu-q
 Ole come.home-HYP_τ-3SG_τ be.busy-begin-be.sure-IND.IV-3SG
 When/if Ole^τ comes home he_τ is sure to get busy.

and anaphora to the input topic or background, with the subscript _τ or _⊥, to give some idea of the discourse function of the grammatical (re)centering system in the Kalaallisut original.

- b. *Ataata angirlarpat Ole ulapilirumaarpuq.*
ataata angirlar-pp-at Ole ulapig-lir-jumaar-pu-q
 dad come.home-HYP_⊥-3SG_⊥ Ole be.busy-begin-be.sure.to-IND.IV-3SG
 When/if Dad[⊥] comes home Ole[⊥] is sure to get busy.
- (11) a. *Ole angirlaraangami ulapilir(ajut)tarpuq.*
Ole angirlar-gaanga-Ni ulapig-lir(-gajut)-tar-pu-q
 Ole come.home-HAB_⊥-3SG_⊥ be.busy-begin(-often)-habit-IND.IV-3SG
 When Ole[⊥] comes home he_⊥ (often) gets busy.
- b. *Ataata angirlaraangat Ole ulapilir(ajut)tarpuq.*
ataata angirlar-gaang-at Ole ulapig-lir(-gajut)-tar-pu-q
 dad come.home-HAB_⊥-3SG_⊥ Ole be.busy-begin(-often)-habit-IND.IV-3SG
 When Dad[⊥] comes home Ole[⊥] (often) gets busy.
- (12) a. *Olep uqarvigaanga ulapinnirarluni*
Ole-p uqar-vigi-pa-anga ulapig-nirar-llu-NI
 Ole-SG.ERG say-to-IND.TV-3SG.1SG be.busy-say-ELA_⊥-3SG_⊥
 Ole[⊥] told me_⊥ he_{se} was busy (i.e. Ole said to me: “I am busy.”)
- b. *Aanip uqarvigaanga Ole ulapittuq*
Aani-p uqar-vigi-pa-anga Ole ulapig-tu-q
 Ann-SG.ERG say-to-IND.TV-3SG.1SG Ole be.busy-ELA_⊥.IV-3SG_⊥
 Ann[⊥] told me_⊥ Ole[⊥] was busy.

Topic-elaboration (ELA_⊥) is of particular importance for this study because Q-verbs often play this role (as in (5i, ii, iii)). Unlike other dependent verbs, topic-elaborating verbs do not evoke situations of their own. Instead they are anaphoric to the verbal head they elaborate, forming a verbal chain whose elements evoke and further specify the same situation.

Thus, in (12a) the matrix verb (IND) introduces an event in which the topical individual (Ole) speaks. This event is the antecedent for the following topic-elaboration (ELA_⊥), which further specifies it as an event of claiming to be busy. The indicative mood on the matrix verb marks this event as a fact—i.e. according to the current beliefs of the speaker of (12a), it is an event that has actually happened.

In Kalaallisut topic-elaborating dependent clauses can either follow the head verb, as in (12a), or precede it, as in (13). Typical semantic relations between a topic-elaborating dependent verb and the elaborated head verb include identity (as in (12a)) or concurrence (as in (13)). In general, the modal and temporal location of the head situation is determined directly, by the morphological marking on the head verb, while the location of the dependent situation is determined indirectly, via its semantic relation to the head.

- (13) *Nuannaarluni* *angirlarnirarpa.*
nuannaar-llu-ni *angirlar-nirar-pa-a*
 be.happy-ELA_T-3SG_T come.home-say-IND.TV-3SG.3SG
 A. He_T reported him_I to have come home happy.
 B. He_T happily reported him_I to have come home.

Modulo distributivity, topic-elaborating Q-verbs instantiate the same generalizations. For example, in (5i) and (5ii), the topic-elaborating Q-verbs (‘two-v.in.units.of-ELA_T-3PL_T’ and ‘all-be-ELA_T-3PL_T’) specify the same verbal referents as their respective matrix verbs. That is, the semantic relation is identity—parallel to (12a), modulo distributivity. (12a) evokes a single episode (an event), whereas in (5i) and (5ii) the topic-elaborating Q-verbs evoke distributed episodes—pair-dependent processes in (5i), and pair-dependent states in (5ii). In (5iii) the topic-elaborating Q-verb (‘front-most-be-ELA_T-3PL_T’) is concurrent with the head verb (‘finish-IND.IV-3PL’). That is, this topic-elaboration is analogous to (13), modulo distributivity. In this case the Q-verb evokes a distributive verbal dependency via an anaphoric presupposition. More precisely, the elaborating Q-verb in (5iii) presupposes a distributive state-valued dependency. This anaphoric presupposition is linked to the aforementioned pair-dependent state evoked by the stative Q-verb (‘all-pl_T-be-ELA_T-3PL_T’) in (5ii).

In general, topic-elaborating verbs may enter into anaphoric verbal chains as either antecedents or anaphors. The anaphoric link may involve the semantic relation of identity or concurrence, and the antecedent verb may be either in the same sentence or in prior discourse. In particular, these generalizations hold for topic-elaborating Q-verbs, as discourse (5) attests.

2.1.2 *Lexical aspect and temporal anaphora.* Temporal anaphora in Kalaallisut relies on lexical typing of verbal roots and derivational verbal suffixes for aspectual type. In episodic discourse, temporal anaphora in Kalaallisut distinguishes three aspectual types: *states*, *events*, and *processes*. Of these, states and events have no discourse-transparent proper parts, whereas processes consist of two or more discourse-transparent stages (events). Each aspectual type behaves in a distinctive way in relation to temporal anaphora—a complex of phenomena that determine, e.g., temporal defaults, temporal location, and temporal update (see Bittner, 2007b).

For example, in relation to temporal location, Kalaallisut exhibits a three-way contrast, which extends the familiar two-way contrast found in perfective/imperfective systems (Kamp, 1979; Kamp and Rohrer, 1983; see also section 2.2 below). As expected, states hold at the currently topical period (14a, b), while events fall within the topical period (15a, b). Extending this pattern, processes have a designated stage (event) which falls within the topical period (16a, b). The designated stage depends on the discourse relation (Lascarides and Asher, 1993). A causal relation favors stage one (i.e. process begins during the topical period), while a non-causal relation may favor a later stage (process already in progress).

- (14) a. *Ataata angirlarmat, sinippunga.*
ataata angirlar-mm-at sinig-pu-nga
 Dad come.home-FCT₁-3SG₁ be.asleep-IND.IV-1SG
 When Dad¹ came home I¹ was asleep.
- b. *Ataata angirlarmat, anisimavunga.*
ataata angirlar-mm-at ani-sima-pu-nga
 Dad come.home-FCT₁-3SG₁ go.out-prf-IND.IV-1SG
 When Dad¹ came home I¹ was out.
- (15) a. *Ataata angirlarmat, anivunga.*
ataata angirlar-mm-at ani-pu-nga
 Dad come.home-FCT₁-3SG₁ go.out-IND.IV-1SG
 When Dad¹ came home I¹ went out.
- b. *Ataata angirlarmat, sinilirpunga.*
ataata angirlar-mm-at sinig-lir-pu-nga
 Dad come.home-FCT₁-3SG₁ be.asleep-begin-IND.IV-1SG
 When Dad¹ came home I¹ fell asleep.
- (16) a. *Ataata angirlarmat, allakkat allappakka.*
ataata angirlar-mm-at allagaq-t allag-pa-kka
 Dad come.home-FCT₁-3SG₁ letter-pl write-IND.TV-1SG.3PL
 When Dad¹ came home I¹ {wrote, was writing} a letter (pl).
- b. *Ataata angirlarmat, tiiliurpunga.*
ataata angirlar-mm-at tii-liur-pu-nga
 Dad come.home-FCT₁-3SG₁ tea-make-IND.IV-1SG
 When Dad¹ came home I¹ {made, was making} tea.

According to the theory of Bittner (2007b), the first clause of (14)–(16) updates the topic time to a (*discourse*) *period*: the time of a *state* (here, result state of the home coming). Discourse-initially, the topic time is a (*discourse*) *instant*, the time of the speech *event*, by default. The distinction between topical (*discourse*) periods and topical (*discourse*) instants makes no difference for locating states. States hold at the topic time, be it a period (14a, b) or an instant (17). But the difference is important for other episodes. Relative to topical instants, events and processes are not located directly, but via result states. That is, discourse-initially, an event is located so that its result state holds at the speech instant (18) (cf. (15a, b)); and a process, so that the result state of the designated stage holds (19) (cf. (16a, b)).

22 *Quantification: A Cross-Linguistic Perspective*

(17) *Ataata sinippuq.*
ataata sinig-pu-q
 Dad be.asleep-IND.IV-3SG
 Dad is asleep.

(18) *Ataata anivuq.*
ataata ani-pu-q
 Dad go.out-IND.IV-3SG
 Dad is out.

(19) *Ataata tiiliurpuq.*
ataata tii-liur-pu-q
 Dad tea-make-IND.IV-3SG
 Dad {is making, ??has made} tea.

Turning now to habitual discourse, habits are understood to be current at the topic time. In this respect, they behave like states and some processes. But in contrast to both of these episodic types, habits need not be instantiated at the topic time, as (20) and (21) attest:

(20) {*Niaqunguvunga,* *Niaqungusarpunga.*}
 {*niaquq-ngu-pu-nga,* *niaquq-ngu-tar-pu-nga*}
 {head-have.aching-IND.IV-1SG head-have.aching-habit-IND.IV-1SG}
 {I have a headache (*state*), I have headaches (*habitual states*)}

(21) *Ole {skakkirpuq,* *skakkirtarpuq.}*
Ole {skakki-r-pu-q skakki-r-tar-pu-q}
Ole {chess-do-IND.IV-3SG, chess-do-habit-IND.IV-3SG}
*Ole {is playing chess (*process*), plays chess (*habitual processes*)}*

Moreover, habits, unlike episodes, can be temporally located not only in relation to topical periods and instants, but also in relation to topical kinds of time. For each instance of the topical kind of time, the episode instantiating the habit is located in accordance with its aspectual type (see (6) and (11a, b) above, as well as (22a) and (23a) below).

Kalaallisut explicitly distinguishes habits from episodes. Habituality is marked by the habitual mood inflection (‘-HAB’ in (11a, b)) or a habitual derivational suffix (e.g. *-tar* ‘habit’). A habitual suffix is required in unambiguously habitual contexts. These include the obligatory topic-elaboration of the habitual verbal base par excellence, *iliqquri-* ‘be in the habit of’ (22a), as well as environments where the temporal topic is a kind of time—usually set by the habitual mood (‘HAB’ in (11a, b)) or a temporal noun in an oblique case (e.g. ‘most-PL.VIA’ in (23a)):

- (22) *Juunap* *iliqqurilirsimavaa*
Juuna-p *iliqquq-gi-lir-sima-pa-a*
 Juuna-SG.ERG habit.of-rn\|tv-begin-prf-IND.TV-3SG.3SG
 Juuna^T has formed the habit of
- a. *ataatanilu* *skakkirtarluni.*
ataata-ni=lu *skakki-r-tar-llu-Ni*
 dad-3SG_T.SG=and chess-do-habit-ELAT-3SG_T
 [playing chess with his_T father]_L.
- b.* *ataatanilu* {*skakkirluni*, *skakkiqattaarluni*}
ataata-ni=lu {*skakki-r-llu-Ni*, *skakki-r-qattaar-llu-Ni*}
 dad-3SG_T.SG=and {chess-do-ELAT-3SG_T, chess-do-cyclic.process- ELAT-3SG_T}
- (23) [Ole^T plays chess.]
- a. *Amirlanirtigut* *ajugaasarpuq.*
amirlaniq-tigut *ajugaa-tar-pu-q*
 most-PL.VIA win-habit-IND.IV-3SG
 He_T mostly wins.
- b.* *Amirlanirtigut* {*ajugaavuq*, *ajugaaqattaarpuq*}
amirlaniq-tigut {*ajugaa-pu-q*, *ajugaa-qattaar-pu-q*}
 most-PL.VIA {win-IND.IV-3SG, win-cyclic.process-IND.IV-3SG}

In discourse referential terms, (22b) is ruled out because an episode is of the wrong type to be anaphorically linked to a habit (function from worlds and times to episodes). Similarly, (23b) is out because an episode cannot be located in relation to a kind of time (function from worlds and episodes to times). A process is still an episode, albeit a complex one (successor function on discourse-transparent stages). Therefore, processes (e.g. ‘chess-do-’ as well as the *-qattaar* verbs in (22b) and (23b)) are ruled out, just like basic events (e.g. ‘win-’ in (23b)). Only a properly marked habit (*-tar* or other habitual suffix) will do.

Van Geenhoven (2004) conflates the process suffix *-qattaar* with the habitual suffix *-tar*, misidentifying both as markers of ‘temporal pluractionality’.¹⁴ According to her analysis, which is similar to Lasersohn’s (1995), but recast in an interval-based semantics, *-qattaar* and *-tar* are alike up to the number of repetitions, which *-qattaar* requires to be ‘large’, while *-tar* merely requires to be plural. But then it is a mystery why *-tar* is acceptable in habitual contexts (grammatical (22a) and (23a)), whereas *-qattaar* is not (ungrammatical (22b) and (23b)). As we will see (in section 3.3), there are also other problems with van Geenhoven’s (2004) theory of ‘temporal pluractionality’.

¹⁴ As we understand Newman (1990), ‘temporal pluractionality’ is a contradiction in terms. What distinguishes a pluractional affix from iterative aspect and the like is that the domain of quantification is underspecified for semantic type (recall Bininj Gun-wok discourse (4)). But then it cannot also be specified as temporal.

Further information on aspect-based temporality in Kalaallisut can be found in Bittner (2003, 2005, 2007a, b). The bottom line is that the lexical aspectual system of Kalaallisut distinguishes three types of episodes—states, events, and processes—as well as habits. The system is tenseless but conveys temporal anaphora as precisely as the English tense system.

2.2 (Im)perfectivity as aspectual centering

Indeed, many generalizations about aspect-based temporal anaphora hold for Kalaallisut as well as English. Bittner (2007b) conjectures that they hold universally (*aspectual universals*) and uses them to construct a crosslinguistic theory of aspect-based temporality. One question that arises is how the binary perfective/imperfective system might fit into this theory.

