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DISTRIBUTIVITY STRENGTHENS RECIPROCITY, COLLECTIVITY WEAKENS IT

ABSTRACT. In this paper we examine interactions of the reciprocal with distributive and collective operators, which are encoded by prefixes on verbs expressing the reciprocal relation: namely, the Czech distributive *po-* and the collectivizing *na-*. The theoretical import of this study is two-fold. First, it contributes to our knowledge of how word-internal operators interact with phrasal syntax/semantics. Second, the prefixes *po-* and *na-* generate (a range of) readings of reciprocal sentences for which the Strongest Meaning Hypothesis (SMH) proposed by Dalrymple et al. (1998) does not make the right predictions. The distributive prefix *po-* prefers the Strong Reciprocity reading, although the SMH predicts that a weakening should take place, while with the prefix *na-* we find cases where weaker reciprocal readings are preferable to the stronger ones predicted by the SMH. This behavior of *po-* and *na-* is, we propose, due to the way in which they modulate two factors that are crucial in the interpretation of reciprocal sentences: (i) the relevant subpluralities in the group denoted by the reciprocal's antecedent, and (ii) the strength of reciprocal relations. We provide a detailed analysis of the semantics of the prefixes *po-* and *na-* and their contribution to the meaning of reciprocal sentences within the general framework of event semantics with lattice structures.

1. INTRODUCTION

The meanings of sentences with reciprocal expressions such as the English *each other* have been the object of a number of studies (e.g., Fiengo and Lasnik 1973; Dougherty 1974; Langendoen 1978; Higginbotham 1980; Kanski 1987; Roberts 1987; Lønning 1989; Moltmann 1992, 1997; Heim et al. 1991; Dalrymple et al. 1994a, 1994b; Schwarzschild 1996, among others). It has been firmly established that the interpretation of reciprocal sentences is sensitive to a rich variety of factors, both linguistic and extralinguistic, and cannot easily be accorded any single truth-conditional meaning which persists in all contexts. It has even been suggested that a context independent semantics for reciprocals cannot be given (cf. Roberts 1987; Schwarzschild 1996, for example). The task of integrating the necessary contextual information into the interpretation of reciprocal sentences without hard-wiring it once and for all into the meaning of their constituents has proven a difficult problem.

The most recent and elaborate proposal is presented in Dalrymple et al.'s (1998) paper on "Reciprocal Expressions and the Concept of Reciprocity".[1] They argue that "[t]he reciprocal has just one meaning, a (...) context-sensitive one in virtue of which it makes varying contributions to a statement's truth conditions depending on the context in which it appears" (p. 190). They identify a meaning consisting of a cluster of six reciprocal quantifiers and formulate a principle called the "Strongest Meaning Hypothesis" (SMH) that determines which quantifier, among the logically possible six, is appropriate for the interpretation of a given reciprocal sentence in a given context. According to the SMH, "the reciprocal is interpreted as having the logically strongest candidate meaning which is consistent with the meanings of the reciprocal's scope and antecedent as well as with relevant nonlinguistic information" (p. 193). Dalrymple et al.'s (1998) account of reciprocity is superior to previous ones in so far as the SMH provides a single, explicit mechanism for integrating semantic, pragmatic and world knowledge into the interpretation of reciprocal sentences.

In this paper we wish to build on their theory and observations, extending it in some ways and questioning it in others. The data we examine is from Czech, a West Slavic language. Like other Slavic languages, Czech has a rich set of verbal prefixes. Our focus will be on the interaction of the meanings of reciprocal expressions in Czech and meanings of certain of these verbal prefixes. We will examine two factors that are crucial in the interpretation of reciprocal sentences, both modulated by contextual information. The first one concerns the relevant entities in the antecedent of the reciprocal, i.e., the relevant subpluralities of the plural individual denoted by the subject of the reciprocal predicate (e.g., in a sentence like *The boys looked at each other, The boys* is the antecedent of the reciprocal expression *each other*). The second has to do with the strength of reciprocal relations, i.e., how the relation expressed in the scope of the reciprocal (in the above example, *looked at*) relates the relevant subpluralities in the domain of the reciprocal. For instance, saying that the Capulets and the Montagues hated each other still allows for the instance of Romeo and Juliet loving each other. We will explore how these two factors are influenced by the Czech distributive verbal prefix *po-* and the collectivizing verbal prefix *na-*, which restrict the interpretation to a distributive and a collective context, respectively.

For reciprocal sentences in which these prefixes occur, the SMH appears to be either too strong or too weak. We will find cases with the prefix

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[1] Previous versions of this proposal are presented in Dalrymple et al. (1994a) and Dalrymple et al. (1994b).

na- where a weaker reciprocal reading is preferable to the stronger one predicted by the SMH; the converse case also occurs with *po-*, in which a stronger reading appears than would seem predicted by the SMH. The puzzles that we discuss in this paper are:

(i) Why and under what conditions the strengthening of the reciprocal induced by the distributive marking (*po-*) takes place?

(ii) Why and under what conditions the weakening of the reciprocal induced by the collective marking (*na-*) takes place?

The outline of the paper is as follows. In Section 2, we will introduce Dalrymple et al.'s (1998) proposal along with examples of English reciprocal sentences. In Section 3, we will describe the semantic contribution of *po-* and *na-* to the meaning of sentences. In Section 4, we examine how reciprocal statements are expressed in Czech, and then show how the prefixes *na-* and *po-* interact with the expression of reciprocity, and compare the observations with predictions made by Dalrymple et al's SMH. In Section 5, we will turn to the description of the semantics of the prefixes *na-* and *po-* that makes sense of their interaction with reciprocity, and attempt an answer to the puzzles in (i) and (ii).

While we draw our main examples from Czech, we expect to be raising the larger issue of the extent to which our conclusions are applicable to similar constructions in other languages, including other Slavic languages.[2] But such an examination remains beyond the scope of the present paper.

2. RECIPROCITY IN DALRYMPLE ET AL. (1998)

Dalrymple et al. (1998) define six reciprocal quantifiers, which together constitute the meaning of the reciprocal, and which collectively define the set of options available in a given context. We give examples of five of these in (1), in order from the strongest relation to the weakest (we here

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[2] For example, a description of the relevant uses of the Russian prefixes *po-* and *na-* can be found in Isačenko (1960, pp. 385–418, 1962). The various relevant uses of the prefix *na-* in Russian are discussed in great detail in Russell (1985). Kipka (1990) describes the distributional and semantic properties of the Polish prefix *na-* and the distributive prefix *po-*.

omit their "Strong Alternative Reciprocity", as it is not exemplified in their paper).[3]

(1)   Reciprocal "Meanings"

(i) Strong Reciprocity (SR)

House of Commons etiquette requires *legislators* to address only the speaker of the House and *refer to each other indirectly.*

$|A| \geq 2$ and $\forall x, y \in A(x \neq y \rightarrow Rxy)$

SR says that every member of A is related directly by R to every other member.

(ii) Intermediate Reciprocity (IR)

Five Boston pitchers sat alongside each other: Larry Anderson, Jeff Reardon, Jeff Gray, Dennis Lamp and Tom Bolton.

$|A| \geq 2$ and $\forall x, y \in A(x \neq y \rightarrow$ for some sequence
$z_0, \ldots, z_m \in A(x = z_0 \wedge Rz_0z_1 \wedge \cdots \wedge Rz_{m-1} z_m \wedge z_m = y))$

IR says that every member of A is related directly or indirectly to every other member via the relation R.

(iii) One-Way Weak Reciprocity (OWR)

"The captain!" said *the pirates, staring at each other in surprise.*
$|A| \geq 2$ and $\forall x \in A \, \exists y \in A(x \neq y \wedge Rxy)$

OWR says that every member x of the set A participates with some other member in the relation R as the first argument of the relation.

(iv) Intermediate Alternative Reciprocity (IAR)

Instead, *countless stones* – each weighing an average of 300 pounds – *are arranged on top of each other* and are held in place by their own mass and the force of flying buttresses against the walls.

$|A| \geq 2$ and $\forall x, y \in A(x \neq y \rightarrow$ for some sequence $z_0, \ldots, z_m \in A$
$(x = z_0 \wedge (Rz_0z_1 \vee Rz_1z_0) \wedge \cdots \wedge (Rz_{m-1}z_m \vee Rz_mz_{m-1}) \wedge z_m = y))$

IAR requires that all pairs in A be connected directly or indirectly via

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[3] Strict Reciprocity and Intermediate Reciprocity are discussed by Langendoen (1978) and Inclusive Alternative Ordering in Kanski (1987). Dalrymple et al. (1998) propose two new meanings: One-Way Weak Reciprocity and Intermediate Alternative Reciprocity cf. p. 168, 175).

the reciprocal relation R, ignoring the direction of the arrows (in contrast to IR, where directionality of arrows is taken into consideration). That is, each member x of A should be related to every other member y via a chain of reciprocal relations.

(v) Inclusive Alternative Ordering (IAO)

He and scores of other inmates slept on *foot-wide wooden planks stacked atop each other* – like sardines in a can–in garage-sized holes in the ground.

$$|A| \geq 2 \text{ and } \forall x \in A \exists y \in A (x \neq y \wedge (Rxy \vee Ryx))$$

IAO, the weakest relation, says that every member x of the set A participates with some other member in the relation R as the first or as the second argument, but not necessarily in both roles.

The most important innovation is the formulation of the Strongest Meaning Hypothesis (SMH), which is stated as follows:

(2)   Strongest Meaning Hypothesis (SMH): A reciprocal sentence S can be used felicitously in a context c, which supplies non-linguistic information I relevant to the reciprocal's interpretation, provided the set S_c has a member that entails every other one:

$S_c = \{ p \mid p$ is consistent with I and p is an interpretation of S obtained by interpreting the reciprocal as one of the six quantifiers listed ... $\}$.

In that case, the use of S in c expresses the logically strongest proposition in S_c.

(Dalrymple et al, 1998, p. 193)

Informally, the SMH says that "the reciprocal is interpreted as having the logically strongest candidate meaning which is consistent with the meanings of the reciprocal's scope and antecedent as well as with relevant nonlinguistic information" (Dalrymple et al., 1998, p. 193). The SMH is intended as a semantic principle that determines "the literal meaning of utterances of certain expressions in any context appropriate for the expression" (p. 197), though Winter (1996) questions whether this is an appropriate understanding of it. It is important to emphasize Dalrymple et al.'s (1998) claim that the great variation in the interpretation of reciprocal statements cannot be treated in terms of an ambiguity (i.e., reciprocals are not six-ways ambiguous), nor in terms of general pragmatic rules of interpretation. They explicitly argue against postulating a single fixed strong

meaning (e.g., SR) that may be pragmatically weakened,[4] and they also argue against postulating any single weaker interpretation for the reciprocal (like Weak Reciprocity, as in Langendoen, 1978) which relies on pragmatic strengthening, by means of conversational implicature, for example, to yield a stronger speaker's meaning.[5,6]

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[4] The implausibility of the pragmatic weakening strategy can be illustrated by an example like *Five Boston pitchers sat alongside each other: Larry Anderson, Jeff Reardon, Jeff Gray, Dennis Lamp and Tom Bolton* (Dalrymple et al. 1998). The meaning of the words in this sentence, and the nonlinguistic knowledge that baseball pitchers, being people, have only two sides, is inconsistent with the strongest meaning, namely the SR meaning: It is impossible for each pitcher to sit alongside every other one. If the appropriate reading, here IR, were to arise as a result of pragmatic weakening of SR by conversational implicature, it would have to be cancellable. But it is not. Another example that excludes the SR reading is *Mrs. Smith's third-grade students gave each other measles* (see Dalrymple et al. 1998). It is impossible for each member of the third-grade to give measles to every other member. Given that measles is a disease that cannot be contracted more than once, no one can give measles back to whoever gave it to them.

[5] Dalrymple et al. (1998, p. 167) observe that pragmatic strengthening of Weak Reciprocity by conversational implicature cannot work, because the added strength over Weak Reciprocity would not be cancellable. For example, a sentence like *Willow School's fifth-graders know each other* cannot be continued with ... *but the oldest one does not know the youngest* without resulting in a contradictory statement. (The example is taken from Dalrymple et al., 1994, p. 63).

Dalrymple et al. (1994, p. 63, fn. 2) also make an interesting observation with respect to reciprocals in combination with the *exception* construction, instantiated by a sentence like *Willow School's fifth-graders know each other, except the oldest one doesn't know the youngest one*. They propose that the *exception* construction is felicitous only in the presence of universal or negative universal quantification over appropriate n-tuples. This behavior is puzzling and no motivation for it has been provided so far, to our knowledge.

[6] Krifka (1996, p. 146–7) proposes that the variety of reciprocal readings can be accounted for by the general pragmatic rule: "(39) If grammar allows for a stronger or a weaker interpretation of a structure, choose the one that results in the stronger interpretation of the sentence, if consistent with general background information!" Krifka's pragmatic principle is similar to the SMH by Dalrymple et al. (1998), given here in (2). However, Dalrymple et al. (1998) argue that the variety of reciprocal meanings does not lend itself to being derived by pragmatic rules of interpretation. (See fn. 5 and 6.) According to them (p. 167), each of the reciprocal statements they have considered is *literally false* if the stronger conditions are not met in those situations in which a given reciprocal statement meets conditions of varying strength.

3. THE EFFECT OF VERBAL PREFIXES ON THE INTERPRETATION OF RECIPROCITY: CZECH *po-* AND *na-*

3.1. *A Note on Prefixes*

Prefixation of verbs is very common in Slavic languages; prefixes can be attached to imperfective as well as perfective verbs to derive new perfective verbs. This is illustrated in (3) and (4). (Superscripts "P" and "I" on a verb stand for the aspect of a verb, perfective and imperfective.)

(3)   děla-t^I →   vy - děla-t^P →

       do-INF   **PREF**-*do-INF*

       'to do',   'to earn'

       'to be doing'

       při - vy - děla-t^P

       ADD-PREF-do-INF

       'to earn additional income'

(4)   při - nés - t^P →   **po** - při - nés - t^P

       DIR -carry- INF   *DISTR-DIR -carry- INF*

       'to bring'   'to bring one after the other'

       glosses for prefixes:

       'PREF' prefix   **'COMPL'** completive

       'ADD' additive   **'DIR'**   directional

       'DISTR' distributive

Prefixation in Slavic languages is a derivational process.[7] As is typical of derivation, not all prefixes attach to all verbs, one prefix can be applied

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[7] For a discussion of verbal prefixation in Slavic languages and its derivational nature see Spencer (1991) and Filip (1999), for example. Even if a prefix serves to form a perfective verb from an imperfective one, it is to be classified as a derivational prefix, rather than an inflectional marker of perfective aspect. The reason is that adding a prefix to a verb typically yields a new verb that differs from the base in its lexical semantic properties, and often also in its argument structure. Treating such prefixes as 'aspectual' is misleading, because it may imply the wrong view that verbal prefixes have an inflectional function comparable to grammatical morphemes, such as passé simple/imparfait inflectional suffixes in French.

to different (classes of) verbs, with different semantic effects; conversely, different prefixes can be attached to one verb root or stem so that to one and the same base there typically exists a cluster of prefixed perfective verbs, rather than just one. Prefixes show polysemy and homonymy, and prefixed verbs are not always compositional in meaning. Prefixes can also be iterated in certain combinations, and some can be applied to already prefixed perfective verbs, as is also shown in (3) and (4).

