Cross-linguistic evidence for a non-distributive lexical meaning of conjunction *

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Abstract

This paper investigates the lexical meaning of elements like English *and* ('COORD') in conjunctions with individual-denoting conjuncts by considering cross-linguistic form-function correlations. We present two generalizations concerning the correspondence between distributive readings and formal markedness both inside and outside the coordinate structure. We argue that they suggest that the cross-linguistic lexical meaning of COORD is non-distributive and that distributivity is introduced by additional operators. We then discuss how existing semantic treatments of coordinate structures could be adapted to yield a compositional analysis of the cross-linguistic facts.

1 Introduction

This paper focusses on the lexical meaning of English *and* and its correlates in other languages ('COORD') in '*e*-conjunctions' – conjunctions with individual-denoting conjuncts as in (1-a).

(1) a. *Mary and Sue earned exactly 100 euros.*
b. 'Mary earned exactly 100 euros and Sue earned exactly 100 euros.' — D-reading
c. 'Mary and Sue earned exactly 100 euros between them.' — ND-reading

What we will call **D-theories** assume that this lexical meaning is **distributive**, ('D'), which roughly means that it is reducible to the operation '$\wedge$' from classical propositional logic. **ND-theories**, on the other hand, take it to be **non-distributive** ('ND') which essentially means that COORD expresses an operation analogous to that which forms pluralities from individuals. Each type of analysis has to assume additional operations to derive certain readings of sentences with *e*-conjunctions: For (1-a), D-theories require additional operations to derive the ND-reading in (1-c), whereas ND-theories need additional operations for the D-reading in (1-b).

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But does cross-linguistic evidence support either of these two theories? Based on data from both the literature and our own ongoing study, we address this question by looking at form-function correlations: Broadly speaking, we try to relate the different additional operations posited by the two theories to overt morphological markers that appear in sentences with e-conjunctions. Two formal properties will be correlated with the availability of D- and ND-readings: First, we will look at paradigms of **conjunction patterns**, i.e. ways of expressing the coordinate structure itself. In these paradigms the formal realization of COORD is held constant, but the coordinate structure may contain additional conjunction particles (α), as schematized in (2-a). Second, we will examine paradigms of **conjunction strategies**, which also contain material outside the coordinate structure. In these paradigms, the coordinate structure itself is held constant and variation concerns additional markers (β) occurring *outside* the coordinate structure (2-b).[1] Our survey is restricted in three respects: First, we only consider instances of *iterative coordination*, i.e. coordinate structures that allow for more than two conjuncts (cf. [2] for a more precise definition). Second, we only look at e-conjunctions occurring in *subject position*. Third, we only investigate sentences where such conjunctions occur with what we call **C-predicates**, namely, predicates containing a degree expression, as in (1-a) above, or an indefinite plural, e.g. *read exactly five books.*[2]

(2) a. [A COORD B] [P] vs. [A COORD B α] [P]
b. [A COORD B] [P] vs. [A COORD B] [β P]

Based on our (limited) data set, we present two generalizations which, if they should turn out to be cross-linguistically valid (among languages that have iterative e-conjunction in the first place), would have the following theoretical consequences: First, the lexical meaning of COORD is ND. Second, at least one of the additional operations required by ND-theories – so-called VP-level distributivity operators – must be available cross-linguistically. We then investigate how our findings can be implemented. In most existing theories of COORD, its lexical meaning is defined as a *binary* operation on the conjuncts' denotations. However, many languages display conjunction patterns where *each* conjunct is morphologically marked by α, [6, 10]. This suggests that, in addition to COORD, some conjunction patterns involve a *unary* operator modifying each conjunct. We show how the semantic analyses of such structures in [6, 10] could be adapted to a ND lexical meaning for COORD and point to the remaining problems.

2 Background: Theories of conjunction

D-analyses of conjunction (cf. e.g. [8]) take the meaning of COORD to be defined in a unified way as in (3-b) for all types that "end in t", (3-a), thus accounting for the cross-categorial applicability of COORD in languages like English. For e-conjunctions we thus need the operation in (3-c) that shifts the denotations of the conjuncts to a t-conjoinable type. As a result, we derive the D-reading of e-conjunctions like (1-a) as in (3-e), using the derived meaning for quantifier conjunction in (3-d).

(3) a. The set TC of t-conjoinable types is the smallest set of semantic types such that

[1] Neither of the schemata in (2) is supposed to represent linear order facts or the number of occurrences of α/β. Nor do we assume that COORD must be phonologically realized.

[2] We explicitly instructed our consultants to use C-predicates, and to avoid sentences with inherently distributive predicates – such as *John, Mary and Sue left* – since such predicates won't let us distinguish the D-reading and the ND-reading truth-conditionally. Therefore, our claims about the presence and the obligatoriness of certain distributivity markers might not generalize to inherently distributive predicates.