For example, in relation to temporal location in episodic discourse, Polish (P) exhibits not three patterns, like Kalaallisut, but two (pace Kamp, 1979; Kamp and Rohrer, 1983). Imperfective (IPF) verbs evoke *states*, which hold at the topic time (see (24a), (25a), (26a), (27a)). In contrast, perfective (PFV) verbs evoke (*basic*) *events*, which fall within the topic time (see (24b), (25b), (26b), (27b)).

(24) a. *Jak wróci-li=śmy, Jasia bola-ła głowa.*
 P when return^{PFV}-PST.PL=1PL Jaś.ACC ache^{IPF}-PST.SG.F head.F
 When we got back, Jaś had a head ache.

b. *Jak wróci-li=śmy Jasia rozbola-ła głowa.*
 when return^{PFV}-PST.PL=1PL Jaś.ACC get.bad.ache^{PFV}-PST.SG.F head.F
 When we got back, Jaś got a bad head ache.

(25) a. *Jak wróci-li=śmy, Jaś zasypia-ł.*
 P when return^{PFV}-PST.PL=1PL Jaś fall.asleep^{IPF}-PST.SG
 When we got back, Jaś was falling asleep.

b. *Jak wróci-li=śmy Jaś zasną-ł.*
 when return^{PFV}-PST.PL=1PL Jaś fall.asleep^{PFV}-PST.SG
 When we got back, Jaś fell asleep.

(26) a. *Jak wróci-li=śmy, Jaś (już od paru godzin) pracowa-ł nad swoją książką.*
 P when return^{PFV}-PST.PL=1PL Jaś (already from a.few hours.GEN) work^{IPF}-PST.SG over own.SG.INS book.INS
 When we got back, Jaś {was working, had already been working for a few hours}
 on his book.

- b. *Jak wróci-li=śmy, Jaś (przez parę godzin)*
 when return^{PFV}-PST.PL=1PL Jaś (across a.few hours.ACC)
po-pracowa-ł nad swoją książką.
 [dist-work^{IPF}]^{PFV}-PST.SG over own.SG.INS book.INS
 When we got back, Jaś did a bit of work (for a few hours) on his book.

- (27) a. *Jak wróci-li=śmy Adam robi-ł herbatę.*
 P when return^{PFV}-PST.PL=1PL Adam make^{IPF}-PST.SG tea.ACC
 When we got back, Adam was making tea.
- b. *Jak wróci-li=śmy Adam zrobi-ł herbatę.*
 when return^{PFV}-PST.PL=1PL Adam make^{PFV}-PST.SG tea.ACC
 When we got back, Adam made some tea.

As these examples illustrate, the binary *state*(IPF)/*event*(PFV) contrast holds regardless of the Aristotelian/Vendlerian class and (a)telicity. Orthogonal aspectual phenomena have led some scholars to propose ‘two-component theories of aspect’ (Smith’s, 1991, term), which distinguish ‘grammatical’ (or ‘view point’) aspect from ‘lexical’ (or ‘Aktionsart’) aspect (e.g. Vendler, 1957; Comrie, 1976; Dowty, 1979; Dahl, 1985; Smith, 1991). However, Kalaallisut expresses both by means of the same lexical system of derivational aspectual suffixes, which all derive verbal bases that are aspectually typed as *state*, *event*, *process*, or *habit*. This favors a one-component theory (pace e.g. Moens and Steedman, 1988; Krifka, 1992; Kamp and Reyle, 1993). To analyze both systems we need two basic aspectual types, *events* and *states* (pace Kamp, 1979; Kamp and Rohrer, 1983; Partee, 1984), plus an open class of episode-valued functions. *Episodes* comprise states, events and telic as well as atelic *processes* (pace Moens and Steedman, 1988). In discourse, processes support stage-anaphors (e.g. *next*). Accordingly, they are modeled as successor functions on discourse-transparent stages.

One advantage of this theory is an ontology based on intuitive aspectual primitives: *events* and *states*. All languages recognize this aspectual contrast and many grammaticalize it in various ways (see e.g. Kamp and Rohrer, 1983, on *passé simple* vs. *imparfait* in French; Bittner and Hale, 1995, on verbs vs. nouns in Warlpiri; Bohnemeyer, 2002, on verbs vs. stative predicates in Yukatek Maya; etc). In any language basic *events* and *states*, as well as higher aspectual types such as *processes* and *habits*, can be empirically identified by means of diagnostic tests based on aspectual universals of temporal anaphora (Bittner, 2007b). These make universal predictions about temporal location in relation to topical discourse periods (e.g. (14)–(16), (24)–(27)), topical discourse instants ((17)–(21)), and topical kinds of time ((11a, b), (23a), (30)–(32)), temporal update (all of the above), discourse-initial temporal defaults, etc.

In contrast, two-component theories are based on language-specific diagnostics. For instance, in Vendlerian theories the English progressive and temporal *in/for*-phrases provide empirical diagnostics for *states*, *achievements*, *activities*, and *accomplishments* in English.

Unfortunately, other languages have no translation-equivalents with the same aspectual behavior (e.g. the English *for*-phrase corresponds to an *od* ‘from’-phrase in Polish (26a), but to a *przez* ‘across’-phrase in Polish (26b)). It is therefore not clear what semantic relation, if any, a class A_1 of *verb phrases* that one author (e.g. Dowty, 1979) identifies as ‘accomplishments’ in language L_1 (English) by L_1 -specific diagnostics (good in the progressive; imperfective paradox; good with temporal *in*-phrases; bad with *for*-phrases) bears to a class A_2 of *verbs* that another author (e.g. van Geenhoven, 2004) identifies as ‘accomplishments’ in language L_2 (Kalaallisut) by L_2 -specific diagnostics (unknown). We do not know how to answer such questions. Therefore, we do not see how to identify Vendler’s aspectual classes beyond English in absence of empirical diagnostic tests based on universal semantic phenomena.

There is one more reason to base our theory of aspect on the universals of temporal anaphora. The resulting aspectual ontology—set of episode(-valued function)s based on *events* and *states* plus *worlds*, *times*, *places*, and *individuals*—has the right structure to analyze very different aspectual systems. For instance, to get from the four-way lexical system of Kalaallisut to the binary perfective/imperfective system grammaticalized in Polish and Biniñj Gun-wok, all we need to do is to factor in *centering*—i.e. prominence-ranking of discourse referents (see Grosz *et al.*, 1995; Walker *et al.*, 1998; Stone and Hardt, 1999; Bittner, 2001, 2007a; Nouwen, 2003; etc). More precisely, we propose that the most prominent referent of an imperfective verb is a state. In contrast, for a perfective verb, it is an event on the episodic reading, and an event-valued habit on the habitual reading. Binary semantic contrasts that correlate with the grammatical perfective/imperfective form (e.g. temporal location in Polish (24a, b)–(27a, b)), target the most prominent discourse referent of the verb (the primary state of the imperfective verb in (24a)–(27a), and the primary event of the episodic perfective verb in (24b)–(27b)).

We assume that each morpheme may contribute up to two discourse referents (Bittner, 2003, based on crosslinguistic text studies available at <http://www.rci.rutgers.edu/~mbittner>). So in addition to its primary referent, a verb may also have a less prominent referent—e.g. for a real or intended process (chain of events or event concepts; see Bittner, 2007a). This can be used to draw aspectual parallels orthogonal to the perfective/imperfective dichotomy—e.g. about process verbs. By definition, a process verb supports stage-anaphors (e.g. ‘next’). In virtue of its primary referent, a perfective verb like ‘make^{PFV}’ (or imperfective ‘make^{IPF}’) behaves like a basic event (or state) in relation to temporal anaphora in (27b) (or (27a)). But both (27b) and (27a)—glosses repeated in (28i)—can be elaborated as in (28ii, iii). The stage-anaphors *najpierw* ‘first’ in (28ii) and *następnie* ‘next’ in (28iii) are linked to the first two discourse-transparent stages of the secondary (intended) process referent evoked—in addition to its primary event or state referent—by the antecedent verb, ‘make^{PFV}’ or ‘make^{IPF}’, in (28i).

- (28) [i. when return^{PFV}-PST.PL=1PL, Adam {make^{PFV}-PST.SG, make^{IPF}-PST.SG} tea.ACC]
 P ii. *Najpierw zagrza-ł czajniczek.*
 first warm.up^{PFV}-PST.SG teapot.ACC
 First he warmed up the teapot.
 iii. *Następnie wsypa-ł trochę dobrej herbaty.*
 next pour.in(dry)^{PFV}-PST.SG a.bit good.SG.GEN tea.GEN
 Next he poured in some fine tea leaves.

That the secondary process of the imperfective ‘make^{IPF}’ in (27a) is intended (chain of event concepts), not necessarily real (chain of events), is shown by the possibility of further continuation in (28iv, v), which denies the realization of the complete process. Following Bittner (2007a, b), we model an intended process as a function that sends each stage-concept, except the last, to the next-stage-concept. The realization of each successive stage-concept is contingent on the realization of the preceding concept and is temporally located during its result state. Thus, realizing the first two stage-concepts (28ii, iii) is consistent with failure to realize the entire chain (28v). In contrast, the affirmative perfective ‘make^{PFV}’ in (27b) evokes a secondary process that is actually realized (chain of events). Therefore, (27b) cannot be coherently followed by the denial in (28v), on the pain of contradiction.

- (28) iv. *W tym momencie zadzwoni-ł telefon*
 P in that.LOC moment.LOC ring^{PFV}-PST.SG phone
 At that moment the phone rang
 v. *więc on w końcu tej herbaty nie=zrobi-ł*
 so he in end.LOC that.GEN tea.GEN not=make^{PFV}-PST.SG
 so in the end he didn’t make that [pot of] tea.

An imperfective verb with a secondary process-referent does not entail incomplete realization (pace Comrie, 1976; Dahl, 1985; among others). It need not even conversationally implicate it—as (29ii), noted by Labenz (2004), attests:

- (29) i. *Wie-m, jak się kończy “Effi Briest”,* ii. *czyta-ł=em.*
 P know^{IPF}-NPST.1SG how se end^{IPF}.NPST.3SG read^{IPF}-PST.SG=1SG
 I know how “Effi Briest” ends, I’ve read it.

Labenz proposes that, by default, an imperfective verb is interpreted like a perfective. But this fails to explain the temporal contrast between the imperfective (a) versus perfective (b) verbs in (24)–(27). On our analysis, this contrast instantiates an aspectual universal concerning the temporal location of states (a) versus events (b) in relation to a topical period. To extend this account to (29ii), we first note a difference in the context-setting clause—imperfective

present in (29i) versus perfective past in the *when*-clause of (24a)–(27a). This, in turn, implies a different discourse relation—*elaboration* vs. *explanation* (see Lascarides and Asher, 1993). In (24a)–(27a) the past imperfective state *holds at* the topic time set by the past *when*-clause (result time of the home coming). In discourse (29), on the other hand, the context-setting (29i) evokes a present state of knowledge. To anchor the anaphoric presupposition of the past tense in (29ii), the topic time must be updated to a salient past period—just before this state of knowledge. The primary state of ‘read^{IPF}’ in (29ii) is located in relation to this topical past. Thus, (29ii) evokes a state of the currently topical individual (the speaker) reading the end of “Effie Briest”—a reading-state whose termination *results in* the knowledge-state of (29i).

Last but not least, our theory also accounts for habitual discourse. In a habitual context the primary referent of an imperfective verb is the state counterpart of a secondary referent for a habit (e.g. habitual events in (30) or habitual states in (32a)). In contrast, the primary referent of a habitual perfective verb is an event-valued habit (i.e. habitual events as in (31) and (32b)).

(30) [There is no point in giving Johnny any new toys.]

- P i. *Jak tylko mu się daje nową zabawkę*
 when only him.DAT se give^{IPF}.NPST.3SG new.SG.ACC toy.F.ACC
 As soon as one gives him a new toy
- ii. *zaraz ją gubi.*
 immediately her.ACC lose^{IPF}.NPST.3SG
 he immediately loses it.

(31) [There is no point in giving Johnny any new toys.]

- P i. *Jak tylko mu da-sz nową zabawkę*
 when only him.DAT give^{PFV}-NPST.2SG new.SG.ACC toy.F.ACC
 The moment you give him a new toy
- ii. *zaraz ją zgubi.*
 immediately her.ACC lose^{PFV}.NPST.3SG
 he’ll immediately lose it.

- (32) a. *Jeśli kogoś dobrze zna-m to go na ogół lubi-ę*
 P if sbd well know^{IPF}-NPST.1SG then him usually like^{IPF}-NPST.1SG
 If I know somebody well, I usually like him.
- b. *Jeśli kogoś dobrze pozna-m to go na ogół polubi-ę*
 P if sbd well know^{PFV}-NPST.1SG then him usually like^{PFV}-NPST.1SG
 If I get to know somebody well, I usually get to like him.

Some habitual imperfective/perfective pairs, e.g. (30) and (31), have similar meanings. The imperfective (30) highlights the temporal correlation (hold at) and the overall state of

affairs. The perfective (31) suggests a causal correlation (result in) and perhaps for this reason sounds more like a prediction: if such-and-such event happens, such-and-such event will follow in its wake. For other pairs the meanings are clearly different—e.g. the imperfective (32a) correlates habitual states, whereas the perfective (32b) correlates habitual events.

To summarize the results so far: We have presented a discourse referential theory of verbs that provides a unified account of temporal anaphora in languages with very different grammatical systems. The surface form of each language is taken at face value. Instead of the controversial level of LF, semantic generalizations are captured by means of semantic tools. These include a universal ontology, based on *events*, *states*, *times*, *worlds*, *places*, and (*animate* or *inanimate*) *individuals*. They also include centering, i.e. prominence-ranking of discourse referents, and last but not least, universal constraints on basic meaning assignment.

Universally, a morpheme may introduce up to two discourse referents. If the morpheme is a verb or verb-forming affix then its most prominent referent must be an episode(-valued function). *Episodes* comprise basic *events* and *states* as well as higher-order *processes*. The latter support discourse anaphora to stages (events) and are formally modeled as successor functions on discourse-transparent stages.