There is a long tradition in Slavic linguistics of classifying prefixes into *Aktionsart* classes according to their lexical semantic contribution to the meaning of verbs (cf. Agrell 1908; Maslov 1959; Isačenko 1960, pp. 485–418, 1962). Quantificational notions like 'distributivity', 'frequentativity', and 'partitivity', as well as closely related ones like 'collectivity', 'additivity', or 'small/large measure of', serve as prominent classificatory criteria (see Isačenko 1960, pp. 485–418; Petr et al. 1986, for example). We find prefixes whose meaning involves notions comparable to vague determiner quantifiers like *some, many, much, a lot, a few, a little*, for example. The relevant uses of the prefixes *na-* and *po-* discussed here are traditionally classified as 'accumulative' Aktionsart (here glossed as 'ACM') and 'distributive' (here glossed as 'DISTR'), respectively. The prefixes *na-* and *po-* have other Aktionsart meanings, which we will briefly acknowledge below, but we will disregard them for the purposes of this paper.

3.1.1. *The Semantic Contribution of the Distributive Prefix PO-*

To illustrate the semantic contribution of the distributive *po-*, let us first look at examples in (5). From the perfective non-distributive verb *schovat* 'to hide' (in 5a) we derive with *po-* the perfective verb *poschovat* (5b), which adds the component of distributivity to the meaning of the base verb:

(5)   **perfective** → **distributive** perfective
        schovat   **PO**-schovat
        hide.INF   **DISTR**-hide.INF

     a.   Schoval^P bankovky   pod   matrací
         hide.PAST.3SG banknote.PL.ACC under mattress
         'He hid (all) the banknotes undernearh a mattress.'

     b.   **PO**-schoval^P bankovky   pod   matrací
         DISTR-*hide.PAST.3SG banknote.PL.ACC under mattress*
         'He hid (some/the) the banknotes undernearh a mattress.'

c.   **PO**-schoval[P]   bankovky   *??najednou* pod

DISTR-*hide.PAST.3SG banknote.PL.ACC ??all.at.once under*

matrací.

mattress

'He hid (all) the banknotes all at once undernearh a mattress.'

(5a) either refers to a single act of hiding a whole wad of banknotes (*collective* interpretation), or to several separate hiding acts each of which may involve a single banknote (*total distributive* interpretation) or a bunch of banknotes out of the whole contextually determined wad (*intermediate distributive* interpretation). *Po-* in (5b) requires that there be a number of events of hidings of the banknotes, which may be satisfied under the *total distributivity* reading to each single banknote or some *intermediate distributive* interpretation. Unlike (5a), (5b) also strongly suggests that the banknotes were hidden during successive hiding events, and preferably at different places underneath a mattress. As we see in (5c), the distributive verb *poschovat* is odd with the temporal adverbial 'all at once', excluding the complete temporal overlap of all the hiding subevents. In general, the distributive prefix *po-* requires that the relevant subevents be individuated by separate participants, separate running times or locations. Given that (5b) describes a plurality of events all of which are initiated by a single agent participant, the most natural way in which the subevents may be individuated is in terms of their non-overlapping running times and/or distribution over separate locations.

The prefix *po-* produces a distributive reading not only for the object argument, as in (5b), but also for the subject argument, as illustrated in (6b):

(6)a.   Děti   se   schovaly[P].

children REFL hide.PAST.3PL

'The children hid.' (collective/distributive)

b.   Děti   se   **PO**-schovaly[P].

children REFL **DISTR**-*hide.PAST.3PL*

'The children hid.' (distributive)

(6b) is true in a situation in which there is an event that is the sum of hidings by the relevant subpluralities of children, possibly down to atomic individuals. One natural interpretation would involve a plurality of hiding events distributed over partially overlapping running times and separate children hiding at separate locations.

The distributive prefix *po-* manifests all the hallmarks of 'pluractional markers' (in the sense of Newman 1980, 1990). Pluractional markers are morphemes that are typically affixed to the verb and express a broad range of 'distributive' notions, indicating a multiplicity of actions that involve multiple participants, times or locations (see Lasersohn 1995, p. 240).[8] Such morphemes are common in Slavic languages,[9] and also in the languages of North America, West Africa, Dravidian languages, and American Sign language, for example (for references see Lasersohn 1995; Matthewson 1998).

In general, the prefix *po-* derives distributive verbs from non-distributive ('mixed') verbs (subsuming atomic individuals and collections) or from collective verbs (see examples (23) below). Such *po*-verbs hold true of pluralities of events, where the property described by the base verb distributes to each relevant subplurality of the group of individuals, and/or to separate times or locations.[10] Just as other pluractional markers, *po-* encompasses a family of related distributive readings that largely depend on the criteria evoked for the individuation of the subevents in the denoted sets. Participant-based individuation of subevents yields readings involving notions like *individually, each separately*. Individuation of subevents based on separate running times results in adverbial temporal meanings of *successively, consecutively, one at a time* (e.g., *pozamykat* 'to lock X part by part, one (group) at a time, after another'). Individuation of subevents based on separate locations yields readings like *here and there, all over*. With base verbs describing some action of applying or attaching something onto something else or creating marks on something, *po-* gen-

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[8] Lasersohn (1995, p. 242) observes that the semantics of particular pluractional markers in different languages may involve different strategies for individuation of subevents denoted by verbs to which they are attached. For example, in some languages, the notion of distribution in time may play a more prominent role here than the notions of distribution to separate locations or participants. This seems to be the case with the pluractional marker *pelpála* in St'át'imcets, a Northern Interior Salish language, Matthewson (2000) argues that temporal separation is always sufficient, spatial separation is marginally sufficient, and participant-based separation is insufficient.

[9] For example, Czech has other distributive prefixes, apart from the prefix *po-*: *vy-*, as in *vymřít*[P] 'to die out (successively, one (group) after the other)' and *s-*, as in *skoupit*[P] 'to buy (successively, one (group) after the other)'.

[10] There are two related questions, among others, that this situation poses for future research: First, does *po-* exclude the complete temporal overlap of all the distributive subevents in all its uses? The second question regards a spurious conflation of readings (see also Lasersohn 1995, p. 250): Is participant-based distributivity a special case of spatial distributivity? Cusic (1981) assimilates participant-based distributivity to spatial-temporal distributivity. This would make sense given that different individuals cannot simultaneously occupy the same space.

erates the totality meaning of 'to cover x with V-ing', 'to V all over x' (e.g., *pomalovat* 'to completely cover x with paint').

The basic meaning of distributivity may be accompanied by refinements that have to do with some notion of attenuation or diminutivity in a variety of domains: namely, some notion of a small quantity, a low degree measured with respect to a certain contextually determined scale and to some standard or subjective expectation value. It may regard a relatively low frequency (*a few times, now and then, sporadically*) or low intensity, short duration, tentativeness, insignificant effort, or result of the denoted subevents (*lightly, gently, slightly, (a) little, partly, tentatively, in a superficial way*): cp. *pokřikovat* 'to cry out a few times', *pobolívat* 'to hurt a little now and then', for example. The prefix *po-* also has a few other meanings and uses,[11] in this paper, however, we will disregard all but its distributive use.

3.1.2. *The Semantic Contribution of the Prefix NA-*

The semantic contribution of the prefix *na-* is illustrated in (7). From the imperfective *procházet se* 'to take a walk', 'to be taking a walk', the prefix *na-* derives a new verb *naprocházet se* 'to have walked a lot', which is perfective and adds to the verb the meaning of approximately 'a lot (of)' in a variety of ways.

(7) *imperfective* → ***accumulative*** *perfective*
        procházet se   **NA**-procházet se
        walk.INF REFL   ACM-walk.INF REFL
        'to take a walk',   'to have walked a lot'
        'to be taking a walk'

a. Ivan se prošel[P] po městě.
    Ivan REFL walk.PAST.3SG around town
    'Ivan went for a walk/took a walk around the town.'

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[11] The prefix *po-* can also be used non-distributively, with just the attenuative/diminutive meaning of a relatively small measure or degree (*pospat si* 'to sleep for a short while'). Moreover, it can be used to derive perfective verbs that have a completive meaning pure and simple, as in *pozdravit* 'to greet'. For a description of the various uses of the Czech prefix *po-* see Petr et al. (1986, pp. 397-398).

b.   Ivan se   **NA**-procházel^P po   městě.

Ivan REFL **ACM**-*walk.PAST.3SG around town*

'Ivan went for a walk/took a walk around the town.'

(i)   (a) *temporal measure:*

'Ivan spent a lot of time taking a walk around the town.'

(b) *path measure:*

'Ivan covered a long distance by taking a walk around the town.'

(ii)   *measure/quantifier over events:*

'There were a number of occasions on which Ivan went for a walk around the town.'

(iii)   'Ivan walked to his heart's content all over the town.'

One effect of the prefix *na-* is comparable to temporal and path measures, such as those expressed by durative adverbials and locative extent phrases in English. So (7b) can be understood as 'Ivan spent *a lot of time* walking around the town' and/or 'Ivan covered *a long distance* by walking around the town'. The prefix *na-* may also function as a vague measure or a quantifier over a collection of events (or cases). The effect of the prefix *na-* in (7b) can then be paraphrased as 'There was a *(sufficiently/exceedingly) large number of occasions* on which Ivan took a walk around the town', or simply as 'Ivan took *a lot of/enough/many walks*'.[12]

Closely related to the use of *na-* as a temporal and path measure, is the use of this prefix as a measure over a participant associated with the Incremental Theme argument (in the sense of Dowty (1988, 1991) and some previous proposals in Krifka (1986)).

(8)   Děti   **NA**-nosily^P dřevo   / dřeva.

children **ACM**-*carry.PAST.3PL wood.SG.ACC / wood.SG.GEN*

'The children gathered a lot of/a (large) quantity of wood.'

In (8), the prefix *na-* can only be linked to the direct object 'wood', the Incremental Theme argument. The direct object describes what entity/entities the measurement expressed by *na-* is restricted to range over. Crucially, the prefix *na-* does not function here as a measure over the individual variable supplied by the subject noun phrase, because (8) does not mean 'Many children gathered (some) wood' or 'Many children gathered

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[12] Following Kŕížková (1958), Isačenko (1960, p. 247) labels this the 'saturative-frequentative' use of the accumulative *na-*.

a lot of wood'. Nor can (8) mean 'The children often/many times gathered wood', a reading one would expect if *na-* functioned as a measure over a plurality of events.

It is typical of lexical verb operators, such as verbal prefixes, to exhibit a striking selectivity in targeting specific arguments of a verb for their semantic effects.[13] As far as the 'accumulative' *na-* is concerned, Filip (1993/1999, 1996, 2000) proposes that it selects *either* the event variable *or* individual variable, but not both.

What the uses of *na-* as a measure over the running time, path and Incremental Theme participant of the described event have in common is that in each case we can establish a one-to-one relation between parts of the measured entity and event parts. This in turn allows us to compute aspectual properties of a predicate in a compositional way. In general, if the running time, path or Incremental Theme participant are delimited in some way (by some measure expression, for example), the corresponding event predicate will be delimited, telic, or bounded, as well. The early accounts of aspectual compositionality of predicates go as far back as Verkuyl (1972), Dowty (1972, 1979), Hoepelman and Rohrer (1980), and more recent analyses are Krifka (1986, 1992, 1998), Tenny (1987, 1994), Dowty (1988, 1991), Verkuyl (1993, 1999), Jackendoff (1996).

The focus of this paper will be the use of *na-* as a vague measure over a plurality of events, specifically, the use of *na-* as a pluractional marker that generates a collective action reading of a sentence. This is illustrated in (7a', b'):

(7)a'. Naši přátelé   se   prošli^P po   městě
         our   friend.PL.NOM REFL walk.PAST.3PL around town
         'Our friends went for a walk/took a walk around the town.'

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[13] See Partee, et al. (1987) and Partee (1991, 1995, p. 556) for cross-linguistic data and a discussion. The *selectivity* of Slavic verbal prefixes with respect to the arguments they target for their measurement and quantificational effects is discussed in Filip (1993/1999, 1996 and 2000) in connection with the following hypothesis: Morphological *V*-operators that function as quantifiers or measures over episodic predicates and their arguments are linked to the Incremental Theme argument. If there is no Incremental Theme argument, lexical *V*-operators are linked to the eventuality argument alone; if there is neither, quantification or measurement is undefined.

b'.	Po	městě	se	naši	přátelé
	around	*town*	*REFL*	*our*	*friend.PL.NOM*

NA-procházeli^P už   dost.

ACM-*walk.PAST.3PL already enough*

'Our friends have already spent a lot of time walking around town.'

'Our friends have already walked enough/a lot around the town.'

(7a') asserts that the group denoted by the subject argument 'our friends' is in the extension of the plural perfective verb *prošli se* 'they took a walk', 'they went for a walk'. Translated as the plural predicate *take-a-walk (where '*' is the pluralization operator, see Section 5.1.2 below) it applies to all individual friends who went for a walk in a given model, and to all sums of our friends that can be formed from the atomic individuals in that model. This is not the case for (7b'), where the property of 'spending a lot of time walking' or 'walking enough/a lot' expressed by the *na*-verb does not necessarily distribute to every friend, but it is necessary that at least some individuals in the group denoted by 'our friends' have this property. What we have here is a partial distributivity, which in turn is a collectivity effect, as Landman (1996) argues, and specifically what he calls 'a collective action reading'. This licenses the attribution of the property of 'walking enough/a lot' to the whole collection of the individuals denoted by the subject argument, that is, to our friends *together, as a group*. The collective action reading is naturally accompanied by spatial/temporal proximity or even temporal simultaneity of the component actions.