$t \in TC$ and if $b \in TC$, then for all a, $\langle ab\rangle \in TC$. (cf. [8])

b. $[\![\text{COORD}_t]\!] = \lambda p_t.\lambda q_t.p \wedge q$, and for every type $b \in TC$ and every type a: $[\![\text{COORD}_{\langle ab\rangle}]\!] = \lambda P_{\langle ab\rangle}.\lambda Q_{\langle ab\rangle}.\lambda x_a.[\![\text{COORD}_b]\!](P(x))(Q(x))$ (cf. [8])

c. $[\![\uparrow]\!] = \lambda x_e.\lambda P_{\langle et\rangle}.P(x)$ (cf. [7])

d. $[\![\text{COORD}_{\langle\langle et\rangle t\rangle}]\!] = \lambda \mathbf{P}_{\langle\langle et\rangle t\rangle}.\lambda \mathbf{Q}_{\langle\langle et\rangle t\rangle}.\lambda R_{\langle et\rangle}.\mathbf{P}(R) \wedge \mathbf{Q}(R)$

e. $[\![[[\uparrow \text{M}_e]\ \text{COORD}_{\langle\langle et\rangle t\rangle}\ [\uparrow \text{S}_e]]\ \text{P}]\!] = [\![\text{P}]\!]([\![\text{M}]\!]) \wedge [\![\text{P}]\!]([\![\text{S}]\!])$

Without further assumptions, the D-analysis does not straightforwardly account for the ND-reading in (1-c). Yet, D-analyses *can* retrieve ND-readings by assuming additional operations. [11] posits two operators, MIN (4-a), and ∃ (4-b), which attach to the conjunction (we slightly adapt his proposal for our purposes). In combination, they yield existential quantification over those pluralities[3] consisting exclusively of individuals the conjuncts' denotations identify (4-d) – which will give us the ND-reading for sentences like (1-a).

(4) a. $[\![\text{MIN}]\!] = \lambda \mathcal{P}_{\langle\langle et\rangle t\rangle}.\lambda x_e.\exists Q_{\langle et\rangle}.[\mathcal{P}(Q) \wedge \forall Q'_{\langle et\rangle}[Q' \subseteq Q \wedge \mathcal{P}(Q') \rightarrow Q' = Q] \wedge x = \bigoplus Q]$

b. $[\![\exists]\!] = \lambda P_{\langle et\rangle}.\lambda Q_{\langle et\rangle}.\exists x_e[P(x) \wedge Q(x)]$

c. [[∃ [MIN [[↑ Mary] $\text{COORD}_{\langle\langle et\rangle t\rangle}$ [↑ Sue]]]] [earned 100 euros]]

d. $[\![\exists\ [\text{MIN}\ [[\uparrow \text{M}]\ \text{COORD}_{\langle\langle et\rangle t\rangle}[\uparrow \text{S}]]]]\!] = \lambda Q_{\langle et\rangle}.\exists x_e[x = m\oplus s \wedge Q(x)] = \lambda Q_{\langle et\rangle}.Q(m\oplus s)$

ND-analyses of conjunction (cf. e.g. [4]) on the other hand assume that COORD denotes a sum operation ('⊕') in the individual domain, (5-a). *e*-conjunctions denote pluralities of individuals and we straightforwardly derive the ND-reading. With this type of analysis, additional operations – e.g. a **distributivity operator** – are required to derive the D-reading. There are two potential implementations: D_1 in (5-b) shifts a type *e* plurality to a distributive quantifier. Applying D_1 after COORD yields the same result as the D-analysis in (3-e). D_2 in (5-c) modifies the predicate rather than the subject (cf. a.o. [5]). (6) shows that both approaches yield the same result for (1-a), but as shown below, they make distinct cross-linguistic predictions.

(5) a. $[\![\text{COORD}_e]\!] = \lambda x_e.\lambda y_e.x \oplus y$

b. $[\![\text{D}_1]\!] = \lambda x_e.\lambda P_{\langle et\rangle}.\forall y \leq_{AT} x.P(y) = 1$

c. $[\![\text{D}_2]\!] = \lambda P_{\langle et\rangle}.\lambda x_e.\forall y \leq_{AT} x.P(y) = 1$