This universal framework allows for considerable crosslinguistic variation. For example, Kalaallisut has two grammatical centering systems—one for individuals (e.g. ‘3SG_T’ vs. ‘3SG_I’), and one for topical modalities (grammatical mood). In addition, it has a lexical aspectual system, which types each verbal base according to the aspectual type of its primary referent, as *state::atomic inanimate*, *event::atomic animate*, *process::plural*, and *habit::kind*. In contrast, Polish and Bininj Gun-wok grammaticalize (re)centering for topic times (grammatical tense) and basic aspectual types (event-prominent perfective vs. state-prominent imperfective). This binary aspectual system provides empirical support for distinguishing two basic aspectual types, *events* and *states*, from an open class of episode-valued functions. The latter (*processes*, *habits*, etc) can still be introduced, as less prominent verbal referents. Thus, even very different linguistic systems can be communicatively equivalent.¹⁵

3 DISTRIBUTED REFERENTS FOR Q-VERBS

In this section we apply the discourse referential theory of verbs to the special case of Q-verbs by factoring in distributivity. We propose that Q-verbs evoke referents for *distributive* episode-valued functions. For instance, Q-verbs may refer to *processes*—functions that send each discourse-transparent stage (event), except the end, to the next stage; or to *habits*—functions

¹⁵ Bittner (2007b) applies this theory to English. She argues that English verbs are lexically underspecified for aspectual type, which is first determined by anaphoric interactions at a higher level (e.g. VP, pace Dowty, 1979).

that send each instantiation world and time to the instantiating episode. In addition to events, worlds, and times, the distribution may be over other semantic domains, e.g. individuals or places. That is, Q-verbs may refer to *distributed states* (e.g. (5ii)), *distributed events* ((2), (4)), *(distributed) processes* ((3), (5i)), or *(distributed) habits* ((6i, ii), (11a, b)). The exact type depends on the base and the affix that jointly form the Q-verb. Either of these elements, or both, may be distributive. If the base is verbal, its primary referent may be aspectually typed, e.g. in Kalaallisut, as a state(-valued function), event(-valued function), process(-valued function), or habit(-valued function). In Kalaallisut verbal suffixes that form Q-verbs are also aspectually typed if they evoke verbal referents of their own; otherwise, they preserve the aspectual type of the base. These various options give rise to a wide variety of Q-verbs, which we now proceed to illustrate.

3.1 Distributed states

Stative Q-verbs evoke discourse referents for distributed states, i.e., state-valued distributive dependencies. The domain can be of any type, e.g. entities (33), places (34), or times (35).

(33) [A: What's your weapon? B₁: A bow. A: And yours? B₂ replies:]

Pingasuulluta pisissimik sakuqarpugut.
pingasu-u-llu-ta pisissiq-mik saku-qar-pu-gut
 three-be-ELAT-1PL bow-SG.MOD weapon-have-IND.IV-1PL
 The three of us_T are (each) armed with a bow.

(34) [Canada^T is unlike Greenland.]

Kujataani narsaatiqartitirpuq.
kujata-a-ni narsaq-ut-qar-titir-pu-q
 south-3SG₁.SG-LOC plain-owned-have-dist-IND.IV-3SG
 In the south^T there are fields (*lit.* owned plains) everywhere_T.

(35) *Sapaatip akunnira kingulliq*
sapaat-p akunniq-a kingu-lliq-q
 Sunday-SG.ERG interval-3SG₁.SG rear-most-SG

Last week
arlaliriarlunga niaqunguvunga.
arlalik-riar-llu-nga niaquq-ngu-pu-nga
 several-v.cn.times-ELAT-1SG head-have.aching-IND.IV-3SG
 I had a headache several times.

Morphologically, the distributivity may be due to a plural nominal item (e.g. ‘three-’ in (33)), distributive verbal item (‘-dist’ in (34)), or both (e.g. ‘several-’ and ‘-v.cn.times’ in (35)). Stativity may stem from an adjacent stative item (e.g. ‘-be’ in (33), ‘-have’ in (34)), or from a more distant stative item (e.g. ‘-have.aching’ in (35)), whose anaphoric link to the Q-verb forces the Q-verb to refer to the same state-valued distributive dependency.

In discourse referential terms, the topic-elaborating Q-verb (ELA_T) in (33) evokes an individual-dependent state. The domain of this distributive dependency consists of three individuals, including the current speaker (B₂), all of whom experience their respective states at the same time. The matrix verb (IND) further specifies this distributive dependency: each individual in the domain is mapped to a state of being armed with a bow. In (34) the Q-verb refers to a place-dependent state with a field. These dependent states, with their respective fields, are distributed over a set of places that jointly constitute a cover of the currently topical area (south of Canada). Similarly, in (35) the topic-elaborating Q-verb (ELA_T) evokes a time-dependent state of the topical individual (the speaker). The states are distributed over several times within the currently topical period (last week). The matrix verb (IND) further specifies that each time in the domain is mapped to a different state of the topical individual having a headache.

Most distributive verbal suffixes in Kalaallisut are aspect-preserving, like *-titir* (34) and *-riar* (35). The aspectual type of the distributed episodes is determined via anaphoric chains with aspectually typed verbal items (here, with stative *-qar* ‘have’ in (34) and *-ngu* ‘have aching’ in (35)). The semantic type of the domain of the distributive dependency may also be underspecified and determined by anaphora. Thus, the suffix *-titir* may distribute either over places (as in (34)) or individuals (as in (36)). Typically, the domain of the distribution is topical (as in (34) and (36)), but it can also be backgrounded (e.g. plural object NP in (67iii)).

- (36) *Ndolami inuit tamangajammik marlunnik atiqartitirput*
Ndola-mi inuk-t tamaq-ngajak-mik marluk-nik ati-qar-titir-pu-t
 N.-SG.LOC person-PL all-almost-PL_T two-PL.MOD name-have-dist-IND.IV-3PL
 In Ndola, almost all the people^T have two names each_T
aappaa zambiamiutut aappaalu tuluttut.
aappa-a Zambia-miu-tut aappa-a=lu tuluk-tut
 mate-3SG_⊥.SG Zambia-inhabitant-EQU mate-3SG_⊥.SG=and Englishman-EQU
 one in the language of Zambia, and the other one (*lit.* its mate) in English.

Finally, recall that topic elaboration may involve either identity (12a) or concurrence (13). The latter relation allows a distributed state evoked by a topic-elaborating Q-verb to antecede a collective matrix verb. In (37) the narrator is a musher in a trans-Alaska race. In (37iii) the topic-elaborating stative Q-verb (-be-ELA_T)—similar to the Q-verb in (33)—evokes a state-valued distributive dependency. The domain of distribution is a salient plural set of

individuals who all experience their respective states at the same time. In (37iii) the domain set consists of all of the speaker's dogs at this point in the race. To satisfy the collective matrix verb (IND), the image set of the simultaneous states of being somewhere is taken to be part of a hypothetical state (-*gunar* 'be likely') where the dogs on one side of a scale are weighed against the bull moose on the other side.

- (37) [i. The bull moose^T was big.]
 ii. *Qimmikka tamarmik immikkut*
qimmi-kka tamaq-mik immi-kkut
 dog-1SG.PL all-PL_T self-SG.VIA
 My dogs^T each_T (*lit.* all individually)
30 kiilut sinnirlugit uqimaatsigipput,
30 kiilu-t sinnir-llu-git uqimaag-tsigi-pu-t
 30 kilo-PL exceed-ELA_T-3PL_⊥ weigh-that.much-IND.IV-3PL
 weighed over 70 pounds,
 iii. *pannirsuarlu taanna*
panniq-rsuaq=lu taanna
 bull-big.SG=and this
 and this great bull^L
qimmima tamarmiullutik uqimaaqatigunarpaat.
qimmi-ma tamaq-mik-u-llu-tik uqimaag-qat-gi-gunar-pa-at
 dog-1SG.PL.ERG all-pl_T-be-ELA_T-3PL_T weigh-mate-rn\|tv-be.likely-IND.TV-3PL.3SG
 probably weighed as much as all of my dogs_T put together.

Similarly, in Bininj Gun-wok (BG) the pluractional reduplicating Q-affix combines with stative verb stems (e.g. 'lie', 'be high', 'stink', 'hang') to evoke distributed states:

- (38) a. *Bene-red-ngalke-ng wirlarrk bokenh yongo-yo-y.*
 BG 3DU.PST-nest-find-PFV.PST egg two 3PST.lie+lie-PFV.PST
 They found a nest with two eggs. (Evans, 2003, (10.361))
 b. *Kabirri-barnh+barndi kardab.*
 3PL-be.high+be.high.NPST spider
 There are spiders up [on the wall]. (Evans, 2003, (10.370))
 c. *Ka-kord-nud-bana+banj*
 3-shit-rotten-stink+stink.NPST
 It stinks of rotten shit all around. (Evans, 2003, (9.151))
 d. *Ka-karrme marlakka ka-welh+welme kore ku-kom ngalengarre.*
 3-have.NPST bag 3-hang+hang.NPST loc LOC-neck her
 She has a bag hanging from her neck. (Evans, 2003, (10.270))

The distribution can be over a contextually salient plural set of individuals (38a), places (38b, c), or subintervals of the topical period (38d).

In sum, stative Q-verbs are structurally diverse but are nonetheless amenable to a unified semantic analysis in terms of discourse reference. They all evoke referents for distributed states—i.e. state-valued dependencies that send each semantic object in a contextually salient plural domain to a different state.

3.2 Distributed events

In Kalaallisut eventive Q-verbs are structurally parallel to stative Q-verbs. In discourse referential terms, eventive Q-verbs evoke referents for distributive event-valued dependencies, which send different objects in a contextually salient plural domain—e.g. salient pluralities (39), places (40), or times (41)—to different events.

- (39) *Marlukkuutaarluta* *aallaqatigiippugut.*
marluk-kkuutaar-llu-ta *aallar-qat-gii-g-pu-gut*
 two-v.in.units.of-ELA_T-1PL set.out-mate-set-cn\iv-IND.IV-1PL
 We_T set out in pairs.

- (40) *Kangirluarsuk* *iluliarujussuanitsitirpuq.*
kangirluarsuk *iluliaq-rujussuaq-nig-titir-pu-q*
 fiord.SG iceberg-huge-acquire-dist-IND.IV-3SG
 All over the fiord^T there appeared huge icebergs.

- (41) i. *Ullumi* *marluriarlunga* *puurtugarsivunga,*
 ullu-mi *marluk-riar-llu-nga* *puurtur-gaq-si-pu-nga,*
 day-SG.LOC two-v.cn.times-ELA_T-1SG wrap.up-tv\rn-get-IND.IV-1SG
 Today I_T got presents (*lit.* wrapped things) twice,
 ii *siullirmik* *maani,* *taavalu* *uqaluvvimmi.*
 siu-lliq-mik *maa-ni* *taava=lu* *uqaluvvik-mi*
 front-most-SG.MOD here-LOC then=and church-SG.LOC
 first here, and then in the church.

In (39) the topic-elaborating (ELA_T) Q-verb is aspectually neutral. It evokes an episode-valued dependency from a set of pluralities (pairs) that jointly cover the current individual topic ('we'). The anaphorically linked matrix verb (IND) further specifies this dependency: each pair is mapped to an event in which the pair sets out. The matrix verb is aspectually typed by the event-root, *aallar-* 'set out', whose aspectual type is preserved by the next three

suffixes. The nominal suffixes, *-qat* ‘mate’ and *-gii* ‘set of rn-relata’, form plurality-valued kinds instantiated in events of departure, while the aspect-preserving verbalizer *-g* forms a departure-valued dependency from the currently topical set of such pluralities (cf. stative (33)).

Similarly, in (40) the Q-verb refers to a place-dependent event of one or more huge icebergs appearing in that place. These appearing-events, with their respective icebergs, are distributed over a set of places that jointly cover the currently topical fiord (cf. stative (34)).

Finally, in (41) the speaker is a child at home on Christmas Eve. In (41i) the topic-elaborating Q-verb (ELA_T) evokes a time-dependent episode centered on this topical individual. The episodes are distributed over two (disjoint) times within the topical period (day of the speech event). As usual, the matrix verb (IND) further specifies this dependency: each time in the domain is mapped to a different event, within this temporal frame, when the topical participant (the speaker) gets one or more presents (cf. stative (35)). The post-posed ellipsis (41ii) specifies this dependency still further, by repeated instantiating anaphora.

Bininj Gun-wok exhibits similar patterns. For instance, recall discourse (4), where three pluractional event-verbs distribute their events over contextually salient times (4i), individuals (4ii), or other events (4iii). In each case, the reduplicating pluractional Q-affix combines with an event-base: *na-* ‘look, see’ in (4i), *me-* ‘get’ in (4ii), or *kurrme-* ‘put’ in (4iii).

In Polish (P) the input to the distributive Q-prefix *po-* must be an imperfective (state-prominent) verbal base with a non-stative secondary referent (e.g. *budowa-* ‘build^{IPF}’ in (3), *gubi-* ‘lose^{IPF}’ in (42iii), *oddawa-* ‘give.away^{IPF}’ in (42iv)). The output is a *po*-perfective (event-prominent) base with a secondary referent for a distributive event-valued function (42iii, iv) or a distributive process-valued function (recall (3)).

- (42) i. *Jaś dostał mnóstwo nowych zabawek na gwiazdkę.*
 P Jaś get^{PFV}-PST.SG tons.ACC new.PL.GEN toys.GEN on Christmas.ACC
 Jaś got tons of new toys for Christmas.
- ii. *Bardzo się cieszył ale*
 very se be.happy^{IPF}-PST.SG but
 He was very happy, but
- iii. *wkrótce większość po-gubił u różnych kolegów*
 soon majority.ACC [dist-lose^{IPF}]^{PFV}-PST.SG at various.PL.GEN friends.GEN
 he soon lost most of them, in quick succession, at various friends
- iv. *a resztę po-oddawał innym kolegom.*
 and rest.ACC [dist-give.away^{IPF}]^{PFV}-PST.SG other.PL.DAT friends.DAT
 and gave the rest away, one after another, to other friends.