The measurement and collective action readings induced by *na-* are related to and often accompanied by strong affective connotations. They all concern some notion of 'augmentation' in the sense of a high degree, intensity, considerable effort, and the like, and yield readings, such as 'to perform *V* in a protracted, uninterrupted, persistent, intensive, excessive manner', 'to perform *V* to one's heart's content', 'to perform *V*-ing to a state of satisfaction', 'to tire oneself with *V*-ing'; 'to experience a lot of, enough *V*-ing', for example. In addition to the meanings and uses of *na-* that we mentioned above, *na-* also has a few other meanings and uses,[14] which we will not discusss here, as they are irrelevant for the main points of this paper.

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[14] The prefix *na-* can be used in perfective verbs that have a completive meaning pure and simple, as in *napsat* 'to finish writing', or it can be used with the directional and locative sense 'onto' and 'on', as in *naložit* 'to load (onto)', for example. For a description of the various uses of the Czech prefix *na-* see Petr et al. (1986, p. 396).

To sum up, in the most general terms, the prefix *na-* introduces a vague measure function at the level of verb morphology, contributing to the verb the augmentative meaning of a (sufficiently or exceedingly) large quantity or a high degree, measured with respect to a certain contextually determined scale and some standard or subjective expectation value. This basic meaning of the prefix *na-* is manifested in a variety of ways, depending on the lexical semantics of verbs with which *na-* combines, their argument structure, and on linguistic and extra-linguistic context. The prefix *na-* may measure a single event by imposing a measure over its running time, path or one of its participants (associated with the Incremental Theme argument); or it may measure a plurality of events of the type denoted by the verb to which it is attached. In the latter case, *na-* is a pluractional marker, and it generates a collective action reading in the appropriate context. The variety of contextually determined uses of *na-* mentioned above are closely related, and often jointly contribute to the interpretation of a single verb.

We see that *na-* and *po-* can be essentially taken to be converses of each other with respect to two (among other) parameters that determine the variation in the uses of pluractional morphemes (see Cusic 1981 and Lasersohn 1995): (i) the *relative measure parameter* (large quantity (corresponding to a variety of augmentative readings) vs. small quantity (corresponding to a variety of attenuative/diminutive readings)) which sets the relative size, effort, efficacy, etc. of the component actions in a complex event or of a complex event itself, and (ii) the *distributive parameter* which in our case relates to a scale with the total distributive reading to atomic individuals as one extreme and the collective reading as the other extreme, and a number of intermediate distributive readings to subgroups of various sizes between the two extremes.[15] While the prefix *na-* derives collective action verbs from distributive ones (as in (7b′) above), the prefix *po-* derives distributive verbs from non-distributive ('mixed') verbs (subsuming atomic individuals and collections) or from collective verbs (see examples (23) below). The collectivizing and augmentative effect of *na-*, on the one hand, and the distributive and attenuative/diminutive effect of *po-*, on the other hand, will be crucial in our account of how *na-* weakens and *po-* strengthens reciprocity, to which we will turn in Section 5.

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[15] Cusic (1981, p. 102) characterizes the distributive parameter as follows: "The basic idea of distribution is separation in time, space, or some other way, of actor from actor, action from action, object from object, property from property, and so on. In relation to our idea of plurality as internal complexity and external multiplicity, distributivity can be thought of as a function which takes the internally or externally complex entity, redivides it into its separate bounded units, and assigns these units to temporal loci, spatial loci, or matches them one-to-one with other bounded units".

3.2. *The Expression of Reciprocal Statements in Czech*

3.2.1. *The Basic Situation*
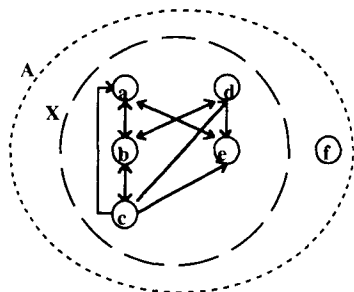
The most common means of expressing reciprocity in Czech is the reciprocal particle *se*, as in

(9) Členové   delegace   **se**

member.PL.NOM   *delegation.SG.GEN*   **REC.ACC**

objali^P.

embrace.PAST.3PL

'The delegation members embraced **each other**.'

(9) consists of the reciprocal particle *se* in the accusative case, the subject NP 'members of the delegation' (the antecedent of the reciprocal *se*) and the perfective transitive verb 'embraced'. The reciprocal particle *se* may take on other case forms, and there are also emphatic forms.[16] As with the English reciprocal *each other*, the Czech particle *se* fills an object argument position of a syntactic predicate. The basic semantic properties of the reciprocal are the same in English and Czech. For (9) it holds that the reciprocal does *not* require that every member of the delegation be related to every other member by the relation of embracing, and the direction in which this relation holds is not restricted to exclusively symmetric ones. That is, (9) does not require the selection of Strong Reciprocity (SR) for its interpretation. In this respect, (9) behaves just like the corresponding English reciprocal sentence *The delegation members embraced each other*. For example, (9) and its English counterpart may be true in the situation depicted in the Diagram (10):

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[16] *Navzájem, vzájemně; jeden druhého* (ACC) (the accusative case form is here selected for the citation purposes, other case forms are possible, as well) 'each other, one another', for example. *Navzájem, vzájemně* seems to enforce the SR reading, while *jeden druhého* (ACC) prefers SR in sentences allowing for readings of different strengths, but does not enforce it. For example, *??Sedli si vzájemně vedle sebe* – 'They sat next to each other' is odd, precisely because *vzájemně* 'each other' enforces the SR reading, which is unacceptable given our world knowledge about the spatial arrangement of people sitting next to each other. On the other hand, *Sedli si jeden vedle druhého* – 'They sat one next to the other' is acceptable. Given the lexical semantic constraints of such emphatic reciprocal forms, we use the reciprocal particle *se* throughout the paper, because it readily allows for a wide range of reciprocal readings that can be modulated by the contribution of the prefixes *na-* and *po-*.

(10)

'A' is the group of entities which comprise the domain determined by the antecedent of the reciprocal (denoted by the subject NP); 'X' is a proper subset of A; '↔'/'→' the relation which is determined by the scope of the reciprocal (the verb 'embrace').

The reciprocal statement expressed in (9) is satisfied in a situation in which one individual (here (f)) does not participate in the denoted event at all. That is, the reciprocal does not necessarily hold of the whole group A, the domain determined by the reciprocal's antecedent, but may only hold of a proper subset X. Hence, in a situation in which Nikita is one of the delegates, we could continue (9) by (11) without inconsistency or contradiction:

(11)   ..., ale Nikita   stál   opodál s cigaretou   a   jen

    ..., but Nikita.SG.NOM stood aside   with cigarette and only

    se   usmíval^1.

    REFL smile.PAST.3SG

    '..., but Nikita stood off to the side with a cigarette and was only smiling.'

Notice also that not all relations within the subset X need be symmetrical, as illustrated in the Diagram (10).

This view of (9) is compatible with the opinion of many that a sentence like The delegation members embraced each other, the English translation of (9), is true even if not every single delegation member embraced every other delegation member, that is, even if there is no SR. (See Fiengo and Lasnik 1973; Langendoen 1978; Schwarzschild 1996; Moltmann 1992, 1997, for example.) The main formal difference between (9) and its English analogue is the absence of the definite article on the subject NP. However, although definiteness is not formally marked by means of the definite article in Czech, it is safe to assume that the subject NP in (9) is to be interpreted as a definite NP, given that it occurs in the initial position of

a non-generic and non-iterative sentence.[17] The claim that both the Czech sentence (9) and *The delegation members embraced each other* are true even if there is no SR is related to the observation that their definite subject noun phrases refer to a specific group of delegates; nevertheless the sentence does not entail a universal quantification over all its members, but rather allows for a certain vagueness in the exact number of delegation members who embraced.

Contrary to this, Dalrymple et al. (1998) propose that reciprocal sentences with non-universal interpretations of definite plural noun phrases still yield SR, albeit a certain "loose" interpretation of SR. For example, a sentence like *The men are hitting each other* means SR "... but exhibits a certain amount of imprecision" (p. 177), especially in a situation in which the antecedent group *A* is large and the situation is unclear with respect to discrete partitioning of the group denoted by the reciprocal's antecedent. A similar 'imprecision' may be found, according to them, in universal statements like *Everyone in the room was drunk*. However, allowing for such a "loose" view of SR obscures the predictive power of the SMH, given that the definition of SR given by Dalrymple et al. (1998) explicitly requires universal quantification: namely, that every member of the group denoted by the reciprocal's antecedent is related by the reciprocal relation to every other member.

It is important to realize that the possibility of the non-universal interpretation of noun phrases that serve as antecedents of the reciprocal quantifier is separate from the logic of reciprocity. The fact that definite plural noun phrases in non-generic, non-iterative sentences may have a non-universal interpretation is well-known (cf. Kempson and Cormack 1981; Burton-Roberts 1981; Kleiber 1983; Declerck 1987; Link 1983, 1987; Hawkins 1991; Landman 1996, and others). Link (1983, p. 310; 1987, p. 169ff.) suggests that the vagueness in the interpretation of definite plural noun phrases has to do with the nature of collective interpretations. For example, a sentence like *The children built the raft* may be true even if not every (relevant) child actively takes part in the building of the raft, but the raft is a result of some collective action of the children. Lasersohn (1988) argues that we ascribe collective responsibility to the agent in a

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[17] According to the Theme-Rheme informational structuring of a sentence, familiar elements, elements introduced into the discourse tend to be placed towards the beginning, while new information tends to be placed at the end or close to the end of a sentence. Subjects are more likely than nonsubjects to represent discourse-old information and the formal definiteness of the subject NP or the interpretation of the subject NP as a definite NP (in the absence of a formal marking) can be viewed as reflexes of this tendency. Hence, the most natural interpretation of subject NPs in the sentence-initial position of Czech sentences is the definite interpretation.
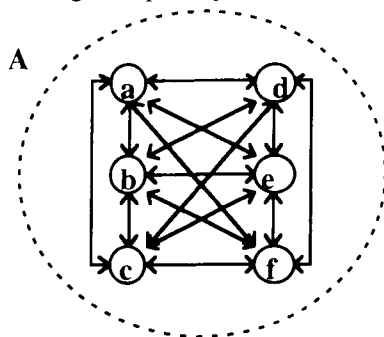
collective predication, so that in *The gangsters killed their rivals* the individual gangsters are co-responsible, even though not every gangster may have performed any actual killing. The possibility of the non-universal interpretation of definite NPs exists outside of the context of collective action sentences, of course. For example, Hawkins (1991, p. 409) points out that *There are cracks in the paving stones* is true in a situation in which not all the paving stones have cracks in them. The possibility of the non-universal interpretation of definite NPs is one of the contextual factors that contributes to the strength of the reciprocal readings. Since it is a factor clearly independent from the logic of reciprocity, it should be kept separate from the characterization of SR which by definition explicitly requires universal quantification in the standard logical sense (see the definition of SR in (1) above).

3.2.2. *Reciprocal Statements with NA- and PO-*

If the reciprocal particle *se* occurs in combination with a distributive *po-* verb as in (12), the preferred reading seems to be the strongest one, namely SR, in which each member embraces every other member, as is depicted in the Diagram (13), for example:

(12)   Členové   delegace   **se**
       member.PL.NOM   *delegation.SG.GEN* **REC.ACC**
       PO-objímali^P.
       DISTR-embrace.PAST.3PL

       'The members of the delegation embraced each other.' [successively]

(13)   Strong Reciprocity

Since the prefix *po-* strongly favors the reading in which each possible pair of individuals in *A* embraces, continuing (12) by (14) is judged odd:

(14) ?? ..., ale Nikita   se   neobjal^P s

    ..., *but Nikita.SG.NOM REC NEG.embrace.PAST.3SG with*

Maem.

Mao.SG.INSTR

'..., but Nikita and Mao did not embrace.'

Continuing (12) by (11) exemplified earlier, which excludes one delegate, Nikita, from embracing anybody and being embraced by anybody, is judged to be worse than continuing (12) by (14) immediately above, which requires Nikita and Mao to still have embraced and be embraced by every other delegate (who is not Nikita or Mao). Some speakers judge the continuation of (12) by (11) to result in a contradiction, in particular if the antecedent group is considered to be small, in contrast to the continuation in (14), which is merely odd. This indicates that the distributive prefix *po-* strongly favors, if not requires, that the relation cover the whole set *A* without an exception. More importantly, we see that the prefix *po-* strongly favors the interpretation in which every member of *A* is directly related by the scope relation *R* to every other member, that is, it favors SR.
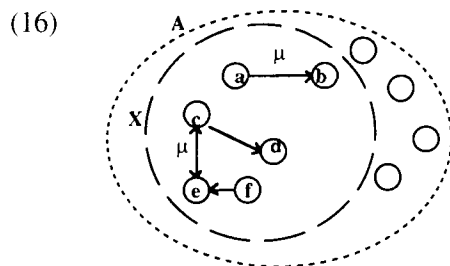
Let us now turn to the prefix *na-* and the reciprocal particle *se* in (15):

(15)   [situation: Mao, Nikita and their entourage take part in a photo-op during a conference on Soviet-Chinese relationships. One of the translators for Nikita makes the following comment]

To **se**   ti   delegáti   ale   před

it **REC.ACC** *these delegate.PL.NOM EMPH in.front.of*

fotografy   **NA**-objímali^P

photographers **ACM**-embrace.PAST.3PL

'Boy, did the delegates embrace a lot in front of the cameras

– (ale za   zavřenými dveřmi to vypadalo zcela

– *(but behind closed   doors   it looked   altogether*

jinak).

differently

– (but behind the closed doors it was quite a different story).'