(6) a. $[\![[\text{D}_1\ [\text{Mary COORD}_e\ \text{Sue}]]\ \text{earned 100 euros}]\!] = [\lambda P_{\langle et\rangle}.\forall y \leq_{AT} m \oplus s.P(y) = 1]([\![\text{earned 100 euros}]\!]) = 1$ iff $\forall y \leq_{AT} m \oplus s.[\![\text{earned 100 euros}]\!](y) = 1$

b. $[\![[[\text{Mary COORD Sue}]\ [\text{D}_2\ [\text{earned 100 euros}]]]]\!] = [\lambda x_e.\forall y \leq_{AT} x.[\![\text{earned 100 euros}]\!](y) = 1](m \oplus s) = 1$ iff $\forall y \leq_{AT} m \oplus s.[\![\text{earned 100 euros}]\!](y) = 1$

Our question in the following will be whether one of the analyses could hold **universally** (among languages with iterative *e*-conjunctions).[4]

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[3] We assume a set $A \subseteq D_e$ of atomic individuals, a binary operation ⊕ on D_e and a function $f : (\mathcal{P}(A) \setminus \{\emptyset\}) \rightarrow D_e$ such that: 1) $f(\{a\}) = a$ for any $a \in A$ and 2) f is an isomorphism between the structures $(\mathcal{P}(A) \setminus \{\emptyset\}, \cup)$ and $(D_e, \oplus)$. Hence there is a one-to-one correspondence between plural individuals and nonempty sets of atomic individuals. We will use the notions in (i), following much of the literature.

(i) For any $a, b \in D_e$, $S \subseteq D_e$:

a. $a \leq b \Leftrightarrow a \oplus b = b$ ("a is a part of b")

b. $a \leq_{AT} b \Leftrightarrow a \leq b \wedge a \in A$ ("a is an atomic part of b")

c. $\bigoplus S = f(\bigcup\{f^{-1}(x) \mid x \in S\})$ (the sum of all individuals in S)

[4] We rule out the possibility that COORD is lexically ambiguous between a D-meaning and a ND-meaning: This is unlikely to be universally correct, given examples like (i) (adapted from [1]) which show that at least

3 Correlating form and function cross-linguistically

As the two analyses differ in which reading of sentences like (1) they take to be 'basic', they make different predictions about cross-linguistic form-function correlations. These relate to how formal *markedness* relations between coordination patterns or strategies correlate with distributivity. We present two cross-linguistic generalizations, one about coordination *patterns*, one about coordination *strategies*. We then specify the predictions of the analyses and show that the generalizations support the ND-analysis for a cross-linguistic lexical meaning of COORD.

Our data set comprises examples from the literature and from our on-going Terraling study 'Conjunction and disjunction' which currently contains data from 15 languages.[5] Terraling is an open-ended, open-source database where language experts (mostly native speaker linguists) answer metalinguistic questions in a 'yes/no/does-not-apply' format, and also have the option of providing glossed examples (cf. [3]). Our study is the first to use this database for formal semantics. Therefore, in our questionnaire we asked consultants whether particular forms were available in their language (with a focus on the presence / absence of additional markers that enforce a certain reading), but importantly we also asked whether these different forms can express D- and ND-readings [2]. In particular, we asked our consultants to construct sentences with C-predicates for different coordination patterns/strategies in their language. They then had to test for the presence of distributive and non-distributive interpretations by judging whether these sentences adequately describe certain scenarios that distinguish between the two readings. We asked consultants to use modified numerals inside the C-predicate where possible, in order to make it easier to distinguish the two readings truth-conditionally.

3.1 Generalization A: Conjunction patterns

Generalization A concerns markedness relations within the coordinate structure itself.

(**A**) **Generalization A**: For any pair of iterative coordination patterns within a language that have a conjunctive meaning and apply to proper names, where one pattern can be obtained from the other by adding "additional markers":
(a) If the **marked** pattern permits a **ND** interpretation, so does the **unmarked** pattern.
(b) If the **unmarked** pattern allows for a **D** interpretation, so does the **marked** pattern.

For two *coordination patterns* P and P+α, where P has both a D-reading and a ND-reading and α stands for one or more overt morphological markers inside the coordinate structure, there are three logical possibilities.[6] The first possibility is that P+α could also have both readings, in

in some cases, the ambiguity is due to the predicate rather than COORD: (i) is ambiguous between a D- and a ND-reading of VP2 and can thus be true in a scenario where Mary and Sue drank exactly one glass each. For this reading, a distributive lexical meaning of COORD would be needed – but this conflicts with the requirement that COORD must be non-distributive to license the collective predicate in VP1.