In (42iii) the *po*-perfective Q-verb presupposes a salient plural set. This presupposition is linked to the object NP ‘majority.ACC’, which evokes a set containing most of the aforementioned toys. The Q-verb partitions this plural set into several subsets with one or more

toys in each subset. The secondary referent of the *po*-perfective Q-verb is a distributive event-valued dependency that maps each subset of toys to a different losing event. The primary event referent is an atomic event corresponding to the entire set of toy-losing-events. That is, it is an event in which the same agent (Jaś) loses the entire set of toys, temporally located in the minimal period that includes all of the losing-event times, and spatially located in the minimal place that includes all of the losing-event places. It is the primary referent of the *po*-perfective Q-verb, i.e. the atomic event, which is temporally located by the tense within a brief period after the aforementioned Christmas. But it is the secondary referent, for the distributive event-valued dependency, that is further specified by the modifier ‘at various friends’. This modifier evokes a distributive house-valued dependency, which maps each losing-event to the house of a different friend or friends of Jaś. That is, ‘various’ receives a dependency-internal reading. Since there are several losing events, there are also several houses—hence the plural number.

Similarly, in (42iv) the *po*-perfective Q-verb presupposes a salient plural set—this time, linked to the remaining set of toys (‘rest.ACC’). Again, the Q-verb partitions this plural set into a plural domain of quantification, consisting of several subsets with one or more toys, and maps each subset to a different giving-away-event. The set of the experiencers (DAT) is a plural set of Jaś’s friends, disjoint from the plural set evoked in (42iii).¹⁶

Thus, eventive Q-verbs are structurally heterogeneous, just like stative Q-verbs. But they, too, are amenable to a unified crosslinguistic analysis in terms of discourse reference. The only difference is that they evoke distributed events instead of distributed states.

3.3 (Distributed) processes

In the present ontology processes are episodes consisting of at least two discourse-transparent stages, where each stage is an atomic event. Formally, a process-chain is a distributive event-valued dependency that sends each discourse-transparent stage, except the end, to the next stage (and temporally locates the latter during the result state of the former). This accounts for the fact that process-verbs pattern like plural nouns in relation to discourse anaphora. In particular, both processes and pluralities support anaphora to discourse-transparent atomic parts (by stage-anaphors like *next*, or nominal atomic-part-anaphors like *one of them*).

The inherent distribution over stages implies that any verb with a process-suffix is a Q-verb. In Kalaallisut a case in point is the suffix *-qattaar*, which evokes cyclic processes (like *keep v-ing, one by one, up and down*, etc., in English). In (43ii) the topic-elaboration with *-qattaar* evokes a cyclic kissing process concurrent with the matrix event of Pippi bidding

¹⁶ Filip (1999) and Filip and Carlson (2001) propose alternative analyses of the Slavic distributive *po*-. Both analyses only consider the combination of a *po*-verb with its ‘incremental theme’ (ACC). It is not clear to us what they predict for (42) and other discourses in this study, so we do not attempt any theory comparison.

farewell to the sailors on her father's ship (43i). The cyclic kissing process in (43ii) is further specified by the object Q-NP, 'all-PL_⊥', and a path-modifier, 'forehead-3PL_⊥.PL-VIA'.

- (43) i. *Ullut ilaanni Pippip inuulluaqquai*
ulluq-t ila-at-ni Pippi-p inuu-lluar-qqu-pa-i
 day-PL.ERG part-3PL_⊥.SG-LOC Pippi-SG.ERG live-well-tell-IND.IV-3SG.3PL
 One day Pippi^T bid them_⊥ farewell
- ii. *tamaasa qaavisigut apaqattaarlugit.*
tamaq-isa qaa-isi-gut apa-qattaar-llu-git
 all-PL_⊥ forehead-3PL_⊥.PL-VIA kiss-cyclic.process-ELA_⊥-3PL_⊥
 kissing them all_⊥ one by one on the_⊥ forehead.

In discourse-referential terms, the object Q-NP 'all-PL_⊥' specifies that the experiencers of the successive kissing events that constitute the stages of this cyclic process add up to the entire plural set of sailors referred to in (43i). Given world knowledge, this suggests as many kissing events as sailors. The path-modifier (VIA) quantifies over the kissing events—i.e. stages of this cyclic process—mapping each kissing event to the forehead of its experiencer (the current sailor). The plurality of the kissing events accounts for the plurality of the foreheads.

Both of these NP-dependents of the *qattaar*-verb in (43ii) present problems for van Geenhoven (2004). On her analysis, 'kiss-*qattaar*-' denotes a relation that holds between a time interval t , a set-property P , and an individual a , just in case there is a P -set B and 'many' non-overlapping subintervals $t_1, \dots, t_n \subseteq t$ such that at each t_i , a kisses some individual $b \in B$.¹⁷ This is adequate for bare NP arguments, which is all that van Geenhoven considers. But it fails for quantified NPs, such as 'all-PL_⊥' in (43ii). Interpreted as a set-property (as in Partee, 1986; Link, 1987), 'all-PL_⊥' presumably holds of the entire set of sailors evoked in (43i). But then van Geenhoven's analysis is too weak: it only requires many times when Pippi kisses some sailor or other, possibly the same sailor every time. This is not a possible interpretation of (43ii). In addition, the path-NP (VIA) presents a compositionality problem. In van Geenhoven's terms, 'forehead-3PL_⊥.PL-VIA' modifies the kissing-relation that holds between a time and two atomic individuals, which is how she models events. Compositional modification would require rebracketing (43ii) at LF. This would violate lexical integrity, which some syntactic theories would consider sufficient reason to reject this analysis (e.g. HPSG, LFG). There is also a semantic reason to reject it because it fails to explain the plural agreement ('3PL_⊥.PL')—i.e. not

¹⁷ As van Geenhoven (2004) notes, this is an adaptation of Carlson's (1977:90–92) kind-based analysis of the scope contrast between *kill dogs for a year* vs. *#kill {a dog, some dogs} for a year*. Van Geenhoven's version in terms of properties is less general—it only accounts for bare NPs, not e.g. *some dogs*. Also, unlike Carlson's (1977) formally explicit and correct implementation, the few translations van Geenhoven (2004) spells out are formally incorrect, e.g. she conflates times with sets of times, writing '*dial(x, y) at t*' as well as '*number(t) > 1*'. We ignore her implementation and focus on the basic idea, which is intuitively coherent but empirically incorrect.

with one forehead, as rebracketing would predict, but with the entire plural set of foreheads. None of these problems arise in our surface-based analysis in terms of discourse reference to distributive dependencies.

In addition to the process-internal distribution over stages, entire processes can be distributed just like atomic events and states. Thus, (5i) evokes a set of processes (*suli-* ‘work’) distributed over groups, parallel to the set of events (*aallar-* ‘set out’) distributed over groups in (39). Similarly, (44) evokes a spatially distributed set of processes (*-liur* ‘make’), formed by the suffix *-titir*, which can also distribute basic events (40) as well as states ((34), (36)).

(44) [Denmark^T wanted to support the whaling industry in Greenland. So...]

1700-kkut naalirniranni

1700-kku-t naa-lir-nir-at-ni

1700-&co-PL end-begin-v\n-3PL_⊥.SG-LOC

at the end of the 18th century

Kalaallit Nunaata Kitaani

kalaalliq-t nuna-ata kita-a-ni

Greenlander-PL.ERG land-3PL_⊥.SG.ERG west-3SG_⊥.SG-LOC

arvanniarnirmut nunami stationiliurtitilirpuq.

arviq-niar-nir-mut nuna-mi stationi-liur-titir-lir-pu-q

whale-hunt-v\n-SG.DAT land-SG.LOC station-make-dist-begin-IND.IV-3SG

it_T began to build land-based whaling stations all over West Greenland.

The Polish sentence (3), with the distributive Q-prefix *po-*, is almost equivalent to Kalaallisut (44), but not quite. In both sentences an initial temporal modifier updates the topic time to a period in the late 18th century. The primary referent of the Q-verb—*po*-perfective in Polish (3), *-titir* verb in Kalaallisut (44)—is located in relation to this topic time. The most prominent referent is an atomic event, so it is located within the topic time (i.e. within the late 18th century). However, it is not the same event. In Polish (3) the primary event is evoked by ‘PFV’—i.e. it is the event-counterpart of the entire set of building events in the range of the spatially distributed dependency evoked by the Q-prefix *po-* (‘dist-build^{IPFV}’). Thus, Polish (3) is about the whaling stations that were established within the topical period at the end of the 18th century. In contrast, in Kalaallisut (44) the primary event is evoked by the last aspectual suffix, *-lir* ‘begin’. So it is only the first of the spatially distributed building events, evoked by the Q-suffix *-titir*, that is required to fall within the topical period (cf. ‘began to build’ in the English translation). Some of the whaling stations evoked in (44) could be built later.

In Kalaallisut (44) as well as Polish (3) the nominal argument of the Q-verb refers to a kind of whaling station planned in the context of this particular building project. In the present ontology this modally and spatio-temporally localized kind is a partial function that sends each pair of, one, a world where the building project is successfully realized and, two, a completed

building-process, to the whaling station that comes into existence in the final stage of this process.¹⁸ This predicts, correctly, that the whaling stations that instantiate this local kind are available for discourse anaphora. Kalaallisut (44) was found in a natural history book where the next sentence made precisely such an anaphoric reference (*Many of these land-based stations later grew into towns that we know nowadays in Greenland*).¹⁹ Polish (3) likewise supports such discourse anaphora to an aforementioned local kind.

Discourse reference to processes is also found in Bininj Gun-wok (BG). One construction that seems to set up a referent for a process combines verb incorporation (exemplified in (45a, b)) with pluractional reduplication, as illustrated in (46a, b). Semantically, the incorporated verb and the pluractional verb co-specify the same process—in (46a) a process in which the topical individual walks back and cries, in (46b) a process in which the topical individual whines while lying down. The perfective past inflection evokes a related atomic event and locates it in the topical past.

- (45) a. *Birri-kanj-yi-lobm-i-durnd-i*.
 BG 3PL.PST-meat-with-run-v\|v/v-return-PFV.PST
 They ran back with the meat. (Evans 2003, (12.37))
- b. *Ga-nalk-gi-wokdi*.
 3-cry-v\|v/v-speak.NPST
 She's crying and talking at the same time. (Evans 2003, (12.45))
- (46) a. *Nalk-kih-durn+durnd-i*
 BG 3.PST.cry-v\|v/v-return+return-PFV.PST
 He went all the way back crying. (Evans 2003, (12.36))
- b. *Ngiwkmih+ngiwkm-i-yo-y*.
 3.PST.whine+whine-v\|v/v-lie-PFV.PST
 He lay down, whining and whimpering. (Evans 2003, (12.42))

Thus, the hypothesis that Q-verbs evoke discourse referents for distributive episode-valued dependencies extends to processes. Because of the internal distribution within a process, the distributed episodes can be either the discourse-transparent stages of the process (as in Kalaallisut (42) and Bininj Gun-wok (46)) or entire processes (as in Kalaallisut (43) and Polish (3)).

¹⁸ Recall that Carlson (1977) models an intuitively different notion of a *global kind*—e.g., the kind instantiated by all possible whaling stations—as a total function that sends each world and time to the set of all instantiating objects in that world at that time. This implementation (or the neo-Carlsonian version in Chierchia, 1998) is not suited for the analysis of creation verbs proposed here in terms of Bittner's (2003, 2007a) theory of *local kinds*—e.g., in (44), a kind of whaling station referred to in the context of a particular building project.

¹⁹ Heide-Jørgensen, M. and K. Laidre. (2006). *Kalaallit Nunaanni ukiumi arferit* ('Greenland's Winter Whales'), p. 6. Ilinnisiorfik.

3.4 (Distributed) habits

Habits, like processes, have internal distribution, but their anaphoric behavior in discourse is different. Processes support discourse anaphora to atomic events that constitute their discourse-transparent stages. In contrast, (local) habits support predictions and anaphora to instantiating episodes, which can be of any aspectual type (state, event, or process). Accordingly, we model processes as successor functions on discourse-transparent stages, and (local) habits, as partial functions from instantiation worlds and times to the instantiating episodes. On this analysis, Q-verbs include verbs with habitual suffixes—e.g. the habitual mood inflection *-gaang(a)* as well as derivational habitual suffixes such as *-tar* ‘habit’, *-gajut* ‘often’, *-llattaaar* ‘sometimes’, etc.

For example, in (47) the initial topic-setting clause (47i) evokes a habitual state experienced by the aforementioned plurality in which the entire plurality is located within the aforementioned igloo. The plurality is promoted to topical status (3PL_T) and the temporal topic is updated to the kind of time instantiated, in each of these states, by the duration of the state. The matrix verb (47ii) evokes a correlated habitual state, instantiated at each time of the topical kind, by a state of the topical plurality being very cramped.

(47) [Their_I igloo^T was small.]

- | | | | |
|----|--|-----|--|
| i. | <i>Tamarmiugaangamik</i> | ii. | <i>tattunngajattarpaat.</i> |
| | <i>tamaq-mik-u-gaanga-mik</i> | | <i>tattug-ngajag-tar-pa-at</i> |
| | all-pl _T -be-HAB _T -3PL _T | | not.fit.in-almost-habit-IND.TV-3PL.3SG |
| | When they ^T were all [there], they _T almost couldn't fit in. | | |

Habits can also be instantiated by distributed episodes, evoked by any combination of Q-verbs. In discourse (48) the matrix verb (48iii) refers to a habit (*-tar*), which is co-specified by three anaphorically linked topic-elaborations (48i, ii, iv).

(48) [The little auk^T is a sea bird.]

- | | | | | |
|------|---|--|--|--|
| i. | <i>Immami</i> | <i>ataatsimuurlutik</i> | ii. | <i>katirsakkuutaarlutik</i> |
| | <i>imaq-mi</i> | <i>ataasiq-mut=Vr-llu-tik</i> | | <i>katirsa-kkuutar-llu-tik</i> |
| | sea-SG.LOC | one-SG.DAT=IV-ELA _T -3PL _T | | flock-v.in.units.of-ELA _T -3PL _T |
| | Gathering into flocks on the sea | | | |
| iii. | <i>mitsimagajuttarput</i> | iv. | <i>alluqattaartarlutik.</i> | |
| | <i>mit-sima-gajut-tar-pu-t</i> | | <i>allur-qattaar-tar-llu-tik</i> | |
| | land-prf-often-habit-IND.IV-3PL | | dive-cyclic.process-habit-ELA _T -3PL _T | |
| | they _T often settle down and dive again and again. | | | |

The first two topic-elaborations, in (48i) and (48ii), form an anaphoric chain that evokes and further specifies a habitual plurality-dependent event in which the plurality gathers on the sea

(48i) into a flock (48ii). For each world and episode where the currently topical little auk-valued kind is instantiated, the pluralities in the domain of this distributive dependency cover the set of birds of this local kind. The temporal topic is updated to the kind of time instantiated, for each gathering event, by the time of the result state. The matrix verb (48iii) evokes a correlated habitual state, whose temporal distribution includes many of the result times of the topical kind. For each flock, this correlated state is the result state of landing on the sea. Finally, the post-posed topic-elaboration (48iv) evokes a correlated habitual cyclic process in which the flock dives, over and over, in search of food.