With the prefix *na-*, the most decisive factor for the truth of a reciprocal statement in (15) is the sheer number of occurrences of the event denoted by the two-place relation *embrace*: The prefix *na-* here requires that there be many events of embracing taking place among the delegation members. This exemplifies what we identified in Section 3.1.2 as the use of the prefix *na-* as a vague measure or a quantifier over events and as inducing a collective action reading. Recall that *na-* in this use requires that the number of event occurrences meets or exceeds some contextually determined (relatively high) value. Unlike *po-*, *na-* does not impose any special requirements on how the scope relation covers the domain *A* (i.e., it easily allows for some delegation members to stand aside and do nothing) or on the strength of reciprocal relations (i.e., even those involved in the embracing need not participate symmetrically with all the others). (15) not only suggests that there was a lot of embracing going on, but it also allows for some pairs of participants to embrace each other repeatedly, thus contributing to the large number of embracing event occurrences. (15) can be true in the situation represented by the Diagram (16), where the Greek letter 'μ' next to the arrow indicates that the pair of individuals connected by it embraced each other more than once.[18]

(16)

If the antecedent denotes a group of a certain critically large size, *na-* allows for a great deal of imprecision or looseness with respect to

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[18] Allowing for the reciprocal to be true in a situation in which a given single participant may repeatedly embrace other participants requires that the relevant embracing events be not simultaneous. In a sentence like (14) it contributes the meaning of approximately a 'gradual accumulation of events into one complex event'. To this it may be objected that the evaluation at a number of consecutive time points should not enter into the truth conditions of reciprocity, and that therefore, our observations do not bear on Dalrymple et al.'s (1998) statement of reciprocal meanings and the SMH. Notice, however, that Dalrymple et al. (1998) also consider reciprocal statements that are not evaluated at a single time point, namely, reciprocal statements that involve genericity, as in (2/34) *House of Commons etiquette requires legislators to address only the speaker of the House and refer to each other indirectly* (SR), and iterativity, as in (45) *A scant year ago, heavily-armed men stood in these towers day and night training sophisticated military optics at each other and reporting every move they saw* (OWR).

whether everybody in the group denoted by the antecedent participates in the denoted relation, and also with respect to the direction in which the reciprocal relation holds. This in turn is crucially related to the semantic contribution of *na-* as a quantifier over a large number of embracing events. For example, in the situation depicted by the diagram (16) four out of ten delegation members (the group *A*) do not participate in the embracing at all. Most importantly, *na-* does not prohibit (15) from having stronger readings than the one depicted in (16), including SR, i.e., it may be true in a situation that involves a lot of events during which every individual participates in the embracing relation with every other. However, due to the prefix *na-* the most strongly preferred interpretation of (15) is not one involving SR. This means that the SMH is too strong for (15), because it predicts that SR must be selected for its interpretation, and yet weakening of reciprocity occurs in (15).[19] In short, (15) allows for readings of different strengths that are compatible with the scope relation of the reciprocal, its antecedent, linguistic context and general world knowledge. Contrary to the SMH, it can be true under an interpretation that is weaker than the strongest possible meaning predicted by the SMH, namely SR.[20]

The claim that the prefix *na-* requires that there be a (relatively, sufficiently, exceedingly) large number of events of the type denoted by the verb to which it is attached (e.g., 'many times') can be clearly substantiated by those cases in which *na-* clashes with the lexical information of the base verb and the general world knowledge associated with it. A case in point is the combination of *na-* with base verbs that describe 'one-time' or not repeatable events. Suppose we modify the biblical story about the two brothers Cain and Abel and allow for a new version in which Cain and Abel somehow manage to kill one another. Suppose this modified story is described by (17a) and (17b), which differ in the presence of the accumulative prefix *na-* in (17b). ((17b) also contains the emphatic reciprocal *sebe*

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[19] Winter (1996, pp. 307–308) also mentions cases in English where weakening of reciprocity occurs, although it is not supposed to, according to the SMH, as in *The boys are tickling each other*, an example due to Philip (1996). According to Winter, the reason for this potential counterexample to the SMH is possibly some gap in our world knowledge associated with verbs like *tickle*. Although it may be the case that a boy tickles more than one other boy, the default assumption may be that a given person may tickle exactly one other person. Under this default assumption the SMH could be salvaged. However, we do not find it convincing that a verb like *tickle* should be associated with such a default assumption.

[20] Notice that Krifka's (1996, p. 146) pragmatic rule (39) (see fn. 6 above) would also be too strong for (15). Similarly as the SMH, it would force us to select the strongest meaning possible here, namely SR.

'each other', which is here added for purely stylistic reasons and does not affect the truth-conditional content of the reciprocal sentence):

(17)a. Kain a Abel   se   navzájem zabili^P.
  Cain and Abel **REC.ACC each.other** *kill.PAST.3PL*
  'Cain and Abel killed each other.'

  b. ?Kain a Abel   se   navzájem   sebe
  ?Cain and Abel **REC.ACC   each.other   REC.ACC.EMPH**
  NA-zabíjeli^P.
  ACM-*kill.PAST.3PL*
  ?'Cain and Abel killed each other a lot.'

In (17a,b) the domain of the reciprocal is a group with two members, Cain and Abel. In general, the SMH predicts that antecedent groups of two require symmetry of reciprocal relation, and hence SR. In our case, this means that the reciprocal proposition RECIP({Cain, Abel}, $\lambda x.\lambda y.$KILL$(x.y)$) is true if and only if Cain and Abel each stands in the scope relation to the other, which in turn yields two subevents: Cain killed Abel (event$_1$) and Abel killed Cain (event$_2$). This interpretation is correctly assigned to (17a), which accurately describes our revised situation. However, (17b) is odd, because the prefix *na-* here requires, implausibly, that there be a large number of killing events, which would mean that Cain and Abel each would have to die more than once. This is, however, preempted by the constraints imposed by the lexical semantic properties of the predicate KILL and general world knowledge associated with it, which require that a single participant cannot die more than once (under normal circumstances). In sum, the oddity of (17b) clearly indicates that the prefix *na-* in (17b) functions as a vague quantifier over relatively large sets of events. This clashes with the only plausible SR reading predicted by the SMH, which involves sets with exactly two subevents. However, if the predicate is changed into one that denotes a repeatable situation, such as talking to each other, or embracing each other, the *na-* version would be entirely acceptable provided there was a lot of talking, or embracing.

Let us now return to our example (15) (with *na-*) and compare it with (9) (lacking a prefix) and (12) (with *po-*). The situation depicted by the Diagram (16) would not be felicitously described by (9), which contains the simple unprefixed perfective verb *objali se* 'they embraced'. (9) leaves less freedom than (15) for allowing that certain members of a delegation did not participate at all in the embracing. (9) also seems to suggest that

there were more symmetrical relations among those participating than in the situation described by (15). Unlike (15), (9) suggests that most, if not all, of embracing events took place simultaneously (e.g., '*at the beginning of the conference*, the delegates embraced each other). (15) not only suggests that there were more events overall that took place than (9), but also that these events may have taken place over a longer period of time than in (9) (e.g., '*during the conference*, the delegates repeatedly/often/many times embraced each other'). Nevertheless, the collective action reading of (15) implies a spatial/temporal proximity or even temporal simultaneity of the events constituting collective action. The most striking difference we find between (15) with *na-* and (12) with *po-*: (12) would be judged false in the situation depicted by the Diagram (16), which represents a situation making (15) true. Thus, given judgements about (9) as the baseline, we see that *na-* weakens the reciprocal relationship, intuitively, while *po-* strengthens it.

As Dalrymple et al. (1998) propose, the strength of the reciprocal relation chosen is affected by the meanings of the reciprocal's scope and antecedent, as well as the relevant nonlinguistic information associated with a particular reciprocal sentence. We will now look at the role of the nonlinguistic context and examine the same set of sentences, given in (18), in a situation in which the nonlinguistic context does not impose any specific constraints on reciprocal relations, and then a situation in which the nonlinguistic context is highly constrained.

(18)   [situation: the members of a famous acrobat family took part at the annual gathering of circus artists]

a. Na.zvedali^P se   sobě   na
    LOC.lift.PAST.3PL   *REC.DAT*   *REC.DAT(EMPH)*   *on*
    ramena.
    shoulder.PL.LOC
    ([They] lifted each other on [the] shoulders.)
    'They lifted each other onto each other's shoulders.'

b. **PO**-na.zvedali^P se   sobě   na
    DISTR-*LOC.lift.PAST.3PL*   *REC.DAT*   *REC.DAT(EMPH)*   *on*
    ramena.
    shoulder.PL.LOC

([They] all lifted each other on [the] shoulders, successively, one (group) after another.)

'They lifted each other onto each other's shoulders.'

c. **NA**-na.zvedali[P]   se   sobě   na
ACM-*LOC.lift.PAST.3PL*   *REC.DAT*   *REC.DAT(EMPH)*   *on*

ramena.

shoulder.PL.LOC

([They] a lot lifted each other on [the] shoulders.)

'They lifted each other onto each other's shoulders many times.'

(Notice that sentences in (18) have no overt subject corresponding to the reciprocal's antecedent. The subject omission of this type in Czech is sanctioned by the general constraints governing *pro*-drop languages.) The reciprocal's scope relation is expressed in (18) by the Czech predicate that roughly corresponds to *nazvedat* 'to lift on top of'. Now, consider an unconstrained context for the set of sentences in (18), in which the acrobats put on a show for the others at the annual gathering in which they lift each other on another's shoulders resulting in a variety of formations. For example, this allows for the acrobat a to lift the acrobat b on his shoulders, and then b lifting a, in turn, on his. In this respect, the situation evoked by (18) would be similar to that described by example (2/34) *House of Commons etiquette requires legislators to address only the speaker of the House and refer to each other indirectly*, which Dalrymple et al. (1998, p. 160, 170ff.) use to illustrate SR. Moreover, the examples in (18) would have then readings that parallel the readings of the earlier examples with the predicate *embrace (each other)*.

In (18a), without a prefix, the reciprocal does *not* require that every member of the delegation be related to every other member by the relation of lifting, and the direction in which this relation holds is not restricted to exclusively symmetric ones. In other words, (18a) does not require the selection of Strong Reciprocity (SR) for its interpretation. Moreover, not all the members of the acrobat family need have participated in the lifting. In contrast, (18b) with *po-* requires that they all participate in the lifting relation R, and it strongly prefers the reading under which each pair of acrobats directly participates in the lifting relation R (i.e., SR).

In (18c), with *na-*, fewer acrobats overall need have participated than in (18a,b), and fewer need have participated symmetrically than in (18a,b), but if the group is small enough there had to have been repeated liftings between the same individuals in order to make for enough liftings overall

to satisfy the semantic requirement of *na-*. For example, (18c) can be true in the situation depicted by (16). Based on our previous observations, this pattern of judgments is expected.

Let us now consider a changed context in which the family of acrobats lift each other on another's shoulders with the goal of forming a single pyramid. In this situation, in using the sentences of (18), the speaker intends to describe a goal-directed process that consists of a number of subevents culminating in a particular final state, namely the pyramid being formed. Let us also assume there are ten acrobats. In this new, revised context, the unprefixed version (18a) is felicitous. However, the SMH predicts that the strongest relation SR cannot hold, given that the relation *nazvedat* 'lift onto/on top of' in the context of building of a pyramid is asymmetric. The next weaker IR cannot hold either, given that the lifting relation cannot be cyclic here. Neither can the next weaker OWR hold, because OWR requires that every member of the set A participates with some other member in the lifting relation as the first argument (see Dalrymple et al. 1998, p. 172), which would entail that whoever is on the bottom can be at the same time on somebody else's shoulders, and this is not so. Notice also that SAR, only briefly mentioned in Dalrymple et al (1998, p. 191), is implausible, because it requires that every pair of individuals is in direct physical contact, which is inconsistent with our expectations of what a plausible pyramid of ten acrobats may look like. The IAO reading allows the antecedent group A to be partitioned into disjoint subgroups, which is inconsistent with the nonlinguistic context in which only one pyramid is formed. In contrast to IAO, the IAR reading entails that there was one single group. Thus, for (18a), the strongest meaning consistent with the lexical meaning of the reciprocal's scope, the antecedent and nonlinguistic context is IAR, which in our case seems correct.

While (18a) adequately describes the situation in which the acrobats formed a pyramid, yielding the IAR reading, (18b) and (18c) cannot be appropriately used in this constrained context. The simplest way to illustrate this claim is the observation that only (18a), but not (18b) and (18c), could be easily continued with … *and built a human pyramid*. Consider the evaluation of (18c) that contains *na-* under these circumstances. Although the semantics of the prefix *na-* is compatible with the most plausible IAR reading consistent with our constrained nonlinguistic context, (18c) sounds odd here, because it evokes a haphazard collection of a relatively large number of events, which is incompatible with a goal-directed process that consists of a number of consecutive subevents culminating in a particular final state, namely the pyramid being formed. This is consistent with our earlier observation (Section 3.1.2) that the most decisive factor for the truth

of sentences in which *na-* functions as a measure of over a large number of events and specifically generates a collective action reading is the sheer number of occurrences of the event of the type denoted by the verb to which it is attached.

The situation with (18b), involving *po-*, is somewhat different. Even in the context of building a pyramid, *po-* still insists on distributing the scope relation to each possible pair in A without an exception. The observation that (18b) sounds odd in our constrained nonlinguistic context indicates that (18b) strongly prefers SR, the logically strongest relation, despite the fact that SR is inconsistent with the constrained nonlinguistic context.[21] Most importantly, the SMH predicts that a weakening of reciprocity ought to occur, yielding IAR, due to the scope relation and the given nonlinguistic context, and yet the predicted weakening does not occur in (18b). In this case the SMH appears too weak, because it predicts that a weakening of reciprocity should take place, but this prediction is not borne out due to the contribution of the prefix *po-*.

The observation that the prefix *po-* strongly favors the SR reading in reciprocal statements for which the SMH excludes it, holds not only for (18b) in the highly constrained nonlinguistic context of forming of a pyramid, but it is also clearly evident in those cases in which the nature of the situation denoted by the scope relation (rather than the specific nonlinguistic context) prevents that every member of the reciprocal's antecedent be related to every other member. Such cases are illustrated by (19a,b). In (19a) the distributive *po-* is combined with the predicate *nakazit neštovicemi* 'to infect with smallpox' and in (19b) with *doprovázet* 'to accompany':

(19)a. ?Děti   se   **PO**-nakazily^P

       ?children.NOM.PL   *REC*   **DISTR**-*infect.PAST.3PL*

       neštovicemi.

       smallpox.PL.INSTR

       'The children infected each other with smallpox.'

   b. ?Po   tanečních hodinách   se   studenti

       after   dance lessons   *REC*   *student.PL.NOM*

       PO-doprovázeli   domů.

       DISTR-*accompany.PAST.3PL home*

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[21] Note that there is another reading of (18b), in which *po-* distributes the relevant subevents over separate running times. On this reading, *po-* does not insist on distributing the scope relation to every possible pair of A without an exception. However, we disregard this purely temporal reading.

'After dance lessons, the students accompanied each other home [i.e., to their respective homes].'

(19a) is odd and the reason is that it is impossible for every child to infect every other child with smallpox, which is the interpretation that the distributive *po-* here seems to favor. However, according to the SMH, a weaker reading than SR, namely IAR, would be the most likely candidate meaning for (19a), given the constraints that are due to the lexical semantics of the main predicate and the common world knowledge associated with it. The oddity of (19a) indicates that the distributive prefix *po-* preempts such a weakening predicted by the SMH. Similarly, in (19b) the weakening predicted by the SMH does not take place, either. Here, the prefix *po-* favors the implausible SR reading in which each student accompanies every other student to his/her respective home.[22]

To summarize, we have observed that the prefixes *na-* and *po-* give rise to the weakening and strengthening of reciprocal meanings. Moreover, they give rise to (a range of) readings for which the SMH does not make the right predictions, because it is either too strong or too weak. For reciprocal sentences with the prefix *na-* (such as (15)) a weaker reciprocal reading is preferable to the stronger one predicted by the SMH, where readings of different strengths are compatible with the scope relation of the reciprocal, its antecedent, and general world knowledge associated with them. Hence, for reciprocal sentences with the prefix *na-* the SMH is too strong. On the other hand, for reciprocal sentences with the distributive prefix *po-* the SR reading is preferred. This preference for the logically strongest relation persists even if the nonlinguistic context or the lexical semantics of the scope relation prohibits the SR reading. The former case was illustrated with (18b) interpreted against the highly constrained nonlinguistic context of forming of a pyramid, while the latter case was illustrated with examples given in (19). Here, the SMH predicts that a weakening of reciprocity ought to occur, due to the scope relation and nonlinguistic context, and yet the predicted weakening does not occur. Hence, in such cases the SMH is too weak. Most of our examples without prefixes allow a range of reciprocal relations, rather than just the strongest available (as do their corresponding English examples). The unprefixed form has the most natural interpretation 'in the middle', so to speak, with distributive *po-*verbs yielding stronger interpretations and *na-*verbs yielding weaker interpretations.

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[22] Once again, it must be emphasized that examples in (19a,b) would be acceptable, if *po-* did not have the distributive interpretation, and instead just had its alternative meaning of temporal succession (distribution to separate time points) pure and simple.

It may be objected that the above observations may not constitute a problem for the SMH, because the SMH only applies in the evaluation of the core reciprocal predication, namely the reciprocal predicate and its arguments: e.g., RECIP({a, b}, R). The prefixes *po-* and *na-*, however, are operators over such predicates: e.g., PO(...RECIP({a, b}, R)) or NA(...RECIP({a, b}, R)). As one reviewer pointed out, this objection is invalid, because the same argument does not apply in the interpretation of other operators, such as the negation operator. As is well-known, a negated reciprocal sentence like *John and Mary do not like each other* has two possible readings: One in which the reciprocal has wide scope with respect to *not*, which amounts to *John does not like Mary and Mary does not like John*, RECIP({John', Mary'}, NOT(like')). In the other reading, the reciprocal has narrow scope with respect to *not*, NOT(RECIP({John', Mary'}, like')), which allows for the possibility that John does not like Mary, but Mary likes John, for example. The SMH correctly predicts that the former reading is (preferably) selected, as it is the stronger meaning here. This, however, means that it cannot be just the reciprocal predicate and its arguments alone that enter into the evaluation of a reciprocal statement.

4. RECIPROCITY, DISTRIBUTIVITY AND COLLECTIVITY

In this section we will first outline our fundamental assumptions, and then we will turn to the semantics of the distributive *po-* and collectivizing *na-*. We will show how their impact on the interpretation of reciprocal statements discussed above follows from their independently motivated semantic properties. The characterization of distributivity expressed by the prefix *po-* largely assumes previous work on distributivity, while the properties of the 'accumulative' prefix *na-* in its augmentative and collectivizing sense have not yet been systematically explored. Therefore, less will be said about *po-* than about *na-*.

4.1. *Fundamental Assumptions*

4.1.1. *D-Quantifiers and A-Quantifiers*
Let us first put our observations about the verbal prefixes *po-* and *na-* into the context of semantic typology. Viewed from a broad typological perspective, *po-* and *na-* belong to a subclass of lexical A-quantifiers that function as morphological operators on verbs. (For a discussion of this point see also Filip 1993/1999, 1996, 2000.) According to Partee, Bach and Kratzer (1987), the expression of quantification (and closely related

notions) across languages falls into two main classes: D-quantification and A-quantification. D-quantifiers are determiner quantifiers like *every, all, most, some,* which syntactically form a constituent with a projection of the lexical category Noun. A-quantifiers constitute a large and heterogeneous class which includes adverbs of quantification, such as *usually, always, in most cases* (see Lewis 1975), "floated" quantifiers *(both, all, each),* auxiliaries, verbal affixes, and various argument-structure adjusters. Partee (1991, 1995) proposes that the class of A-quantifiers is not a natural class, but rather it should be split into two main types: "(i) true A-quantification, with unselective quantifiers and a syntactic (or topic/focus (...)) basis for determining, insofar as it is determinate, what is being quantified over, and (ii) lexical quantification, where an operator with some quantificational force (and perhaps further content as well) is applied directly to a verb or other predicate at a lexical level, with (potentially) morphological, syntactic, and semantic effects on the argument structure of the predicate" (Partee 1995, p. 559).

Slavic languages have a number of verbal prefixes with a quantificational and closely related content, such as distributivity and measure. Similar morphological verb operators can be found in other, and typologically, unrelated, languages: in Australian aboriginal languages (Evans 1995), ASL (Petronio 1995), to name just a few. (For such cross-linguistic data see Bach, et al. 1995.) Many morphological verb operators historically developed from prepositions and adverbials used for the expression of location and direction in space and time as well as for various specifications of manner. Therefore, morphological verb operators often combine quantificational and measurement meanings with non-quantificational adverbial meanings. We saw clear examples of this in our initial description of the semantic contribution of the Czech verbal prefixes *po-* and *na-* in Sections 3.1.1 and 3.1.2.

4.2. *Event Semantics with Lattice Structures*

We presuppose the general framework of event semantics that assumes that certain aspects of the meaning of verbal and nominal predicates can be represented in terms of the part-structure of their respective denotata and modelled as complete join semilattices (see Link 1983, 1987; Bach 1981 1986). The domain of universe (U) contains individuals, eventualities and times. It has a mereological structure that is (partially) ordered by the part relation '$\leq$' (see proposals in Link 1983, 1987, and in Krifka 1998):

(20)   'U_P' is a set of entities (individuals, eventualities and times): I_P
$\cup E_P \cup T_P \subset U_P$

'$\otimes_P$' is a binary *sum operation*, it is a function from $U_P \times U_P$ to U_P.

It is idempotent, commutative, associative.

'$\leq_P$' is the *part relation*: $\forall x, y \in U_P \ [x \leq_P y \leftrightarrow x \otimes_P y = y]$

'$<_P$' is the *proper part relation*: $\forall x, y \in U_P \ [x <_P y \leftrightarrow x \leq_P y$
$\wedge x \neq y]$

'$\otimes_P$' is the *overlap relation*: $\forall x, y, z \in U_P \ [x \otimes_P y \leftrightarrow \exists z \in U_P$
$[z \leq_P x \wedge z \leq_P y]]$

remainder principle: $\forall x, y, z \in U_P \ [x <_P y \rightarrow \exists! z [\neg [z \otimes_P x]$
$\wedge z \otimes_P x = y]]$

Eventualities (in the sense of Bach 1981) are the domain of denotation of verbal predicates and sentences, which fall into three main classes: events, processes and states. Events and processes, but not all the states, are denoted by episodic (stage-level) predicates. Episodic predicates introduce an eventuality variable e into the logical representation of sentences. The eventuality variable e corresponds to the event variable, as introduced in Davidson (1967), Parsons (1986) and Kratzer (1989).

Non-quantificational plural noun phrases, which may be plural due to the presence of plural morphology (*boys*) or conjunction (*Bill and John*), denote pluralities of individuals that are viewed as mereological sums of atomic individuals and as having the same ontological status as atomic individuals (see Link 1983, 1987). In general, the extension of a plural predicate has the structure of a complete *atomic* join semilattice. For example, a plural term like *boys* has in its denotation all the individuals that are individual boys (atoms), just as a singular term like *a boy*, and in addition, all sum (plural) individuals that can be formed from the individual boys. In Link's approach the representation of syntactically plural nouns like *boys* involves the pluralization operation '*': *boy. The denotation domain of mass nouns forms a complete *non-atomic* join semilattice. The non-atomic semilattice from which mass nouns take their denotation is homomorphic to the atomic one that structures the domain of plural nouns.[23]

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[23] In Link's analysis, every count predicate P denoting a set of atomic individuals has a mass term correspondent $^m P$ which denotes a set of quantities of matter: $[\![^m P]\!] = \{x \in D | x \leq \sup[h[\![P]\!]]\}$ (Link 1983, p. 309). The supremum function *sup* applies to the materialized counterpart of P, that is, the result of applying the materialization function h to the denotation of P, to yield the sum of the quantities of matter which make up the individuals in the intepretation of P. For example, the denotation of *apple* in *There is apple in the salad* (used as a predicative mass noun) is the set of quantities of matter that are m-parts of the value of h applied to the set of apples in the world.

Verbal predicates also have denotations that have the algebraic structure of a complete join semilattice (see Bach 1981, 1986). Each event predicate (e.g., *find a key, write a letter*) has an atomic structure, just like the denotation of a singular count noun. The atoms are the particular events denoted by verbal predicates. This is motivated by direct structural analogies to singular count nouns: just as *an apple* denotes an entity with clearly demarcated boundaries, so can an event predicate like *write a letter* be taken to describe eventualities with (temporal) delimitations or boundaries. Event predicates are opposed to predicates that entail no delimitations: namely, process (e.g., *run*) and state (e.g., *be in New York*) predicates. The denotation of a state or process predicate has the form of a non-atomic join semilattice, just as a mass noun.

Mass and bare plural nouns also pattern with process and state predicates in being cumulative, while singular count nouns and event predicates are quantized. As Quine (1960, p. 91) originally observed, mass terms like *water* refer cumulatively: any sum of parts which are water is water. By contrast, a singular count noun like *an apple* is quantized: no proper part of an apple can fall under the denotation of *an apple*. Krifka's (1997) mereological definitions of the cross-categorial properties of 'quantization' and 'cumulativity' are given in (21):

(21)a. A predicate P is *quantized* iff $\forall x, y[P(x) \wedge P(y) \rightarrow \neg y <_P x]$

[A predicate P is quantized iff, whenever it applies to x and y, y cannot be a proper part of x.]

b. A predicate P is *cumulative* iff $\forall x, y[[P(x) \wedge P(y) \rightarrow P(x \otimes_P y)] \wedge \text{card}(P) \geq 2]$

[A predicate P is cumulative iff, whenever it applies to x and y, it also applies to the sum of x and y, provided that it applies to at least two distinct entities.]

4.3. *Strengththening of Reciprocity by the Distributive Prefix PO-*

Our analysis of distributivity presupposes three independently motivated claims: First, the collective/distributive reading is located in the verbal predicate, rather than in the noun phrase (see Hoeksema 1983; Bartsch 1973; Scha 1981; Link 1984, 1987, 1998; Dowty 1986; Lønning 1987; Roberts 1987, Landman 1989; Lasersohn 1988/1990, 1995, 1998; Schwarzschild 1991, 1994, 1996).[24] Second, distributive predicates are predicates

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[24] One argument for locating the collective/distributive readings in the verbal predicate, rather than in the noun phrase, is the existence of sentences that have a conjoined

of sums of individuals, and not just individuals. Following Link (1983, 1987, 1998), distributive predicates are treated as pluralizations of singular verbs. Third, distributive predicates are taken to distribute simultaneously over the members of a group and parts of an event, as Lasersohn (1990, 1995, 1998) and Schein (1993) propose.

In Section 3.1.1, we showed that the role of *po-* is to derive a distributive verb from a non-distributive one, thereby removing the collective/distributive indeterminacy. In Section 4.2.2, we observed that the distributive prefix *po-* influences how the scope relation R covers the reciprocal's domain A. It requires that the scope relation cover the whole set A without an exception. More importantly, we see that the prefix *po-* strongly favors the interpretation in which every member of A is directly related by the scope relation R to every other member, that is, it favors SR. We propose that this behavior of the distributive *po-* in reciprocal statements is motivated by its behavior in non-reciprocal statements: namely, the prefix *po-* insists on distributing the property expressed by its base verb to all the individuals as far 'down' as is consistent with the meaning of the lexical predicate as well as the relevant discourse and nonlinguistic information. To illustrate this point, let us first consider the contrast between (22a) and (22b):

(22)a. Vojáci   zabili^P   muže   v té   vesnici.
    soldier.PL.NOM kill.PAST.3PL man.PL.ACC in that village
    'The soldiers killed some/the men in that village.'

  b. Vojáci   **PO**-zabíjeli^P   muže   v té
    soldier.PL.NOM **DISTR**-*kill.PAST.3PL man.PL.ACC in that*
    vesnici.
    village
    'The soldiers killed all the men in that village.' [one (group) after another]

(22b) differs from (22a) in so far as the prefix *po-* in (22b) enforces the *total distributive* reading for the direct object argument:[25] it asserts that

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verb phrase with one collective and one distributive predicate that combine with a single plural noun phrase, as in *The Beatles split up and (each) started a solo career* (see Link 1991/1998, p. 50).

[25] Lasersohn (1998) provides a definition of a generalized distributivity operator that allows us to produce distributive readings not only for subject arguments, but also for non-subject arguments (direct objects, objects of prepositions, and noun phrases in other structural positions).

each atomic individual member of the sum individual denoted by the direct object has the property of being killed, and any sum of individuals that can be formed from the atomic individuals is assigned the property of being killed, as well. Hence, (22b) entails that *all* the men in the village under consideration are dead as a result of the described event. Continuing (22b) with a clause like "... but three men survived the soldiers' attack" would yield a contradiction. This does not necessarily hold in (22a), which may be true even if the soldiers did not kill each and every man in the village.

The total distributive reading to each atomic individual is one extreme on a scale which encompasses 'intermediate' distributive readings with distributions to subgroups of various sizes, and which has the collective reading as the other extreme (see Katz 1977, p. 127; Link 1991, 1998, p. 52ff.; Schwarzschild 1996, p. 63ff.; Lasersohn 1998, for example). In general, the salient intermediate groups and their size are determined by the lexical semantics of the main predicate, its sentential context and the relevant discourse and nonlinguistic information.[26] For example, the formation of an intermediate group level can be induced by collective predicates, as is illustrated in (23b).

(23)a. Vojáci   se   shromáždili^P na cvičebním poli.
         soldier.PL.NOM REFL gather.PAST.3PL on exercise   field
         'The soldiers gathered on the exercise field.'

   b.   Vojáci   se   **PO-shromáždili^P**   na cvičebním
         soldier.PL.NOM REFL **DISTR-***gather.PAST.3PL on exercise*
         poli.
         field
         'The soldiers gathered into groups on the exercise field.'