We have argued that a local kind is a semantic object available for discourse reference (e.g. in Polish (3) and Kalaallisut (44)). This predicts that it should be possible to quantify over local kinds. And indeed it is, as shown by the following example of a set of local habits distributed over a plural set of local kinds of whales. That each kind is mapped to a different habit is shown by the possibility of continuing e.g. with *The most common kind is the narwhal*.

- (49) *Arvirit* *assigiinngitsut* *femtenit* *missaat*
arviq-t *assi-gii-g-nngit-tuq-t* *femten-t* *missa-it*
whale-PL.ERG copy-set-cn\iv-not-iv\cn-PL.ERG fifteen-PL.ERG vicinity-3PL_⊥.PL
About fifteen different kinds of whales
Kalaallit *Nunaata* *imartaani* *siumurniqarajupput.*
kalaaliq-t *nuna-ata* *imaq-taq-i-ni* *siumur-niqar-gajut-pu-t*
Greenlander-PL.ERG land-3PL_⊥.SG.ERG sea-of-3SG_⊥.PL-LOC see-passive-often-IND.IV-3PL
are commonly seen in the seas around Greenland.

In the present ontology local kinds are anaphorically and formally parallel to local habits. Both support predictions and instantiating anaphora (see section 6, and Bittner, 2007b). Another anaphoric parallel is quantification over local kinds (49) as well as local habits (50):

- (50) [Some people just hate foreigners.]
Qanurluunniit *iliurtaraluaruma*
qanuq=luunniit *iliur-tar-galuar-gu-ma*
how=or do-habit-...but-HYP_T-1SG
No matter how I behave
iliqqura *tamanna pissutigalugu* *saassuttuassavaannga*
iliqquq-ga *tamanna pissut-gi-llu-gu* *saassut-tuar-ssa-pa-annga*
habit-1SG.SG that cause-rn/tv-ELA_T-3SG_⊥ attack-always-prospect-IND.TV-3PL.1SG
they will always attack me because of that pattern of behavior.

In an (im)perfective system, which does not explicitly mark habits, habitual readings are instead induced by the context. For instance, in Polish (P) the Q-adverb ('sometimes') in (51i)

sets up a topical kind of time, inducing a habitual reading of the *po*-perfective verb in (51iv). This refers to a habit instantiated by distributed wounding events, where the distribution can be over individuals (as in episodic (42iii, iv)) and/or places (as in episodic (3)). In (51i) there is an anaphoric reference to this local habitual pattern ('that') as well as a related local kind ('mates'):²⁰

(51) [The artillery bombardment would go on like that for half an hour, or an hour.]

- P
- i. *Wpadnie czasem kula armatnia do okopu*
 fall.in^{PFV}.NPST.3SG sometimes shell artillery.SG (in)to trench.GEN
 Sometimes a canon shell would land in a trench
- ii. *i tu wybuchnie* iii. *połozy paru ludzi*
 and here explode^{PFV}.NPST.3SG put.down^{PFV}.NPST.3SG couple people.GEN
 and explode here—it would kill a couple of people
- iv. *po-kaleczy kilku.*
 [dist-wound^{IPF}]^{PFV}.NPST.3SG a.few.ACC
 and wound a few more.
- v. *Ale przyzwyczajeni już nic sobie z tego nie=robią towarzysze.*
 but accustomed.PL already nill *se* of that not=make^{IPF}.NPST.3PL mates
 But their mates, already used to it, wouldn't make much of that.

Imperfective verbs can have secondary referents for habits—e.g., in Bininj Gun-wok (BG), habitual events (52a), (distributed) habitual states (52b), or habitual processes (52c):

- (52) a. *An-h-djawa+djawa-n munguih an-me-ga.*
 BG 3/1-PRS-ask+ask-NPST always CL-food-GOAL
 He's forever asking me for food. (Evans, 2003, (5.71))
- b. *Gabarri-h-ningi+nin munguih gu-bolk-gudji.*
 3PL-PRS-sit+sit.NPST always LOC-place-one
 They always stay in one place (Evans, 2003, (9.148))
- c. *Na-kudji na-marladj ngiwkmih+ngiwkm-i-re-y.*
 MSC-one CL-orphan 3.PST.whine+whine-v\|v-go-IPF.PST
 An orphan was always [going around?] crying. (Evans, 2003, (12.34))

In sum, Q-verbs are a natural semantic class of verbs. What characterizes Q-verbs is discourse reference to *distributive* episode-valued dependencies, which map different elements of a contextually salient plural domain to different episodes. We now turn to show that this discourse referential analysis explains the characteristic behavior of Q-verbs in discourse.

²⁰ Korczak, J. (1957). *Król Maciuś Pierwszy* ('King Matt the First'). Nasza Księgarnia, Warszawa.

4 SCOPE OF QUANTIFICATION

In the nominal domain Q-NPs participate in scope interactions, whereas names and other referential NPs do not. On the present analysis, all NPs involve discourse reference. The difference is that Q-NPs evoke (i.e. introduce or are anaphoric to discourse referents for) distributive nominal-valued dependencies, which can interact scopally, whereas name-like NPs evoke atomic nominal types, which cannot. Similarly, in the verbal domain we predict a parallel distinction between Q-verbs, which evoke distributive episode-valued dependencies, and atomic episodic verbs, which evoke basic events or states.

4.1 Scopal independence

Two Q-verbs, or Q-affixes, may co-specify the same distributive dependency. In that case they are scopally independent, that is, neither is in the scope of the other.

For example, in Kalaallisut habitual Q-suffixes presuppose that the verbal base evokes a habit (Bittner 2007a). Two habitual Q-suffixes may occur in sequence (e.g. *-gajut-tar* ‘often-habit’ in (6ii), (11a, b), (48iii); or *-llattaar-tar* ‘sometimes-habit’ (53ii)), in which case they co-specify the distribution of the base habit. The first habitual Q-suffix (*-gajut* ‘often’ or *-llattaar* ‘sometimes’) locates the episodes instantiating the base habit at Q-many instances of the aforementioned kind of time (in discourse (53), evoked in (53i)). The second Q-suffix (*-tar* ‘habit’) sets up a new discourse referent for this temporal distribution—i.e. a new kind of time.

- (53) i. *Ataataga sapaatikkut isirtarpuq.*
ataata-ga sapaat-kkut isir-tar-pu-q.
 dad-1SG.SG Sunday-SG.VIA enter-habit-IND.IV-3SG
 My dad drops in on Sundays.
- ii. *Skakkirlattaartarpugut.*
skakki-r-llattaar-tar-pu-gut
 chess-do-sometimes-habit-IND.IV-1PL
 Sometimes we play chess.

Alternatively, a co-specifying anaphoric chain may consist of a topic-elaborating Q-verb and the elaborated Q-verb. Thus, (54) is truth conditionally equivalent to (53) but differs in information structure. The topic-elaborating Q-verb (54ii) evokes a habit of the topical plurality (the speaker and his father) that is instantiated at Q-many times of the aforementioned kind (54i). The matrix verb (54iii) further specifies that each episode instantiating the aforementioned habit (54ii) is a process in which the topical plurality plays chess.

- (54) i. *Ataataga sapaatikkut isirtarpuq.*
ataata-ga sapaat-kkut isir-tar-pu-q.
 dad-1SG.SG Sunday-SG.VIA enter-habit-IND.IV-3SG
 My dad drops in on Sundays.
- ii. *Ilaanniiriarluta* iii. *skakkirtarpugut.*
ilaanni-Vriar-llu-ta *skakki-r-tar-pu-gut*
 sometimes-v.with.cn.frequency-ELAT-1PL chess-do-habit-IND.IV-1PL
 Sometimes we play chess.

Anaphorically linked Q-verbs may co-specify any distributive verbal dependency. In (54ii, iii) the dependency is a habitual process, i.e. a set of processes (range of the dependency) is distributed over worlds and times (plural domain). In (23a), a set of atomic events is distributed in this way; in (5i), a set of processes is distributed over pluralities; in (35), a set of states is distributed over times; in (48iii, iv), a set of processes is distributed over pluralities, worlds, and times; and so on, and so forth. Anaphorically linked Q-verbs can also co-specify distributive verbal dependencies quantifying over places (55ii, iii) or individuals (56ii, iii):

- (55) [i. The next day we saw another island.]
 ii. *Qattunirasarhunilu* iii. *urpiqartitirpuq.*
qattuniq-gasaar-llu-Ni=lu *urpik-qar-titir-pu-q.*
 hill-have.everywhere-ELAT-3SGT=and tree-have-dist-IND.IV-3SG
 There were hills and trees everywhere.
- (56) [i. At once the Great Spirit called all the birds together.]
 ii. *Timmissat tuusintilikkuutaarlutik*
timmiaq-t tuusinti-lik-kkuutaar-llu-tik
 bird-PL thousand-with-v.in.units.of-ELAT-3PLT
 Birds by the thousands
 iii. *sumit tamaanga aggiapput.*
su-mit tamaq-anga aggir-at-pu-t
 what-SG.ABL all-ABL approach-simultaneously-IND.IV-3PL
 came flying, all at once, from everywhere.

An anaphoric chain that co-specifies a distributive verbal dependency may contain any number of Q-verbs and may affect the interpretation of the subsequent discourse. For instance, a habitual speech event or a multi-stage speech process—such as (6ii) or (57iii)—may induce a similarly distributed interpretation of a direct quote—i.e. an instance-dependent reading of (6iii) or stage-dependent reading of (57v). The instance-dependent interpretation of the quote in (6iii), induced by the habitual speech event of (6ii), has already been discussed (section 1).

- (57) i. *Ilitsirsuutit malittariniartillutigit,*
ilitsirsuut-t malittari-niar-tit-llu-tigit
 instruction-PL follow-try-state-ELA_T-1PL.3PL
 As we_T worked our way through [the instructions][±]
- ii. *Jimmip Tommillu tulliriiarlutik*
Jim-p Tom-p=lu tulliq-giiaar-llu-tik
 Jim-SG.ERG Tom-SG.ERG=and next-v.in.many.rm.pairs-ELA_T-3PL_T
 [Jim and Tom]^T by turns
- iii. *apiriqattaarpaannga* iv. *ilungirsuraluttuinnarlutik*
apiri-qattaar-pa-annga ilungirsur-galuttuinnar-llu-tik
 ask-cyclic.process-IND.TV-3PL.1PL struggle-increasingly-ELA_T-3PL_T
 kept asking me[±] with increasing desperation:
- v. “*Tullianik sussaanga?*”
tulliq-a-nik su-ssa-pi-nga
 next-3SG₁.SG-MOD do.what-prospect-QUE-1SG
 “What do I do next?”

In the episodic discourse (57) the initial topic-elaboration (57i) updates the topic time to the duration of an attempt by the topical plurality (we_T) to follow a set of instructions. The second topic-elaboration (57ii) promotes the sub-plurality of Jim and Tom to topical status (3PL_T) and evokes a cyclic process, with many cycles, each consisting of two events—an action by Jim followed by an action by Tom. The matrix verb (57iii) further specifies this distributive dependency: each stage of this cyclic process is an event whose agent asks the speaker a question. In addition, the post-posed topic-elaboration (57iv) specifies that at each successive stage the agent ranks one notch higher on a scale of increasingly desperate kinds of individuals (analyzing degrees as local kinds; see Bittner, 2003). In the context of this multi-stage speech process the direct quote in (57v) receives a stage-dependent interpretation—analogueous to the instance-dependent interpretation of the quote in (6iii) induced by the habitual speech event of (6ii). In (57v), for each stage of this speech process, the interrogative mood refers to the time of the current inquiry; the first person refers to the current speaker; and the stage anaphor ‘next-3SG₁.SG’ refers to the currently next stage—temporally located during the result time of the current inquiry—of the aforementioned process of trying to follow a set of instructions.

Similarly, in Bininj Gun-wok (BG) and Polish (P) Q-verbs can enter into co-specifying chains. The grammatical marking varies, but within each chain the antecedent Q-verb (e.g. (58iii) or (59iii)) is scopally independent of co-specifying anaphors in the same chain ((58iv) or (59iv)). In Bininj Gun-wok anaphoric chains with a pluractional and an incorporated verb co-specifying the same process (e.g. (46a, b)) also instantiate this general phenomenon.

- (58) i. *Worhna+worhna-ng* ii. *bi-na-ng* *na-ne*
 BG 3.PST.watch+watch-PFV.PST 3/3.PST-see-PFV.PST M-that
 iii. *ka-m-kud+kudme* iv. *ka-m-re+re* v. *bebme-ng*.
 3-hither-run+run.NPST 3-hither-go+go.NPST 3.PST.emerge-PFV.PST
 He kept watch until he saw him come running home. (Evans 2003, p. 688)

- (59) [i. A terrorist broke into a school and took ten hostages. ii. As it turned out later,]
 P iii. *wkrótce* *ich* *po-zabija-ł*
 soon them.ACC [dist-kill^{IPF}]^{PFV}-PST.SG
 he soon killed off every single one of them
 iv. *codziennie* *wykańcza-jąc* *po* *dwóch* *albo* *trzech*
 daily finish.off^{IPF}-IP dist two.ACC or three.ACC
 finishing off two or three a day
 w *coraz* *bardziej* *okrutny* *sposób*.
 in ever more cruel.SG.ACC manner.ACC
 in an increasingly cruel manner.

In sum, scopally independent Q-verbs can be understood in terms of co-specifying anaphora to a distributive verbal dependency. In contrast, it is not clear how to represent this phenomenon, which is common in natural language discourse, in terms of tripartite LFs.