Here, the distributive prefix *po-* is applied to the collective perfective verb *shromáždili se* '(they) gathered', used on its own in (23a), and derives the distributive verb *poshromáždili se* '(they) gathered into separate groups'. (23a) with the (unprefixed) collective verb *shromáždili se* '(they) gathered' only has a collective interpretation. (23a) is satisfied in a model in which all the relevant soldiers come together on the exercise field. Due to the inherently collective base verb *shromáždili se* '(they) gathered' to which *po-* is attached, (23b) suggests a partition of the total group of soldiers

[26] The importance of pragmatic factors in assigning distributive readings and in resolving the distributive-collective ambiguity is emphasized in Link (1987, p. 174ff.), Schwarzschild (1996, pp. 74–75) and Lasersohn (1998).

into (non-overlapping) cells, where the members of each cell are all non-singular. Suppose the context specifies that the soldiers are partitioned into squads, with each cell of the partition corresponding to one squad whose members come together. (23b) is then true on the intended intermediate reading, provided the property expressed by the collective verb *shromáždili se* '(they) gathered' holds of each cell (each squad). The collective reading in (23a) is compatible with a partitional reading; it can be viewed as its special case: namely, one in which we have the one-element partition comprising the total group of soldiers.

To sum up, in the two cases discussed above – total distributivity (22b) and intermediate distributivity (23b) – the prefix *po-* distributes the property expressed by its base verb (i) to *each* atomic individual (*total distributivity*) or (ii) to *each* smallest sum of individuals (*intermediate distributivity*) into which the domain of interpretation can be divided, modulo the constraints imposed by the meaning of the main lexical predicate, the relevant discourse and nonlinguistic information. If the relevant units are groups, they may be separate or overlapping, in any case, there must be some clear way of differentiating the salient groups.

If the above is correct, we can motivate the observation that the distributive prefix *po-* strengthens reciprocity in the following way: The domain of interpretation of reciprocal predicates is divided into groups consisting of exactly two members that stand in the relation denoted by the reciprocal's scope (namely, the transitive relation denoted by the main lexical predicate). The reciprocal quantifier thus excludes the total distributivity reading to *each* atomic individual, and *po-* distributes the scope relation to *each* smallest member at the next higher level of division, namely to each possible two-membered group (as a matter of strong preference, at least, if not an absolute requirement) that can be formed from the atomic individuals in the group denoted by the reciprocal's antecedent. Put informally, this means that in reciprocal statements the prefix *po-* distributes to a series of statements of the form '*a* and *b* V each other', where '*V*' expresses the scope relation. In general, groups of two require symmetry of reciprocal relation, and hence SR. That is, saying something like *Mao and Nikita embraced each other* adequately describes a situation in which Mao embraced Nikita and Nikita embraced Mao. The strengthening of reciprocity induced by *po-* thus follows from two independently motivated properties: First, the general requirement (or at least a strong preference) of the prefix *po-* to distribute as far 'down' as is consistent with the meaning of the main lexical predicate as well as with other relevant linguistic and nonlinguistic information; second, the simple fact about the reciprocal in-

terpretation, namely that in the case of two-membered antecedent groups, SR must hold no matter what the predicate.

The interpretation of statements with the distributive *po-* must incorporate a means of setting the number of participants involved in each component action in the described complex event: namely, atomic individuals or groups of various sizes into which the domain of interpretation is divided. The number of participants involved in each component action is contextually determined by the main lexical predicate to which *po-* is applied as well as other linguistic and nonlinguistic information. *Po-* strongly prefers that the units of participants be as small as is possibly consistent with the lexical semantics of the verb to which it is applied and other relevant (non-)linguistic information. The intended interpretation is thus essentially of modal and pragmatic nature, and it can be partially characterized in terms of the modal operator '$\Diamond$'. The distributive prefix *po-* also involves universal quantification, because it requires that the property expressed by its base verb be attributable to *each* such unit, namely to each atomic individual member or to each relevant group into which the domain of interpretation is divided. The semantic contribution of the distributive prefix *po-* can be represented as in (24a). (24b) represents a partial derivation for a sentence like (12):

(24)a. $[\![po-]\!] = \lambda P \lambda Q \lambda e \forall u [u \leq_P \sigma x Px) \wedge \Diamond \exists e'[e' \leq_P e \wedge Q(u, e')] \rightarrow \exists e'[e' \leq_P e \wedge Q(u, e')]]$

b. (= 12)

$\lambda P \lambda Q \exists e \forall u [u \leq_P \sigma x Px) \wedge \Diamond \exists e'[e' \leq_P e \wedge Q(u, e')] \rightarrow \exists e'[e' \leq_P e \wedge Q(u, e')]]$ (delegates')(RECIP(embraced'))

$= \lambda Q \exists e \forall u [u \leq_P \sigma x.\text{delegates'}(x)) \wedge \Diamond \exists e'[e' \leq_P e \wedge Q(u, e')] \rightarrow \exists e'[e' \leq_P e \wedge Q(u, e')]]$ (RECIP(embraced'))

$= \exists e \forall u [u \leq_P \sigma x.\text{delegates'}(x)) \wedge \Diamond \exists e'[e' \leq_P e \wedge \text{RECIP(embraced')}(u, e')] \rightarrow \exists e'[e' \leq_P e \wedge \text{RECIP(embraced')}(u, e')]]$

Since it is logically impossible that a reciprocal predicate applies to an atomic individual, distribution is just down to sum individuals that consist of two parts. The sigma operator Í, introduced by Link (1983), forms individual terms of the form '$\acute{I}x Px$', whereby $^a\acute{I}^* x Px^o = {}^a\acute{I}x Px^o$ iff $^a P^o, 2$, otherwise $= 0$ (see Link 1983/1998, p. 28). For a given predicate P, a sigma term denotes the individual sum of all the individuals that are Ps. The part relation '$\leq_P$' (defined in (20)) relates individuals or sum (plural) individuals formed from atomic individuals to the individual sum of all the

individuals that are Ps. In (24b), we get a predicate that applies to events e such that for all parts u of the sum of P-objects such that it is possible that Q applies to u and a part of e, it holds that Q indeed applies to Q and a part of e. As one reviewer pointed out, there is one problem with this formulation: namely, the event e may here contain extraneous subevents. We want to say that an event of embracing each other just consists of embracings (and not, e.g., photographers taking pictures of the scene, etc.). In other words, we want to have a predicate that applies to events e that consists of all the possible embracings, nothing less, but also nothing more. However, this is not captured in (24a, b).

4.4. *Weakening of Reciprocity by the Collectivizing Prefix na-*

The weakening of reciprocity by the prefix *na-* is here directly attributed to its use as a pluractional marker that generates a collective action reading of sentences. In the simplest terms, the contribution of *na-* in such contexts is roughly '[to V] many times together, as a group'. This use of the prefix *na-* belongs to the family of related 'augmentative' (traditionally also labeled 'accumulative') uses of *na-* that share the basic measurement component of 'a large quantity'. The measurement component of 'a large quantity' and the collective action reading derived from it clearly distinguish *na-* from the distributive *po-*.

In Section 3.1.2 we have seen that the contribution of *na-* is semantically close to that of measure adverbials like *for a long time*, vague measures of amount like *a long distance*, *a large quantity (of)*, and vague determiner quantifiers like *a lot (of)*. Intuitively, it makes then sense to treat *na-* as expressing a vague extensive measure function at the level of verb morphology, as is proposed in Filip (2000). Presupposing the arguments and assumptions made there, the general formula for the semantic representation of verbal prefixes that express some notion of vague measure can be given as in (25a), and specifically the meaning of *na-* as in (25b):

(25)a. $[\![\text{PREFIX}]\!] = \lambda P \lambda x [P(x) \wedge m_c(x),$ where P is homogeneous]

   b. $[\![na\text{-}]\!] = \lambda P \lambda x [P(x) \wedge m_c(x) \geq r_c,$ where P is homogeneous]

   'm_c': a free variable over (extensive) measure functions that are linguistically or contextually specified

   'r_c': contextually determined expectation value (e.g., positive integer)

In (25), the contribution of a verbal prefix is characterized in terms of a free variable m_c over extensive measure functions that is applied to an entity x (an individual or event) of type P. A measure function applied to an entity x yields as a value some positive real number. In the case of the prefix *na-* this number meets or exceeds some contextually determined expectation value r_c. The presuppositional *where*-clause on P captures the general input requirement of measure functions, it says that their domain of application is restricted to homogeneous predicates.

Following some proposals in Higginbotham (1995) and Krifka (1998) the general definition of an extensive measure function for a part structure $P = \langle U_P, \oplus_P, \leq_P, <_P, \otimes_P \rangle$, defined in (20) above, can be given as in (26):

(26) m is an extensive measure function for a part structure P iff:

    a. m is a function from U_P to the set of positive real numbers.

    b. *additivity:* $\forall x, y \in U_P[\neg x \otimes_P y \to m(x \otimes_P y) = m(x) + m(y)]$

    c. *commensurability:* $\forall x, y \in U_P[m(x) > 0 \wedge \exists z \in U[x = y \oplus_P z] \to m(y) > 0]]$

'+' stands for the arithmetical addition. The essential property of measure functions is the property of additivity, which is defined in (26b). According to (26b), the sum of the measure of non-overlapping elements is the measure of their sum. Hence, extensive measure predicates cannot be cumulative (see definition (21a) above). Depending on the context, the identity of m_c is specified in terms of a standard measure (e.g., *hour, kilometer, pound*), a non-standard vague measure (e.g., *quantity, piece*), or it may be left indeterminate. The function m_c measures the running time, path or the participant associated with the Incremental Theme argument of a verb. Provided a one-to-one relation can be established between parts of the measured entity and parts of the event, the measure expression that introduces the function m_c ultimately delimits the denotation of the corresponding event predicate, following the general constraints on aspectual compositionality (see also Section 3.1.2 above).

In general, extensive measure functions map homogeneous predicates onto quantized predicates. (However, in the case of *vague* extensive measure functions, such as that expressed by the prefix *na-*, this does not lead to strict quantization of the output predicate in the sense introduced in (21a). See Filip, 2000.[27]) Intuitively, homogeneous predicates are predic-

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[27] To illustrate this point, take *naprocházet se* in the sense of 'to spend a long time walking'. If six hours of walking is considered to be walking for a long time in a given

ates not delimiting the extent of entities in their denotation. Technically, homogeneous predicates are cumulative and divisive:

(27)a.   A predicate P is *cumulative* iff $\forall x, y[[P(x) \wedge P(y) \rightarrow P(x \otimes_P y)] \wedge \text{card}(P) \geq 2]$

b.   A predicate P is *divisive* iff $\forall x, y[P(x) \wedge y <_P x \rightarrow P(y)]$

For example, mass predicates like *flour* are divisive, as proper parts of some quantity of flour count as flour (at least down to a certain level of 'minimal' flour parts). They are also cumulative, as any sum of parts which are flour is flour (see Quine 1960, p. 91). Similarly, process verbs like *run* are homogeneous: A temporal proper part of an event of running is again an event of the same type (divisivity); running and running amounts to running (cumulativity). In order to individuate and identify portions or quantities of entities in the denotation of homogeneous predicates, we need to project a structure on their denotation domain, which they do not inherently have. This can be done by means of measure and classifier-like expresssions: e.g., *a cup of flour, two cups of flour*, and the like. The homogeneity input restriction on the application of extensive measure functions is motivated by the observation that we do not use various measure expressions to individuate or delimit the denotations of predicates that are already individuated or quantized. For example, *3 pounds of flour* is well-formed, but **3 pounds of a horse* is not, as Bach (1981, p. 74), among others, observes. Similarly, event predicates, which are quantized, are odd

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context (event e), then in the same context walking for five hours (event $e', e' < e$), may be as well, but not walking for one hour (event $e'', e'' < e$). This means that there are events like e (walking for six hours) in the denotation of *naprocházet se* that have a proper subpart like e' (walking for five hours) which is also an event in the denotation of this verb. Therefore, *naprocházet se* fails to be quantized, according to (21a). However, with respect to standard distributional tests for perfective verbs, it behaves just like other perfective verbs that are quantized in the sense of the quantization definition given in (21a). This situation is typical for all perfective verbs that contain prefixes with a vague measurement or quantificational content, and it poses problems for the standardly made claim that Slavic perfective verbs are quantized, or, to use other common terms, telic or event-denoting (see Krifka 1986, 1992; Piñón 1995; Schoorlemmer 1995, for example).

A similar quantization puzzle arises with noun phrases that contain vague determiner quantifiers like *most, some, many, a lot* and *(a) few*, vague measure expressions like *a sequence of numbers, a quantity of milk*. Such noun phrases fail to be quantized, when analyzed in isolation as predicates, nevertheless they behave like quantized noun phrases with respect to aspectual composition and temporal adverbials (cf. L. Carlson 1981, p. 54; Mittwoch 1988 fn. 24; Dahl 1991, p. 815; Moltmann 1991; White 1994; Zucchi and White 1996; Partee p.c. to Krifka, for example): cp. *John wrote a sequence of numbers ??in five minutes/for five minutes*. (Examples are taken from Zucchi and White 1996.)

in combination with a measure expressed by a durative adverbial: *It took John an hour to run for an hour (naturally)*, *?John ran for an hour for an hour*,[28] *??John wrote a letter for an hour*.

Our semantic analysis of *na-* as a vague measure function has the advantage that it makes the correct predictions for the behavior of *na-*, which otherwise would be puzzling. In a variety of contexts, we consistently see that *na-* is freely applicable to homogeneous nominal and verbal predicates, but not to quantized ones. For example, if *na-* is linked to the Incremental Theme argument, as in (8), it can be realized by a bare mass or plural noun phrase, but not by a singular count noun phrase, a noun phrase containing cardinal quantifiers that indicate a relatively small number, such as the numeral *pět* 'five', the indefinite numeral *několik* 'several', 'a few'; or a noun phrase with universal determiner quantifiers like *každý* 'every', 'each' (strong) and *všechen* 'all'. (See Filip (2000) for more details on the homogeneity input restriction of the vague measure prefix *na-*.)