4.2 Scope dependencies

In discourse referential terms, a Q-verb takes scope under (over) another element if the distributed episodes it evokes depend on the values (determine the arguments) of a functional referent evoked by that element.

In Kalaallisut (60iii) a temporal quantifier (oblique Q-NP or topic-elaborating Q-verb) is anaphorically linked to a habitual suffix (*-tar*) in the matrix verb. Together, they co-specify the temporal distribution of a habit—world- and time-dependent victory. The habitual suffix, and hence the entire anaphoric chain, is in the scope of a *de se* report suffix (*-nirar* ‘say’). The report suffix evokes a real (IND) speech event in which the topical individual (the speaker’s father) expresses a certain proposition. That is, in addition to the referent for this speech event, the report suffix evokes a modal referent for the class of worlds where the reported proposition is true. The reported winning habit is located in this class of worlds. Since the report may be false, this class need not include the speech reality, even though the reported winning habit is temporally correlated with a real chess playing habit (cf. habitual report in (6)).

- (60) [i. My dad_T plays chess.]
 ii. *Siurna arnami uqaluqatigimmani*
siurna arna-mi uqalu-qat-gi-mm-ani
 last.year mother-3SG_T.SG.ERG talk-mate-rn\|tv-FCT_⊥-3SG_⊥.3SG_⊥
 Last year when his_T mother_⊥ spoke with him_T
 iii. {*ilaannikkut, ilaanniiriarluni*}
 {*ilaanni-kkut ilaanni-Vriar-Ilu-Ni*}
 {sometimes-VIA, sometimes-v.with.cn.frequency-ELA_T-3SG_T}
ajugaasarnirarpuq.
ajugaa-tar-nirar-pu-q
 win-habit-say-IND.IV-3SG
 he_T said he_{se} sometimes won.

In Kalaallisut a temporal NP in the path-case (VIA) refers to a kind of time (e.g. (60iii), (53i)). An NP in the modifier-case (MOD) can refer to any kind. Depending on the nominal base, it can be a kind of time or place (e.g. a kind instantiated with small intervals, see (61iii)), a kind of animate (e.g. ‘woman-SG.MOD’ in (62ii)), a kind of inanimate (e.g. ‘torch-SG.MOD’ in (64iii)), or a kind of proposition (e.g. a kind that is instantiated in states of intent and sends any such state to the proposition that the experiencer of this state is currently in the result state of an event of getting one or more bears, evoked by ‘bear-get-prf-v\|n-3SG_T.SG-MOD’ in (64iv)).

- (61) [i. My dad_T plays chess.]
 ii. *Siurna arnami uqaluqatigimmani*
siurna arna-mi uqalu-qat-gi-mm-ani
 last.year mother-3SG_T.SG.ERG talk-mate-rn\|tv-FCT_⊥-3SG_⊥.3SG_T
 Last year when his_T mother_⊥ spoke with him_T
 iii. *akulikitsumik ajugaasarnirarpuq.*
aku-lik-kig-tuq-mik ajugaa-tar-nirar-pu-q
 interval-with-have.small-iv\|cn-SG.MOD win-habit-say-IND.IV-3SG
 he_T said he_{se} frequently (*lit.* with small intervals) won.

In (61iii) the temporal modifier-NP sets up a topical sub-kind (instantiated with small intervals) of the aforementioned kind of time when the topical individual (he_T) plays chess. It thereby specifies the distribution of the winning habit (-*tar*) in the scope of the *de se* report (-*nirar*) just like the temporal path-NP in (60iii), except for a different quantificational force.

In (62ii) the animate modifier-NP (‘woman-SG.MOD’) evokes a (local) kind of woman, i.e. a function that sends each instantiation world and episode to the woman who instantiates this (local) kind in that episode in that world.

- (62) [i. Juuna^τ is impossible!]
 ii. *Sapaatip akunnira kingulliq unnuit tamaasa*
sapaat-p akunniq-a kingu-lliq-q unnuk-t tamaq-isa
 Sunday-SG.ERG interval-3SG_⊥.SG rear-most-SG evening-PL all-PL_⊥
 Last week every evening
arnamik allamik angirlaassiqattaarpuq.
arna-mik alla-mik angirlar-ut-si-qattaar-pu-q
 woman-SG.MOD other-SG.MOD come.home-with-apass-cyclic.process-IND.IV-3SG
 he_τ came home with a different woman.

This kind-level NP is anaphorically linked to the antipassive suffix (-*si*) in the scope of the cyclic process-forming *-qattaar* on the matrix verb (IND). That is, the evoked process is real (from the point of view of the speech event) and has a cyclic structure consisting of events where the currently topical individual (Juuna) comes home with the woman who instantiates the aforementioned MOD-kind in that event in the speech reality. The modifier ‘other’ receives a kind-internal interpretation, i.e. the kind is instantiated by different women in different events that constitute stages (cycles) of this process. Sentence (62ii) is thus interpreted as an elaboration of sentence (62i), so this discourse is coherent.

In contrast, in (63ii) the unmarked object NP (‘woman-SG’) antecedes singular object agreement on the verb (‘3SG.3SG’). In episodic contexts—including complex episodes, such as cyclic processes—singular agreement requires the referent to be a particular individual. But if the same woman must be involved in each stage (home-coming event) of the process, then the anaphoric presupposition of ‘other’ cannot be resolved. Therefore, there is no sensible discourse relation between sentences (63i) and (63ii), so this discourse is incoherent.

- (63) [i. Juuna^τ is impossible!]
 ii. # *Sapaatip akunnira kingulliq unnuit tamaasa*
sapaat-p akunniq-a kingu-lliq-q unnuk-t tamaq-isa
 Sunday-SG.ERG interval-3SG_⊥.SG rear-most-SG evening-PL all-PL_⊥
 Last week every evening
arnaq alla angirlaatiqattaarpaa.
arna-q alla-q angirlar-ut-qattaar-pa-a
 woman-SG other-SG come.home-with-cyclic.process-IND.TV-3SG.3SG
 he_τ came home with this_⊥ other woman.

In habitual—especially generic—contexts all NPs can refer to kinds (pace Bittner, 1995; contra Bittner, 1987, and van Geenhoven, 2004). Singular agreement on the verb then favors an individual-dependent reading, distributed over the individuals of the kind evoked by the agreeing (subject or object) NP. Thus, the salient interpretation of discourse (64)—with the

process-forming *-qattaar* in the scope of the habitual *-tar*—evokes a habitual cyclic process distributed over bear hunters.

- (64) i. *Kapirlattumi* *piniartuq* *nannussimatilluni*,
kapirlag-tuq-mi *piniar-tuq-q* *nanuq-g-sima-tit-llu-Ni*
 be.arctic.night-iv\cn-SG.LOC hunt-iv\cn-SG bear-get-prf-state-ELAT-3SGT
 During the arctic night when a hunter_T has killed a bear
- ii. *nunaqqatini* *tikikkiarturtillugit*
nuna-qar-qat-ni *tikik-iar-tur-tit-llu-git*
 land-have-mate-3SGT.PL arrive-go.to-process-state-ELAT-3PL_⊥
 and is approaching his_T fellow villagers_⊥
- iii. *qaammartartumik* *ikitsiqattaartarpuq*,
qaammartartu-mik *ikit-si-qattaar-tar-pu-q*
 torch-SG.MOD turn.on-apass-cyclic.process-habit-IND.IV-3SG
 he_T keeps flashing a torch,
- iv. *kalirrinniarlugit* *nannussimanirminik*.
kalirrig-niar-llu-git *nanuq-g-sima-nir-mi-nik*
 alert-intend-ELAT-3PL_⊥ bear-get-prf-v\cn-3SGT.SG-MOD
 (intending) to alert them_⊥ that he_{se}'s got a bear.

That is, for each instantiation world and time, each hunter in the result state of killing one or more bears (initial topic-elaboration (64i)) and in the process of approaching his fellow villagers (second topic-elaboration (64ii)) is mapped to a cyclic process (*-qattaar* under *-tar* in (64iii)). Each cycle of this process is an event in which the hunter turns on the torch that instantiates, in this cycle (kind-anaphor *-si* ‘apass’ under *-qattaar*), the aforementioned kind evoked by the modifier NP (MOD). World knowledge suggests that the same torch is likely to be used throughout this cyclic process on a given hunting trip, but kind-level reference, generally associated with the modifier-case (MOD) in Kalaallisut, suggests that a given hunter may use different torches in cyclic processes instantiating this habit on different hunting trips. The same holds for the proposition-valued kind evoked by the final modifier-NP (in the post-posed topic-elaboration (64iv)), which specifies the propositional object of the concurrent state of intent.

Mutatis mutandis, this account extends to scope dependencies involving other types of Q-verbs—e.g. habitual place- and plurality-dependent states evoked in (65).

- (65) i. *Kalaallit Nunaanni*
kalaaliq-t nuna-at-ni
 Greenlander-PL.ERG land-3PL_↓.SG-LOC
 In Greenland
nunakkut angalasut ilaanniiriartutik
nuna-kkut angala-tuq-t ilaanni-Vriar-llu-tik
 land-SG.VIA travel-iv\cn-PL sometimes-v.with.cn.frequency-ELAT-3PL_↑
 travelers by land sometimes
- ii. *tammartarput*
tammar-tar-pu-t
 get.lost-habit-IND.IV-3PL
 get lost
- iii. *qaqqat ilai assigiaartitirtarmata*
qaqqa-t ila-it assi-giaar-titir-tar-mm-ata
 mountain-PL.ERG part-3PL_↓.PL copy.of-v.in.many.rn.pairs-dist-habit-FCT_↓-3PL_↓
 because everywhere there are mountains_↓ that are all alike.

Neither Polish nor Bininj Gun-wok has recursive morphology that would allow one verbal Q-affix to be scopally embedded under another. Although Bininj Gun-wok is polysynthetic like Kalaallisut (i.e. an average word consists of many morphemes; Sapir, 1921), its morphology is not recursive but templatic, i.e. it imposes an upper limit on a well-formed verbal word (twenty slots, according to Evans, 2003, p. 318). The template does not allow for scopal embedding of Q-affixes, only co-specification (as in (46a, b), (52c)). But other languages with productive Q-affixes and recursive morphology provide evidence of scope dependencies parallel to Kalaallisut—e.g. (66a, b, c, d) in ASL (Poizner *et al.*, 1987):

- (66) a. $a[student]_{TOP}$, *book Ann give_a-exhaustive*
 ASL Ann gave a book to each student.
- b. *give-[[exhaustive] durational]*
 give to each in turn, that action recurring over time
- c. *give-[[durational] exhaustive]]*
 give continuously to each in turn
- d. *give-[[[durational] exhaustive] durational]*
 give continuously to each in turn, that action recurring over time

In sum, scope dependencies involving Q-verbs are amenable to a direct surface-based account. In discourse referential terms, a Q-verb takes scope under (over) another element if the distributed episodes it evokes depend on the values (determine the arguments) of a functional discourse referent evoked by that element.

4.3 Scope ambiguity

We have argued that scope independence as well as scope dependencies can be analyzed in terms of anaphoric relations between discourse referents for functional dependencies. When there is more than one possible relation, this approach predicts ambiguous scope.

A case in point is the Kalaallisut discourse (67), whose interpretation depends on the number of treasures per drawer.

- (67) [i. When the children had eaten, they went into the parlor where there was a huge chest with many tiny drawers.]
- ii. *Pippip* *amusartuararpassuit* *ammaqattaarpai*
Pippi-p *amusartu-araq-paa-rsuaq-t* *ammar-qattaar-pa-i*
Pippi-SG.ERG drawer-tiny-lot-big-PL open-cyclic.process-IND.TV-3SG.3PL
Pippi^T kept opening all the tiny drawers
- iii. *irlinnartuutini* *tamaasa* *takutititirlugit*
irlinnar-tuq-ut-ni *tamaq-isa* *taku-tit-titir-llu-git*
be.treasured-iv\cn-owned-3SG_T.PL all-PL_⊥ see-cause-dist-ELA_T-3PL_⊥
showing all of her_T treasures one by one.

If there is only one treasure per drawer, the Q-verbs in (67ii, iii) are scopally independent. In (67ii) the cyclic process-forming *-qattaar* evokes a function that sends each drawer opening event to the next event. In each event—a stage as well as a cycle of this cyclic process—Pippi opens a different drawer from the aforementioned large set (67i). The whole cyclic process covers the entire set of drawers. In (67iii) the topic-elaborating Q-verb, with the distributive *-titir*, further specifies the aforementioned set of drawer opening events as the range of a different distributive dependency: every opening of a drawer is also a showing of the treasure in that drawer.

Alternatively, suppose there are several treasures in each drawer. The topic elaborating Q-verb in (67iii), with *-titir*, can then elaborate the base ‘open-’ of the antecedent *-qattar* Q-verb in (67ii) (recall analogous ambiguity in (13)). On this reading, *-titir* is in the scope of *-qattaar*. That is, the distributive dependency that maps treasures to showing events does not specify the entire cyclic process of successively opening all the drawers. Instead, it specifies a cycle—the result state of opening one drawer. Each opening of a drawer results in a different plural set of treasure showing events, distributed over the plural set of treasures in that drawer.

Another scopally ambiguous configuration is exemplified in discourse (68). Here the habitual Q-suffix *-gajut* ‘often’ can take either wide or narrow scope relative to the kind-level temporal noun ‘next.day-3SG_⊥.SG-LOC’. The Q-suffix presupposes a salient domain of quantification. On one reading, this domain is identified with the set of days after a chess game, evoked by ‘next.day-3SG_⊥.SG-LOC’. In effect, the Q-suffix *-gajut* ‘often’ takes wide

scope: many days after a chess game are reporting days. More precisely, though, ‘next.day-3SG₁.SG-LOC’ evokes not just a set of days but a kind of day: in each chess playing world, each chess game is mapped to the next day. This kind-level referent supports a distributed reading, with apparently reversed scope: for each chess game many events the next day are reporting events (see Bittner, 2007a, for a formal implementation).

- (68) [i. My dad_T plays chess.]
 ii. *Aqaguani* *uqarajuttarpuq:* “*Ajugaa*simavunga.”
aqagu-a-ni *uqar-gajut-tar-pu-q* “*ajugaa-sima-pu-nga*”
 next.day-3SG₁.SG-LOC say-often-habit-IND.IV-3SG “win-prf-IND.IV-1SG”
 The next day he_T often says: “I won.”