Let us now turn to the behavior of the prefix *na-* in reciprocal statements. The homogeneity restriction on the application of *na-* in (25b) prevents *na-* from being directly applicable to a basic singular reciprocal predicate, which involves exactly two participants, and hence SR. It can be rendered as [RECIP(P)]($a \oplus_P b$). The reason is that such a predicate is not homogeneous. Take, for example, *Mao and Nikita embraced each other (once)*:

(28)   [RECIP(EMBRACE)](Nikita $\oplus_P$ Mao) $\leftrightarrow$ EMBRACE(Mao, Nikita) $\wedge$ EMBRACE(Nikita, Mao)

Adding an event described by *Mao and Nikita embraced each other (once)* to another event of the same type does not result in an event that can be described by *Mao and Nikita embraced each other (once)*, which violates the cumulativity condition given in (27a). Moreover, not every part of an event described by *Mao and Nikita embraced each other (once)* is again an event of the same type, which violates the divisivity condition given in (27b). In short, a basic singular reciprocal predicate, [RECIP(P)]($a \oplus_P b$), is not homogeneous, but rather quantized.

One obvious way of resolving the clash between the homogeneity input requirement of the measure *na-* and a basic reciprocal predicate would be shifting its interpretation into a homogeneous interpretation by means of Link's operation of semantic pluralization '*', which would yield a plural reciprocal predicate: *[[RECIP(P)]($a \oplus_P b$)]. In this way we may obtain,

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[28] A combination of a process predicate like *ran* with a durative adverbial like *for an hour* yields a quantized predicate, see Bach (1981, p. 74).

for example, a sum of reciprocal events $e = e_1 \oplus_P e_2 \oplus_P e_3$, where e_1 = [RECIP(EMBRACE)](Sue $\oplus_P$ John), e_2 = [RECIP(EMBRACE)](Bill $\oplus_P$ Mary), e_3 = [RECIP(EMBRACE)](Nikita $\oplus_P$ Mao).

There are two main objections against trying to coerce reciprocal predicates into a homogeneous interpretation by pluralizing them. First, pluralization yields predicates that satisfy the cumulativity condition on homogeneity, but not necessarily the divisivity condition. If we form a sum of e with other plural 'embrace-each-other' events, we obtain a plurality of 'embrace-each-other' events of the same type (cumulativity). A plurality of 'embrace-each-other' events may have proper parts that are also pluralities of 'embrace-each-other' events (divisivity), provided we do not consider proper parts too small to count as a plurality of 'embrace-each-other' events. In other words, a reciprocal predicate is divisible only up to certain minimal proper parts.[29]

The second main objection against coercion of a reciprocal predicate into a homogeneous interpretation by means of pluralization has to do with the observation that it would not lead to the weakening of reciprocity that we have observed with *na-*. Given that the input predicate involves SR, the pluralization operation would yield sums of reciprocal events, where each component event would exhibit SR.[30] When applied to such plural predicates, *na-*would contribute the assertion that there was a large quantity of such events. In other words, this treatment would make the wrong prediction that the prefix *na-* insists on 'counting' just the number of symmetrical, strong reciprocal relations. This clearly is not the case (see more below). Pluralizations of singular predicates yield distributive predicates; however, *na-* has in fact quite the opposite effect: namely, it generates a collective action reading of a sentence. The property expressed by the reciprocal predicate in combination with *na-* (e.g., 'embrace-each-other-a-lot', 'embrace-each-other-many-times', for example) does not necessarily distribute to every (possible) two-membered group that is formed from the atomic individuals in the group denoted by the reciprocal's antecedent. Nevertheless, it is necessary that there be some two-membered groups with this property, and that this property hold of the *whole* group denoted by the reciprocal's antecedent.

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[29] The divisivity of reciprocal predicates raises the general problem of 'minimal parts' of entities, discussed by Taylor (1977, p. 214), for example.

[30] Notice that this does not require that each individual in the reciprocal's antecedent stand in the scope relation to every other individual. If we take the example of a sum of reciprocal events $e = e_1 \oplus_P e_2 \oplus_P e_3$ given above, we see that John and Bill are the members of the antecedent group {Sue, John, Bill, Mary, Nikita, Mao}, but they do not stand in an 'embrace-each-other' relation.

As we have already observed in Section 4.2.2, the prefix *na-* does not insist on 'counting' just the number of symmetrical, strong reciprocal relations. This point can be best illustrated with the limiting reciprocal case of a two-membered antecedent group:

(29) To **se**   ale   Mao   a   Nikita   před
      it **REC.ACC** *EMPH* *Mao* *and* *Nikita* *in front of*
      fotografy   **NA**-objímali[P]!
      photographers **ACM**-*embrace.PAST.3PL*
      'Boy, did Mao and Nikita embrace a lot in front of the cameras!'

(29) is true in a situation in which the relevant plurality of reciprocal events comprises symmetrical embracing events in which Nikita embraces Mao and Mao also embraces Nikita, and also asymmetrical events in which Nikita or Mao, but not both, is the 'embracer'. If ten embracing events is considered to qualify as 'embracing a lot' in a given situation, then in this situation (29) can be felicitously uttered even if out of the ten events only four are symmetrical, and the rest are asymmetrical.

The collectivizing effect of *na-* in reciprocal statements is directly related to the observation that *na-* here imposes a measure over events. What *na-* here 'counts' is the number of events of the type described by the transitive verb to which it is attached (i.e., the scope relation) and it requires that there be some sufficiently large quantity of such events. Importantly, *na-* imposes no measure over individuals, that is, in reciprocal statements it imposes no requirements on the quantity of individuals denoted by the reciprocal's antecedents. If it did, then in (29), for example, we would get a semantic clash between the vague measurement content of *na-*, approximately *a large quantity (of)*, *a lot (of)*, *many*, and the cardinality of the group denoted by 'Mao and Nikita'. But there is no such clash. Hence, reciprocal statements with *na-* cannot be equivalent to reciprocal statements with quantified antecedents: e.g., 'a large quantity of/a lot of/many x V-ed each other'. This behavior of *na-* can be motivated if we assume that *na-* selectively targets either the event argument or the individual (i.e., Incremental Theme) argument for its semantic effect, but not both (see also Filip 1993/1999 and 2000).

Not only does *na-* impose no requirements on how many members the antecedent domain A has, but also no requirements on how the scope relation covers A and the strength of reciprocal relations. It easily allows for the scope relation not to be restricted to exclusively symmetric ones and for the same two individuals to participate in a reciprocal relation numerous times, thus contributing to the large quantity of events. This allows for

some members of A not to participate at all in the situation described by the scope relation. Nevertheless, the predicate expressed by the na-verb is asserted to hold of the whole collection of individuals denoted by the reciprocal's antecedent. All of this conspires that the effect of na- is to induce a collective action reading and consequently, to weaken reciprocity.

We do note that the participation cannot be reduced to just the same two individuals under most circumstances. If there are ten delegates in the antecedent group, then a reciprocal sentence with na-, such as (15), would not be felicitous if among those ten delegates only Nikita and Mao repeatedly embrace one another, while the remaining delegates stood to the side. This follows from Gricean pragmatic principles of communication, and is not inherent to the interpretation of reciprocity per se. If the speaker knows that it was only Mao and Nikita who embraced numerous times, and all the other delegates just watched them, then it would be misleading for the speaker to assert a less informative, and therefore weaker, statement like 'The delegates embraced each other many times', rather than a more informative, and hence stronger, statement like 'Mao and Nikita embraced each other many times'. However, if there are, a dozen delegates, for example, on each side, repeated embracings by, say, four on each side could easily suffice, provided there were enough events of embracing overall. Again, it should be emphasized that na- does not 'count' just the number of strongly reciprocal relations involved, and in fact, in this example none need occur at all.

The weakening of reciprocity by the collectivizing na- is also supported by the observation that na- is upward and not downward entailing (unlike po-). That is, if the criterial number of events is reached within a smaller group of participating individuals, any larger group of participants need not add any more instances of the denoted event. Thus, intuitively, if there were enough instances of the delegates embracing each other in a certain subset of the delegates, modulo contextual factors, what the other delegates did remains irrelevant, since among the smaller group the criterial value of na- has already been satisfied. The predicate expressed by the na-verb is asserted to hold of the whole collection of individuals denoted by the reciprocal's antecedent. For this collective action reading to be satisfied it is sufficient that there be some criterial number of pairs whose actions contribute to the overall large quantity of reciprocal events, and crucially, a reciprocal sentence with na- does not entail that this holds for each of the salient two-membered groups. Thus, if the minimal group-size we begin with is already reasonably large, allowing for weakening of reciprocity, the upward entailment requires that the property expressed by the scope

relation in combination with *na-* hold of ever-larger groups regardless of the actions of the additional members.

To sum up, the above observations clearly suggest that we cannot ensure the satisfaction of the homogeneity input requirement of *na-* by coercing reciprocal predicates into a homogeneous interpretation by pluralizing them, because *na-* functions as a pluractional marker in reciprocal statements and generates a collective action reading. Another plausible way of coercing a reciprocal predicate into a homogeneous interpretation, and achieving the desired weakening effect on reciprocal interpretations, is by partitive modification. We may define it by using the non-strict part relation '$\leq_P$', which was defined in (20) above:

$$(30) \quad \text{PART}(P) = \lambda e[\exists e'[P(e') \wedge e \leq_P e']]$$

If P is a reciprocal predicate like 'the delegates embraced each other', then PART(P) will apply to parts of a complex embracing event. Since PART(P) is homogeneous, it can serve as an input into the measure *na-*: $[na\text{-}]$(PART(P)). The output is a collective predicate, where the partitive modification is intended to explicitly allow for the component actions to involve reciprocal relations that are weaker than SR, including those involving asymmetrical relations and for some members of the reciprocal's antecedent not participating at all in the component actions.

The partitive modification can be found in other kinds of coercion. For example, *ate three apples* on its own is quantized, and it can be coerced into a homogeneous interpretation in the scope of a measure adverbial, as in *ate three apples for an hour*. The latter is understood as meaning that all of the three apples were partly eaten, but none of them finished, during the period of one hour (see Heny and Tenny, 1992, and Tenny, 2000). That is, a predicate like *ate three apples for an hour* can be represented as applying to events e that are *proper parts* of events of eating three apples (in the sense of the strict proper part relation '$<_P$' defined in (20) above) and that last for an hour.

In light of the above observations, a representation for a sentence like (15) would involve the following subformula:

$$(31) \quad \lambda P \lambda Q \exists e \exists y[y = \sigma^*xPx \wedge \text{NA}(\text{PART}(Q(y, e)))]$$
$$(\text{delegates}')(\text{RECIP}(\text{embraced}')) = \lambda Q \exists e \exists y[y$$
$$= \sigma^*x.\text{delegates}'(x) \wedge \text{NA}(\text{PART}(Q(y, e)))]$$
$$(\text{RECIP}(\text{embraced}')) = \exists e \exists y[y = \sigma^*x.\text{delegates}'(x) \wedge$$
$$\text{NA}(\text{PART}(\text{RECIP}(\text{embraced}'(y, e))))]$$

5. SUMMARY AND CONCLUSIONS

In the simplest cases, *po*-verbs and *na*-verbs morphologically encode the total distributive (to singularities) and collective reading of sentences, respectively. We have used this observation as a means of understanding why reciprocal statements with the prefix *na-* are weaker than those with the distributive *po-*. In a reciprocal sentence, the prefix *na-* produces a collective action reading, which derives from its basic use as a vague extensive measure function over a plurality of events. In a reciprocal statement, this has the effect of *na-* allowing for not all the members of the antecedent group to participate in the reciprocal relation denoted by the scope, and for those who do, they need not stand in the SR relation to each other.

The distributive prefix *po-* derives a distributive verb from a non-distributive one. *Po-* strengthens reciprocity, because the distributive prefix *po-* insists on distributing the property denoted by the predicate to which it is applied in so far 'down' as is possible, given the lexical semantics of the predicate, and other relevant information supplied by the (non-)linguistic context. If the total distributive reading to atomic individuals is precluded by linguistic and extralinguistic factors, that is, if we have intermediate distributivity readings, the semantics of the distributive *po-* makes reference to *all* the particular salient subgroups of the relevant plurality. For reciprocal statements it means that *po-* favors the SR reading under which the reciprocal relation holds of each possible group of two members that can be formed from the individuals in the group denoted by the reciprocal's antecedent, and it requires the involvement of all such individuals. As the groups of participating individuals get smaller, the more likely will *po-* require the interpretation of the reciprocal statement in terms of SR.

We have also observed that the prefixes *po-* and *na-* generate (a range of) readings of reciprocal sentences for which the SMH, literally applied, does not make the right predictions. The prefix *na-* systematically selects weaker reciprocal readings than the strongest possible predicted by the SMH (see example (15)), while the distributive prefix *po-* prefers the SR reading, although the SMH predicts that a weakening should take place (see examples in (18b), (19)). Hence, for reciprocal sentences with the prefix *na-*, the SMH, literally applied, seems too strong, and for those with the prefix *po-*, it is too weak.

The question that remains for the semantics of reciprocals is how we can deal with this type of vagueness or imprecision. We note that in the present case we make a distinction between the inclusiveness of the relation (which members must participate), and the strength of the relation itself. These two dimensions seemed to be teased apart most clearly in

the case of *po-* sentences, which appear to demand that all members participate, but among those a few need not participate reciprocally with all the other individuals, although *po-* in general prefers SR. We also have left open the question of how group/group reciprocals can be interpreted (which comes up most clearly in the case of *na-* sentences, under our analysis), and we take it that a primary goal of the SMH is to characterize the circumstances under which one group can be said to interact reciprocally with another group. In this paper, we have not proposed an alternative formulation. This interacts with the question of whether we need to assume a special theory of collectivity implications, as Lasersohn (1988/1990) proposes, for example. Landman (1996, p. 429) argues, on the other hand, that there is no need for such a theory, because "collective predication is an instance of singular predication. (...) all inferences and implicatures associated with collective readings have to be derived from two sources: the general theory of thematic roles and inferences associated with those, and the nature of the argument filling the role, i.e., the fact that a group, rather than an invidividual fills a role." This may be entirely correct, but how to apply this thinking to the present circumstance with precision is not entirely clear. One possible direction for future research on how to address these problems may include the application of the supervaluation approach to vagueness and imprecision in natural language. (See McConnell-Ginet and Chierchia 1990/92, p. 405ff., for example.)

A lingering issue we do not address concerns the co-occurrence of *na-* and the distributive *po-* on the same verb. This gives rise to the question 'What are their admissible combinations and scopal properties?' If we assume that *na-* expresses a measure function, then it ought to take a narrow scope with respect to scope-sensitive operators in a sentence, such as a distributive operator. Therefore, we would predict that sentences in which the prefix *na-* takes scope over the distributive *po-* ought to be odd. If we also assume that the scope of the prefixes is reflected in their surface order (an assumption which cannot be taken for granted, of course), then this prediction would seem to be borne out by the observation in traditional linguistics that the distributive prefix *po-* is typically attached to a verb prefixed with the measure *na-*, but not the other way round (for Russian, see Isačenko 1960, for example).