In sum, our surface-based analysis of Q-verbs in terms of discourse reference to distributive verbal dependencies fully accounts for their scope behavior, unlike the tripartite LF approach. Scopal independence, as well as scope dependencies and ambiguous scope can all be understood in terms of anaphoric interactions between referents for distributive verbal dependencies evoked by Q-verbs and other functional discourse referents in the local context.

5 DOMAIN AND FORCE OF QUANTIFICATION

Heim (1982) implements Lewis’s (1975) analysis of English Q-adverbs in an LF-based dynamic semantics and extends this analysis to English modals. On her analysis, both Q-adverbs and modals head tripartite LFs (e.g. (1’b, c)). To account for the universal force of bare generics and conditionals, without any Q-adverbs or modals, Heim posits covert universal quantifiers at LF (e.g. $\Box_{1,2}$ in (1’d)). The tripartite LF approach has been very influential in crosslinguistic work on quantification (not least due to Partee, 1991, 1995, and Bach *et al.*, 1995), but even for English it is problematic. The covert quantifiers in bare generics and conditionals are not motivated on independent syntactic grounds, and their universal force must be stipulated. This problem is aggravated by the fact that elsewhere in the same LFs Heim posits covert existential quantifiers (\exists), whose existential force must likewise be stipulated.

Bittner (1995) points out additional problems for the tripartite LF approach, posed by quantification in Kalaallisut. She focuses on Q-verbs formed with the habitual suffix *-tar*, which optionally licenses a temporal Q-noun outside of the Q-verb—e.g. *akulikitsumik* ‘interval-with-have.small-iv\cn-SG.MOD’ in (61iii), or *ilaannikkut* ‘sometimes-SG.VIA’ in (69iii). If the habitual verbal suffix occurs alone, without any temporal Q-noun, then the quantificational force is understood to be universal, just as in bare English habituals. That is, in Kalaallisut (61) as well as (69), if the parenthesized temporal Q-noun is left out, then in those

worlds where the report by the currently topical individual (the speaker's father) is true, the reporting agent wins *every* game instantiating the aforementioned real chess playing habit (evoked in (61i) or (69i)). In contrast, if the parenthesized temporal Q-noun is present, then the reporting agent wins the proportion of the games specified by the Q-noun—i.e., *many* games in (61iii), or *some* in (69iii). In either case, the scope of the optional temporal Q-noun is determined by the verb-internal position of the licensing habitual suffix *-tar*. Without a habitual suffix on the verb, a temporal Q-noun is ungrammatical (e.g. recall *(23b)).

- (69) i. *Ataataga skakkirtarpuq.*
ataata-ga skakki-r-tar-pu-q
 dad-1SG.SG chess-do-habit-IND.IV-3SG
 My dad_T plays chess.
- ii. *Siurna arnami uqaluqatigimmani*
siurna arna-mi uqalu-qat-gi-mm-ani
 last.year mother-3SG_T.SG.ERG talk-mate-rn\|tv-FCT_L-3SG_L.3SG_T
 Last year when his_T mother_L spoke with him_T
- iii. *(ilaannikkunnguug)*
(ilaanni-kkut=gug)
 (sometimes-SG.VIA=RPT)
skakkiiqqatiminit isumaliurluarnirulluni
skakki-r-qat-mi-nit isuma-liur-luar-niru-llu-Ni
 chess-do-mate-3SG_T.SG-ABL idea-make-well-more-ELA_T-3SG_T
 [he_T] said that (sometimes) he_T came up with better ideas than the other player and
- iv. *ajugaasarnirarpuq.*
ajugaa-tar-nirar-pu-q
 win-habit-say-IND.IV-3SG
 won.

Bittner (1995) reports this construction as a compositional challenge for the tripartite LF approach. Partee (1995) seems to disagree, but we still do not see any satisfactory analysis in terms of tripartite LFs. Any such analysis of Kalaallisut (69) would require the same stipulations as the account of English (1). In addition, to derive tripartite LFs for Kalaallisut, we would have to violate lexical integrity—an inviolable principle in crosslinguistically viable and computationally attractive theories of syntax (HPSG, LFG). Compounding the problem, discourse (69) would contain both too few Q-elements and too many. Therefore, we would have to obscure the relation between the actual surface form and the putative tripartite LF still further, by positing covert quantifiers as well as deleting overt material. In the variant of (69) without the temporal Q-noun we would have to posit a covert universal (Heim's \square) to account for the understood universal force. And in the variant with the Q-noun we would have a surplus

of items meaning ‘say’—to wit, the *de se* report suffix *-nirar* as well as the reportative evidential clitic =*guuq*, construed with this suffix. These two Kalaallisut items are not synonymous, so deleting either one at LF should be ruled out on the pain of losing information.

In contrast, the discourse referential analysis of Bittner (2007a) interprets the actual surface form as is, by incremental update. There is no need for any *ad hoc* stipulations. Bittner (2007a) extends Stone’s (1997) analysis of modals as discourse reference to distributive functional dependencies. This approach offers a principled reason why the quantificational force in discourses like (69) (and modal analogues) depends on the presence or absence of a temporal Q-noun. The habitual suffix *-tar* presupposes that the base evokes a habit and identifies the distribution of this habit as a kind of time—the aforementioned kind (as in (69iv)), or else a new kind of time if there is no discourse antecedent (as in (69i)). If there is no temporal Q-noun in (69iii), the habitual suffix *-tar* in (69iv) is anaphoric to the aforementioned kind of time evoked by *-tar* in (69i)—i.e., in the worlds where the father’s report is true *every* chess game terminates in a victory. Thus, the universal force is accounted for in a principled way—as a manifestation of distributivity—not by an *ad hoc* stipulation.

The temporal Q-noun, and its construal with a habitual verb, also falls into place. The Q-noun affects kind-level anaphora by evoking a topical sub-kind—in (69iii), a kind of time instantiated in the father’s report worlds during *some* of the aforementioned chess games. As a temporal kind-level topic, the Q-noun requires a habitual verb to comment. Therefore, the habitual suffix of the verb must be anaphoric to this Q-noun rather than to any previously mentioned kind of time. This accounts for the shift in quantificational force, which on this view is due to anaphora that restricts the domain of temporal distribution to a topical sub-domain.

Last but not least, the construal of the *de se* report suffix *-nirar* in (69iv) with the reportative evidential clitic =*guuq* in (69iii) can also be understood in terms of anaphora. Since both items evoke speech events, they can form an anaphoric chain co-specifying the same speech event—formally parallel to the anaphoric chain in *A doctor came in. She looked tired.*, which co-specifies the same individual. The reportative =*guuq* evokes a speech event whose agent is not the current speaker. By default, the agent is the topical individual, as in (69iii). The proposition expressed is set up as a topical modality. In (69iii) this modality is also the domain of the topical kind of time, evoked by the Q-noun hosting the reportative =*guuq*. The topical kind of time induces a kind- and habit-level interpretation of the following animate noun (ABL) and topic-elaborating verb (ELAT) in (69iii). As usual, topic elaboration forms an anaphoric chain with the elaborated head—here, with ‘win-habit-’ in (69iv), which further specifies the result states of the designated stages of processes instantiating the aforementioned good thinking habit. Finally, the *de se* report suffix *-nirar* in (69iv) further specifies the reporting event evoked by the reportative =*guuq* in (69iii). The new specifications require temporal and individual *de se* (à la Lewis, 1979)—i.e., in the worlds where the proposition expressed is true, the reported winning habit of the reporting agent is current at the time of this speech event.

Both variants of discourse (69)—with or without the optional temporal Q-noun and the reportative evidential clitic—can thus be interpreted directly, by incremental update. The lexical integrity of complex words is respected: roots, suffixes, and clitics are all interpreted exactly where they are. There are no missing temporal or modal quantifiers, so there is no need to posit any covert quantifiers with stipulated force. Neither are there any superfluous items to be deleted. Indeed, all of the transformations required by tripartite LF-based semantics are banned by incremental update, which crucially requires the exact surface form as the input.

In this paper we have extended the surface-based discourse referential approach of Bittner (2007a) to other Q-verbs and other languages. Mutatis mutandis the referential account of the domain and force of temporal and modal quantification in discourse (69) should therefore generalize to all Q-verbs. Examples (70) through (72) below show that other types of distributive verbal dependencies indeed exhibit analogous phenomena—i.e., domain selection by anaphora to a salient, preferably topical, functional referent; default universal force due to distributivity; and non-universal force when the domain of distribution is restricted to a topical sub-domain.

In particular, discourse (70) illustrates all of these phenomena for a set of processes distributed over the currently topical set of (atomic or plural) individuals (cf. (5)).

- (70) *Ullumi atuartitsigama atuartut ilai*
ulluq-mi atuar-tit-si-ga-ma atuar-tuq-t ila-it
 day-SG.LOC study-cause-apass-FCT_T-1SG study-iv\cn-PL.ERG part-3PL_L.PL
 Today in my class some of the students
 (*marlukkuutaarlutik*) *suliqatigiipput.*
 (*marluk-kkuutaar-llu-tik*) *suli-qat-gii-g-pu-t.*
 (two-v.in.units.of-ELA_T-3PL_T) work-mate-set-cn\iv-IND.IV-3PL
 worked together (in pairs).

Discourse (71) exemplifies analogous phenomena for spatially distributed states:

- (71) *Aqaguani qiqirtaq alla takuarput.*
aqagu-a-ni qiqirta-q alla-q taku-pa-rput.
 next.day-3SG_L.SG-LOC island-SG other-SG see-IND.TV-1PL.3SG
 The next day we saw another island.
 (*Ilarujussua*) *qattunirasaarlunilu urpiqartitirpuq.*
 (*ila-rujussuaq-a*) *qattuniq-gasaar-llu-Ni=lu urpik-qar-titir-pu-q.*
 (part-huge-3SG_L.SG) hill-have.everywhere-ELA_T-3SG_T=and tree-have-dist-IND.IV-3SG
 (On most of it) there were hills and trees everywhere.

Finally, discourse (72) illustrates analogous phenomena for habitual distributed processes—i.e., a set of processes distributed in the speech reality over time periods of the currently salient kind. This temporal kind is evoked by *-llattaaar* ‘sometimes’, if this Q-suffix is present in sentence (72iii); otherwise, by the Q-suffix *-gajut* ‘often’ in sentence (72i). For each period of the topical kind, the evoked processes are also distributed over the walrus families that instantiate the topical kind evoked by the plural subject NP (‘walrus-PL’) in (72i).

- (72) i. *Aarrit ilaqutariikkutaarajuttarput.*
aaviq-t ilaqutaq-gii-g-kkuutaar-gajut-tar-pu-t
 walrus-PL relative-set-cn\iv-v.in.units.of-often-habit-IND.IV-3PL
 Walruses_T often live in family groups.
- ii. *Ingirlanirtik sivisutillugu*
ingirla-niq-rtik sivi-su-tit-llu-gu
 travel-v\n-3PL_T.SG duration-have.big-state-ELA_T-3SG_⊥
 When they_T are on a long journey_⊥
- iii. *ilaqutariit nukarlirsaat arnaata*
ilaqutaq-gii-t nukarliq-taq-at arna-ata
 relative.of-set-PL.ERG youngest-of-3PL_⊥.PL mother-3SG_⊥.SG.ERG
amaarlugu ingirlaarut(illattaaar)tarpa.
amaar-llu-gu ingirla-ar-ut(-llattaaar)-tar-pa-a
 carry.on.back-ELA_T-3SG_⊥ travel-a.bit-with(-sometimes)-habit-IND.TV-3SG.3SG
 the_T mother (sometimes) carries the_T youngster of the_T family piggyback for a bit.

Similarly, in Bininj Gun-wok (73) and Polish (74) the distributive Q-affix (pluractional or *po-*) presupposes a plural domain, and this anaphoric presupposition is resolved to the currently salient plural set of individuals—just as in Kalaallisut (70) (recall also Polish (59)).

- (73) i. *Birri-buyika minj balemane birri-bebme-ninj* ii. *bonj*
 BG 3PL-other NEG where 3PL.PST-emerge-IRR finish
 Some of the others had nowhere to get out, and so in the end
birri-ru-y birri-dowe-ng birri-dukka+rrukka-rr-inj.
 3PL.PST-burn-PFV.PST 3PL.PST-die-PFV.PST 3PL.PST-coil.up+coil.up-se-PFV.PST
 they were burned, writhing to death. (Evans 2003, (5.213))

- (74) [i. A terrorist broke into a school and took ten hostages. ii. As it turned out later, ...]
 P iii. *wkrótce większość z nich po-zabija-ł.*
 soon majority.ACC from them.GEN [dist-kill^{IPFV}]^{PFV}-PST.SG
 he soon killed off most of them, one by one.

We conclude that the hypothesis that Q-verbs refer to distributive verbal dependencies fully accounts for the domain of quantification and the apparently variable quantificational force. In referential terms the domain of quantification is the domain of the distributive dependency. This is determined directly off the surface form by centering-based anaphora—within or across sentence-boundaries—to a discourse referent that provides a plural set of semantic objects of the requisite type. For all types of distributive dependencies, the default universal force follows directly from distributivity, without any *ad hoc* stipulations required by LF-based accounts. Non-universal force arises when centering-based domain anaphora is resolved to a topical sub-domain of some lower ranked domain referent.

6 INSTANTIATING ANAPHORA

So far we have motivated our proposal that Q-verbs evoke distributive verbal dependencies on the basis of well-known characteristics of quantifiers: the scope of quantification, domain, and force. We have argued that all of these phenomena are problematic for tripartite LFs but can be understood in terms of discourse anaphora, within or across sentence boundaries, between distributive verbal dependencies evoked by Q-verbs and other discourse referents for plural sets or functional dependencies in the local context. Our analysis crucially relies on discourse reference to functional types. The set of requisite functional types appears to be open, so we do not see any way to recast our analysis in terms of discourse reference to a finite set of basic types (i.e. in a more restricted framework without discourse referents for functions, e.g. DRT of Kamp and Reyle, 1993, or Plural Compositional DRT of Brasoveanu, 2007).