REFERENCES

Agrell, S.: 1908, 'Aspektänderung und Aktionsartbildung beim polnischen Zeitworte: Ein Beitrag zum Studium der indogermanischen Präverbia und ihrer Bedeutungsfunktionen', *Lunds Universitets Arsskrift*, new series, I, iv.2.

Bach, E.: 1981, 'On Time, Tense, and Aspect: An Essay in English Metaphysics', in P. Cole (ed.), *Radical Pragmatics*, pp. 63–81.

Bach, E.: 1986, 'The Algebra of Events', *Linguistics and Philosophy* **9**, 5–16.

Bach, E., E. Jelinek, A. Kratzer, and B. Partee: (eds.): 1995, *Quantification in Natural Languages*, Kluwer Academic Publishers, Dordrecht.

Bartsch, R.: 1973, 'The Semantics and Syntax of Number and Numbers', in J. Kimball (ed.), *Syntax and Semantics*, **2**, Seminar Press, New York.

Burton-Roberts, N.: 1981, 'Review of Hawkins (1978)', *Language* **10**, 167–186.

Cusic, D.: 1981, *Verbal Plurality and Aspect*, Ph.D. Thesis, Stanford University.

Dalrymple, M., M. Kanazawa, S. Mchombo, and S. Peters: 1994a, 'What do reciprocals mean?', *Proceedings of SALT 4*, pp. 61–78.

Dalrymple, M., S. A. Mchombo, and S. Peters: 1994b, 'Semantic Similarities and Syntactic Contrasts between Chichewa and English Reciprocals', *Linguistic Inquiry* **25**(1), 145–163.

Dalrymple, M., M. Kanazawa, Y. Kim, S. Mchombo, and S. Peters: 1998, 'Reciprocal Expressions and the Concept of Reciprocity', *Linguistics and Philosophy* **21**(2), 159–210.

Davidson, D.: 1967, 'The Logical Form of Action Sentences', in N. Rescher (ed.), *The Logic of Decision and Action*, University of Pittsburgh Press, Pittsburgh, pp. 81–95.

Declerck, R.: 1987, 'Definiteness and Inclusive Reference', *Journal of Literary Semantics* **16**, 12–29.

Dougherty, R. C.: 1974, 'The Syntax and Semantics of *Each Other* Constructions', *Foundations of Language* **12**, 1–47.

Evans, N.: 1995, 'A-Quantifiers and Scope in Mayali', in E. Bach et al. (eds).

Fiengo, R. and H. Lasnik: 1973, 'The Logical Structure of Reciprocal Sentences in English', *Foundations of Language* **9**, 447–468.

Filip, H.: 1993/1999, *Aspect, Situation Types and Nominal Reference*, Ph.D. Thesis, University of California at Berkeley, 1993. [Published as *Aspect, Eventuality Types and Noun Phrase Semantics*, 1999. Garland Publishing, Inc., New York/London].

Filip, H.: 1996, 'Quantification, Aspect, and Lexicon', *Proceedings of the Conference on Formal Grammar*, ESSLLI, Prague.

Filip, H.: 2000, 'The Quantization Puzzle', in James Pustejovsky and Carol Tenny (eds), *Events as Grammatical Objects, from the Combined Perspectives of Lexical Semantics, Logical Semantics and Syntax*, CSLI Press, Stanford, pp. 3–60.

Hawkins, J.: 1991, 'On (In)definite Articles: Implicatures and (Un)grammaticality Prediction', *Journal of Linguistics* **27**, 405–442.

Heim, I., H. Lasnik, and R. May: 1991, 'Reciprocity and Plurality', *Linguistic Inquiry* **22**, 63–101.

Heny, F. and C. L. Tenny: 1992, 'Scope and Core Event Structure: The Relationship between Syntactic and Conceptual Structure', *Poster at the Conference on the Relationship between Linguistic and Conceptual Representation*, Antwerp, Belgium.

Higginbotham, J.: 1980, 'Reciprocal Interpretation', *Journal of Linguistic Research* **1**(3), 97–117.

Hoeksema, J.: 1983, 'Plurality and Conjunction', *Journal of Linguistic Research* **1**(3), 97–117.

Hoepelman, J. and Ch. Rohrer: 1980, 'On the Mass-Count Distinction and the French Imparfait and Passé Simple', in Ch. Rohrer (ed.), *Time, Tense and Quantifiers*, Niemeyer, Tübingen, pp. 85–112.

Isačenko, A. V.: 1960, *Grammatičeskij stroj russkogo jazyka v sopostavlenii so slovackim. Morfologija*, pt. 2. Bratislava.

Isačenko, A. V.: 1962, *Die russische Sprache der Gegenwart, Part I, Formenlehre*, Niemeyer, Halle (Saale).

Jackendoff, 1996, 'The Proper Treatment of Measuring Out, Telicity, and Perhaps Even Quantitfication in English', *Natural Language and Linguistic Theory* **14**(2), 305–354.

Kanski, Z.: 1987, 'Logical Symmetry and Natural Language Reciprocals', *Proceedings of the 1987 Debrecen Symposium on Language and Logic*, Akademiai Kiadó, Budapest, pp. 49–68.

Katz, J. J.: 1977, *Propositional Structure and Illocutionary Force*, The Harvester Press.

Kempson, R. M. and A. Cormack: 1981, 'Ambiguity and Quantification', *Linguistics and Philosophy* **4**, 259–309.

Kipka, P. F.: 1990, *Slavic Aspect and its Implications*, Ph.D. Thesis, MIT, Cambridge MA.

Kleiber, G.: 1983, 'Article défini, théorie de la localisation, et présupposition existentielle', *Langue Française* **57**, 87–105.

Kratzer, A.: 1989, 'Stage-Level and Individual-Level Predicates', in E. Bach et al. (eds), *Papers on Quantification*, NSF Report, MA.

Krifka, M.: 1986, *Nominalreferenz und Zeitkonstitution. Zur Semantik von Massentermen, Individualtermen, Aspektklassen*, Doctoral Thesis, The University of Munich, Germany.

Krifka, M.: 1992, 'Thematic Relations as Links between Nominal Reference and Temporal Constitution', in I. A. Sag and A. Szabolsci (eds), *Lexical Matters*, pp. 29–53.

Krifka, M.L 1996, 'Pragmatic Strengthening in Plural Predications and Donkey Sentences', *Proceedings from the Conference on Semantics and Linguistics Theory VI*, Cornell University, Ithaca, pp. 136–153.

Krifka, M.: 1997, 'The Expression of Quantization (Boundedness)', *Paper presented at the Workshop on Cross-Linguistic Variation in Semantics*, LSA Summer Institute, Cornell.

Krifka, M.: 1998, 'The Origins of Telicity', in S. Rothstein (ed.), *Events and Grammar*, Kluwer Academic Publishers, Dordrecht/Boston/London, pp. 197–235.

Křížková, H.: 1958, 'K problematice aktuálního a neaktuálního užití časových a vidových forem v češtině a ruštině', *Československá rusistika* **3**, 195.

Landman, F.: 1996, 'Plurality', in S. Lappin (ed.), *The Handbook of Contemporary Semantic Theory*, Blackwell Publishers, Inc, Oxford.

Langendoen, D. T.: 1978, 'The Logic of Reciprocity', *Linguistic Inquiry* **9**(2), 177–197.

Lasersohn, P.: 1988, *A Semantics for Groups and Events*, Ph.D. Thesis, Ohio State University. [Published in 1990. Garland Publishing, Inc., New York/London].

Lasersohn, P.: 1990, 'Group Action and Spatio-Temporal Proximity', *Linguistics and Philosophy* **13**(2), 179–206.

Lasersohn, P.: 1995, *Plurality, Conjunction and Events*, Kluwer, Dordrecht.

Lasersohn, P.: 1998, 'Generalized Distributivity Operator', *Linguistics and Philosophy* **21**, 83–93.

Lewis, D. K.: 1975, 'Adverbs of Quantification', in E. Keenan (ed.), *Formal Semantics of Natural Language*, Cambridge University Press, Cambridge, pp. 3–15.

Link, G.: 1983, 'The Logical Analysis of Plurals and Mass Terms', in R. Bäuerle, Ch. Schwarze and A. von Stechow (eds), *Meaning, Use, and Interpretation of Language*, pp. 302–323. Reprinted in Link, G.: 1998, *Algebraic Semantics in Language and Philosophy*, CSLI Publications, Stanford, CA, Lecture Notes No. 74, pp. 11–34.

Link, G.: 1984, 'Hydras. On the logic of relative clause constructions with multiple heads', in F. Landman and F. Veltman (eds), *Varieties of Formal Semantics*, GRASS 3. Foris, Dordrecht.

Link, G.: 1987. 'Algebraic Semantics of Event Structures', in J. Groenendijk, M. Stokhof, and F. Veltman (eds), *Proceedings of the Sixth Amsterdam Colloquium*, ITLI, University of Amsterdam, Amsterdam, pp. 243–262.

Link, G.: 1991, 'Plural', *Semantik: Ein internationales Handbuch der zeitgenössischen Forschung*. in A. von Stechow and D. Wunderlich (eds), De Gruyter, Berlin, pp. 418–440. Reprinted in Link, G.: 1998, *Algebraic Semantics in Language and Philosophy*, CSLI Publications, Stanford, CA. Lecture Notes No. 74. pp. 35–76.

Lønning, J. T.: 1989, *Some Aspects of the Logic of Plural Noun Phrases*, Ph.D. Thesis, University of Oslo.

Maslov, J. S.: 1959, 'Glagol'nyj vid v sovremennom bolgarskom literaturnom jazyke (značenie i upotreblenie)', in S. B. Bernstejn (ed.), *Voprosy grammatiki bolgarskogo literaturnogo jazyka*, Izd-vo AN SSSR, Moscow, pp. 157–312.

Matthewson, L.: 1998, *Determiner Systems and Quantificational Strategies. Evidence from Salish*, Holland Academic Graphics, The Hague.

Matthewson, L.: 2000, 'On Distributivity and Pluractionality', in *SALT* **10**.

Moltmann, F.: 1992, 'Reciprocals and Same/Different: Towards a Semantic Analysis', *Linguistics and Philosophy* **15**(4), 411–462.

Moltmann, F.: 1997, *Parts and Wholes in Semantics*, Oxford University Press, Oxford, New York.

Newman, P.: 1980, *The Classification of Chadic within Afroasiatic*, Universitaire Press, Leiden.

Newman, P.: 1990, *Nominal and Verbal Plurality in Chadic*, Foris, Dordrecht.

Parsons, T.: 1986, 'Underlying Events in the Logical Analysis of English', in E. LePore, and B. McLaughlin (eds), *Actions and Events: Perspectives on the Philosophy of Donald Davidson*.

Partee, B. H.: 1991, 'Domains of Quantification and Semantic Typology', in F. Ingeman (ed.), *Proceedings of the 1990 Mid-America Linguistics Conference*, University of Kansas.

Partee, B. H.: 1995, 'Quantificational Structures and Compositionality', in E. Bach et al. (eds).

Partee, B. H., E. Bach, and A. Kratzer: 1987, 'Quantification: A Cross-Linguistic Investigation', NSF proposal, University of Massachusetts at Amherst, ms.

Petr, J.: 1986, *Mluvnice Češtiny I: Fonetika, Fonologie, Morfonologie a Morfemika, Tvoření slov*. Praha: Academia. [Grammar of Czech I: Phonetics, Phonology, Morphophonology and Morphology. Word Formation].

Petronio, K.: 1995, 'Bare Noun Phrases, Verbs and Quantification in ASL', in E. Bach et al. (eds).

Philip, W.: 1996, 'Children who Know *Each Other*', OTS, Utrecht University. ms.

Quine, Willard V. O.: 1960, *Word and Object*, The MIT Press, Cambridge MA.

Roberts, C.: 1987, *Modal Subordination, Anaphora and Distributivity*, Ph.D. Thesis, University of Massachusetts at Amherst.

Russell, P.: 1985, 'Aspectual Properties of the Russian Verbal Prefix *na-*', in M. S. Flier and A. Timberlake (eds), *The Scope of Slavic Aspect*, Slavica Publishers, Columbus, Ohio, pp. 59–75.

Scha, R.: 1981, 'Distributive, Collective and Cumulative Quantification', in J. Groenendijk et al. (eds), *Formal Methods in the Study of Language*, Mathematical Centre, Amsterdam, pp. 483–512.

Schein, B.: 1993, *Plurals and Events*, The MIT Press, Cambridge, MA.

Schoorlemmer, M.: 1995, *Participial Passive and Aspect in Russian*, Ph.D. Thesis, Universiteit Utrecht.

Schwarzschild, R.: 1991, *On the Meaning of Definite Plural Noun Phrases*, Ph.D. Thesis. Amherst: University of Massachusetts.

Schwarzschild, R.: 1994, 'Plurals, Presuppositions and the Sources of Distributivity', *Natural Language of Semantics* 2, 201–248.

Schwarzschild, R.: 1996, *Pluralities*, Kluwer Academic Publishers, Dordrecht.

Spencer, A.: 1991, *Morphological Theory. An Introduction to Word Structure in Generative Grammar*, Blackwell, Cambridge MA.

Taylor, B.: 1977, 'Tense and Continuity', *Linguistics and Philosophy* 1(2), 199–220.

Tenny, C. L.: 1987, *Grammaticalizing Aspect and Affectedness*, Ph.D. Thesis, MIT, Cambridge MA.

Tenny, C. L.: 1994, *Aspectual Roles and the Syntax-Semantics Interface*, Kluwer Academic Publishers, Dordrecht.

Tenny, C. L.: 2000, 'Core Events and Adverbial Modification', in James Pustejovsky and Carol Tenny (eds), *Events as Grammatical Objects, from the Combined Perspectives of Lexical Semantics, Logical Semantics and Syntax*, CSLI Press, Stanford, pp. 245–292.

Verkuyl, H. J.: 1972, *On the Compositional Nature of the Aspects*, D. Reidel Publishing Co., Dordrecht.

Verkuyl, H. J.: 1993, *A Theory of Aspectuality: The Interaction between Temporal and Atemporal Structure*, Cambridge University Press, Cambridge.

Verkuyl, H. J.: 1999, *Aspectual Issues: Studies on Time and Quantity*, CSLI Lecture Notes, Number 98. CSLI Publications, Stanford, CA.

Winter, Y.: 1996, 'What Does the Strongest Meaning Hypothesis Mean?', in T. Galloway and J. Spence (eds), *Proceedings from Semantics and Linguistic Theory VI*, CLC Publications, New York, Ithaca, pp. 295–310.

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