Our third argument is based on *instantiating anaphora* (Bittner, 2007a, b)—another phenomenon that is characteristic of quantifiers and can be understood in terms of discourse reference to functional dependencies. Instantiating anaphora is common in naturally occurring discourse, mediating transitions from talk about a distributed pattern to talk about a particular instance of that pattern. We have already seen several examples of instantiating anaphora to various types of distributive dependencies: individual-dependent states in (5iii) and (36); time-dependent events in (41ii); and habitual (i.e. world- and time-dependent) events in (6iv). In general, we predict that in virtue of evoking a functional dependency any Q-verb will support instantiating anaphora. Moreover, for all types of functional dependencies, we offer a unified semantic account: instantiating anaphora is anaphoric reference that instantiates an antecedent functional dependency—i.e. sets up a discourse referent for the value (the instantiating semantic object) at a currently salient argument.

In addition to the above examples, which have already been discussed, this unified account applies to anaphora instantiating other types of distributive functional dependencies, for example, spatially distributed events in (75):

- (75) [i. Andalaaraq[†] ran through the thicket after the thieving raven.]
 ii. *Tassanngaannaq urluvuq kimillatsitirluni*
tassanngaannaq urlu-pu-q kimillag-titir-llu-Ni
 suddenly trip&fall-IND.IV-3SG get.scratched-dist-ELA_T-3SG_T
 Suddenly he_T tripped and fell and got scratched all over.
 iii. *Kiinnammigut kimillannira annirnarnirpaavuq.*
kiina-mi-kkut kimillag-niq-a annirnar-nirpaa-pu-q
 face-3SG_T.SG-VIA get.scratched-V\N-3SG_L.SG hurt-most-IND.IV-3SG
 The scratch on his_T face hurt most.

In (75ii) the topic-elaborating Q-verb (ELA_T) partitions the body of the currently topical individual into a plural set of places and sets up a discourse referent for a function that maps each of these places to an event of the topical individual getting scratched in that place. In (75iii) the initial path-noun (VIA) sets up one of these places as a topical location, while the following verbal base evokes the corresponding scratching event by instantiating anaphora.

In (76) the topic-elaborating (ELA_T) Q-verb is structurally parallel to (33) and (37iii). Semantically, this topic-elaboration evokes a set of individual-dependent states which all of the individuals in the currently topical set experience at the same time. The matrix verb (IND) further specifies this functional dependency, by evoking a related dependency, distributed over the same individuals, and mapping each of them to a concurrent event of falling through the ice. The indicative mood requires that, from the perspective of the speech event, all of these events are facts (i.e. events that have already happened in the speech reality by the time of the speech event).

- (76) *Hansi, Juuna, Kaalilu tamarmiullutik sikukkut nakkarput*
Hans, Juuna, Kaali=lu tamaq-mik-u-llu-tik siku-kkut nakkar-pu-t.
 Hans Juuna Kaali=and all-pl_T-be-ELA_T-3PL_T ice-SG.VIA fall-IND.IV-3PL
 [Hans, Juuna, and Kaali][†] all_T fell through the ice at the same time.

This analysis predicts, correctly, that (76) (= (77i)) can be elaborated by (77ii), where repeated instantiating anaphora locates these simultaneous falling-through events in different places.

- (77) [i. Hans, Juuna, and Kaali all fell through the ice at the same time.]
 ii. *Hansi Uummannap iqqaani nakkarpuq,*
Hans Uummannaq-p iqqaq-a-ni nakkar-pu-q
 Hans Uummannaq-SG.ERG area-3SG_L.SG-LOC fall-IND.IV-3SG
 Hans[†] fell through near Uummannaq,

Juuna Saattut iqqaanni,
Juuna Saattu-t iqqaq-at-ni
 Juuna Saattut-PL.ERG area-3PL_↓.SG-LOC
 Juuna^T near Saattut (pl),
Kaalilu Pirlirviup iqqaani.
Kaali=lu Pirlirvik-p iqqaq-a-ni
 Kaali=and Pirlirvik-SG.ERG area-3SG_↓.SG-LOC
 and Kaali^T near Pirlirvik.

In contrast, the elaboration in (78ii) is incoherent, because the non-overlapping temporal specifications added by instantiating anaphora conflict with the simultaneity requirement of the antecedent Q-verb in (76) (= (78i)).

- (78) [i. Hans, Juuna, and Kaali all fell through the ice at the same time.]
 ii.# *Hansi siurna nakkarpuq, Juuna ippassaq, Kaalilu ullumi.*
*Hansi siurna **nakkar-pu-q** Juuna ippassaq Kaali-lu ullu-mi*
 Hans last.year fall-IND.IV-3SG Junna yesterday Kaali=and day-SG.LOC
 Hans^T fell through last year, Juuna^T, yesterday, and Kaali^T, today.

Apparent counterexamples involve individual-dependent events that can be construed as stages of a single process, as in (79i). The shared temporal frame evoked by the Q-verb (or its English translation equivalent, *all...simultaneously*) is then the duration of the entire process, so the elaboration in (79ii, iii) (and its English translation) is coherent.

- (79) i. *Ilinniartitsisut tamarmiullutik*
ilinniar-tit-si-tuq-t tamaq-mik-u-llu-tik
 learn-cause-apass-iv\cn-PL all-pl_T-be-ELA_T-3PL_T
atuagassarpassuarnik innirsuussipput.
atuar-gaq-ssaq-paa-rsuaq-nik innirsuut-si-pu-t
 read-tv\cn-prospective-lot-big-PL.MOD recommend-apass-IND.IV-3PL
 All the professors^T have simultaneously recommended many things to read.
- ii. *Ippassaq biulugimi atuagassarpassuatta*
ippassaq biulugi-mi atuar-ga-ssaq-paa-rsuaq-tta
 yesterday biology-SG.LOC [read-tv\rn-prospective-lot-big-1PL.SG.ERG
allattursimavvia pivara
allag-tur-sima-vik-a pi-pa-ra
 write-process-prf-place-3SG_↓.SG] get-IND.TV-1SG.3SG
 Yesterday in my biology class I got a long list of things to read,

- iii. *ullumilu allatursimavviit allat marluk*
ullu-mi=lu allag-tur-sima-vik-t alla-t marluk
 day-SG.LOC=and write-process-prf-place-PL other-PL two
 and today, two more lists
tuluttuurnirmut kalallisurnirmullu.
tuluk-tut=Vr-niq-mut kalaaliq-tut=Vr-niq-mut=lu
 Englishman-EQU=iv-v\n-SG.DAT Greenlander-EQU=iv-v\n-SG.DAT=and
 for [my] English class and [my] Kalaallisut class.

Discourse (79) also illustrates another possible complication: instantiating a distributive verbal dependency may involve instantiating a correlated nominal kind. Thus, in (79i) the topic-elaborating Q-verb and the matrix verb jointly evoke a distributive verbal dependency that sends each teacher to a different recommending-event within the topic time set by the Q-verb. The modifier NP—anaphorically linked to the antipassive suffix within the matrix verb—evokes an individual-valued kind instantiated, in each recommending-event, by a long reading list. Hence, instantiating this distributive verbal dependency in (79ii, iii) introduces not only the particular recommending-events (described from the point of view of a student, who receives the recommendation), but also the particular reading list instantiated in each event.

Discourse (80) illustrates verbal and nominal instantiating anaphora in a habitual context. The speaker is a hunter who has accidentally got his kayak cut on sharp new ice. In (80i) he makes an emergency landing on an iceberg. (80ii) describes the next two events. (80iii) relates this particular kayak trip to the speaker's habit of customary kayak use and a correlated habit of carrying a patching kit. (80iv) shifts back to the episodic mode, via an anaphoric demonstrative (*taanna* 'that') referring to the patching kit that instantiates the aforementioned kind in the aforementioned instance of customary kayak use.

- (80) [i. I_T managed to land on the iceberg just as my kayak began to sink.]
 ii. *Niugama qajara imaarpara.*
niu-ga-ma qajaq-ra ima-ir-pa-ra
 get.out.on.land-FCT_T-1SG kayak-1SG.SG content.of-remove-IND.TV-1SG.3SG
 When I_T got out, I_T poured out the contents of my kayak¹.
 iii. *Qajarturtillunga*
qajaq-tur-tit-llu-nga
 kayak-use.as.customary-state-ELA_T-1SG
 When I_T am out in a kayak,
ilaassamik nassartuaannartarpunga.
ilaaq-ssaq-mik nassar-tuaannar-tar-pu-nga
 patch-prospective-SG.MOD carry-always-habit-IND.IV-1SG
 I_T always carry something to patch it.

- iv. *Taanna tiguriarlugu tuaviinnaq*
taanna tigu-riar-llu-gu tuaviinnaq
 that take-...and-ELAT-3SGT hastily
 I_T grabbed that[±] and hastily
qaanama alinnira ilaalirpara
qajaq-ma alig-niq-a ilaar-lir-pa-ra
 kayak-1SG.SG.ERG tear-v\|n-3SG_±.SG patch-begin-IND.TV-1SG.3SG
 began to patch the tear[±] in my kayak.

In other languages, too, Q-verbs support instantiating anaphors—witness Polish (81) and Bininj Gun-wok (82):

- (81) i. *W latach osiemdziesiątych wielu z moich przyjaciół*
 P in years.LOC eighties.LOC many from my.PL.GEN close.friends.GEN
 In the eighties many of my close friends
po-wyjeżdża-ło z kraju.
 [dist-go.away^{IPF1}]^{PFV}-PST.SG from country.GEN
 left the country, one after another.
- ii. *Najpierw Piotr wyjechał do Stanów, potem Adam do Danii.*
 first Peter go.away^{PFV}-PST.SG to States, then Adam to Denmark
 First Peter left for the States, then Adam, for Denmark.
- (82) [Then the white man said:]
 BG i. “*Ngaben-wono+wo-n kabirri-ma-rr-en, yawurrinj dja yawkyawk.*”
 1/3PL-give+give-NPST 3PL-marry-rcp-NPST lad and lass
 “I will let them marry each other, these lads and lasses.”
- ii. *Wanjh ngokkogen bene-bad-ma-rr-en, bininj daluk.*
 then at last 3DU.PST-in.due.course-marry-rcp-NPST man girl
 So, in due course, two of them get married, a man and a girl.
- iii. *Ngarri-wam, dird-buyika*
 1PL-go.PFV.PST moon-other
 We went on, and the next month
ngal-buyika daluk bi-yawoyh-me-y na-wu bininj.
 F-other girl 3/3.PST-again-marry-PFV.PST M-which man
 another girl was married to another man.
- iv. The white man kept on doing that, *marrying off* whoever grew up at the same time,
 v. until at last he had finished *marrying* them all *off*. (Evans 2003, (11.122))

In sum, instantiating anaphora has many different manifestations in natural language discourse. However, in terms of discourse reference, it is a unified phenomenon—to wit, anaphoric reference that instantiates an antecedent functional dependency, i.e. sets up a discourse referent for the value at a currently salient argument. In particular, Q-verbs support instantiating anaphora because they evoke distributive episode-valued dependencies.

7 CONCLUSIONS AND PREDICTIONS

In addition to the quantificational structures formed by Q-determiners (e.g. *every*), Q-adverbs (e.g. *always*), and Q-auxiliaries (e.g. *would*), familiar from research on English, the theory of natural language quantification must allow for Q-verbs—that is, complex verbs containing Q-roots (e.g. Kalaallisut *tamaq-* ‘all’) and/or Q-affixes (e.g. Slavic distributive *po-*, Bininj Gunwok pluractional affix, or Kalaallisut *-titir* ‘dist’, *-tar* ‘habit’, etc). In languages with recursive morphology a Q-verb may contain any number of Q-affixes. For instance, Kalaallisut has hundreds of derivational suffixes, including many Q-affixes, and its recursive polysynthetic morphology compositionally builds words of any complexity, as productively as English syntax builds sentences. And just like English sentences, polysynthetic Kalaallisut words are transparent to discourse anaphora.

As a consequence, Q-verbs come in many different shapes and sizes. Nevertheless, we have argued for a unified semantic analysis: the most prominent discourse referent of a Q-verb is a distributive verbal dependency—that is, an episode-valued function that sends different semantic objects in a contextually salient plural domain to different episodes. Episodes comprise basic events and states as well as higher-order (telic and atelic) processes. Processes are modeled as successor functions on discourse-transparent stages (events) because they support discourse anaphors to stages (e.g. *next*). The plural domain set may contain objects of any type—including, but not limited to, events (contra Partee, 1991, 1995). In particular, it may contain other distributive dependencies (e.g. local kinds (49) or local habits (50)).

On this analysis, Q-verbs instantiate a semantic universal: the most prominent discourse referent of a verb is an episode(-valued function), while the most prominent discourse referent of a noun is a nominal object(-valued function). In addition, discourse referents for distributive verbal dependencies license anaphoric links that account for some otherwise puzzling characteristics of Q-verbs—to wit, the domain, force, and scope of quantification, as well as the support for instantiating anaphora. In the present empirically oriented paper we have presented these ideas in an informal manner, but they can be formally implemented in terms of surface-based incremental update (see Bittner, 2003, 2007a).

In contrast, the influential analysis in terms of tripartite quantifier-headed LFs—originally proposed for English Q-adverbs, Q-NPs, and Q-auxiliaries (Lewis, 1975;

Heim, 1982)—is problematic for Q-verbs. Any derivation of a tripartite LF would violate the lexical integrity of a Q-verb and would therefore be ruled out by computationally attractive syntactic theories such as HPSG or LFG. LF-based semantics would also require positing covert quantifiers with stipulated force as well as deleting ‘surplus’ elements. And even then it would still fail to capture the interpretation of some Q-verbs—for instance, chains of scopally independent Q-verbs related by co-specifying discourse anaphora, or Q-verbs that serve as antecedents for instantiating discourse anaphors.

While the English-based theory of quantification does not extend to Q-verbs, we conjecture that the crosslinguistic theory of Q-verbs developed in this paper may extend to English Q-categories. A general prediction of our approach is that all Q-categories evoke discourse referents for distributive dependencies, but the values depend on the category. For Q-verbs, the values are of verbal types (episodes); for Q-NPs, the values are of nominal types (individuals, times, places, or propositions); and so on. It is beyond the scope of this paper to develop or test this prediction. We therefore leave it for future research to determine whether our discourse referential approach extends beyond Q-verbs to other Q-categories and other languages.

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