(i) *Mary and Sue [$_{VP1}$ met in the bar] and [$_{VP2}$ had exactly one glass of wine].*

[5] So far, we have data from Akan (Niger-Congo, Kwa), Basa'a (Niger-Congo, Bantu), Cantonese (Sino-Tibetan, Chinese), Chickasaw (Muskogean), Dutch (Indo-European, Germanic), German (Indo-European, Germanic), Greek (Indo-European, Greek), Italian (Indo-European, Italic), Japanese (Japonic), Korean (Koreanic), Nones (Indo-European, Italic), Polish (Indo-European, Balto-Slavic), Serbo-Croatian (Indo-European, Balto-Slavic), Turkish (Turkic) and Wuhu Chinese (Sino-Tibetan, Chinese).

[6] A language may also have two coordination patterns that are not related in an obvious way, i.e. neither of the patterns formally 'contains' the other, e.g. German *A und B* vs. *sowohl A als auch B* 'A as well as B'. Taken at face value, such cases are uninformative w.r.t. our initial question, but cf. [2] for discussion.

which case the additional material α would not affect (non-)distributivity. This case, discussed by [10] for Japanese *A-to B* and *A-to B-to*, is uninformative for the question at hand.

(7) *A-to B(-to) de 100 kg ni naru.*
‘A and B weigh 100 kg.’ (Japanese ([10, 182, (48)]), both D-and ND-reading available)

The second option is that P+α has only a D-reading, i.e. the additional marking α ‘removes’ the ND-interpretation. This is exemplified by (8) from Serbo-Croatian (cf. also [10] for Hungarian). The marked pattern P+α in (8-b) ‘contains’ the unmarked pattern P in (8-a): Whereas in (8-b) the marker *i* modifies each conjunct, this is not the case in (8-a). P is ambiguous between a D-reading and a ND-reading because (8-a) is true in both scenarios in (9). P+α, on the other hand, has only a D-interpretation, because (8-b) is not true in the scenario in (9-b).

(8) a. *[A (i) B i C] su zaradili tačno sto evra.*
A (and) B and C AUX.3PL earn.PART.PL.M exactly hundred euros.GEN
‘A, B and C earned exactly 100 euros.’

b. *[I A i B i C] su zaradili tačno sto evra.*
and A and B and C AUX.3PL earn.PART.PL.M exactly hundred euros.GEN
‘A, B and C earned exactly 100 euros each.’
(Serbo-Croatian, adapted from examples by Jovana Gajić[7])

(9) a. A earned 100 euros, B earned 100 euros, C earned 100 euros.
b. A earned 30 euros, B earned 30 euros, C earned 40 euros.

The third possibility is that P+α has only a ND-reading. This possibility – excluded by (**A**) – is not attested in our data set, although our survey explicitly asks for examples of this kind. We conjecture that additional marking inside the coordinate structure never ‘removes’ a D-reading.

(**A**) captures another interesting gap in our data set: It is never the case that P only has a D-reading and P+α has both a D-reading and a ND-reading. It seems that marking inside the coordinate structure never ‘adds’ a ND-reading. While we did not explicitly ask our consultants whether this pattern exists, we did ask them to provide examples of *e*-conjunctions that only have a D-reading, and of *e*-conjunctions that are ambiguous. These examples never show the markedness relation just described.

3.2 Generalization B: Conjunction strategies

Generalization B relates to additional marking *outside* of the coordinate structure, i.e. on the predicate.

(**B**) **Generalization B**: There are iterative conjunction patterns that require one or more predicate-level markers for a **distributive** interpretation of C-predicates. This means that the D-reading of sentences with a C-predicate is available with the markers, but unavailable if the markers are omitted.
There are no iterative conjunction patterns that require predicate-level markers for a **non-distributive** interpretation of C-predicates.

We are now comparing *coordination strategies* S and S+β, where β stands for one or more additional marker(s) *outside* the coordinate structure and the coordinate structure itself is the same in both strategies. The picture here is analogous to that of coordination patterns: While

[7] *http://test.terraling.com/groups/8/examples/16182, http://test.terraling.com/groups/8/examples/16177*

many languages have overt predicate-level markers that force a ND-interpretation (e.g. English *together*), our data set involves no cases where a predicate-level marker is *required* for a ND-interpretation of a C-predicate. Yet, we do find languages where additional marking on the predicate is required for a D-interpretation, i.e. where S has only a ND-interpretation and S+β allows for a D-interpretation. This is exemplified by Basa'a in (10).

(10) a. *[A, B ni C] ɓá-bí-kosná dikóó dísámal*
A B COORD C 2.SM-PST2-receive 13.thousands 13.six
'A, B and C received six thousand francs.' (ND only)

b. *[A, B ni C] ɓá-bí-kosná dikóó dísámal, híkií mut*
A B COORD C 2.SM-PST2-receive 13.thousand 13.six each 1.person
'A, B and C received six thousand francs each.' (D only)

(Basa'a, adapted from examples by Paul Roger Bassong[8])

The coordinate structure in (10-a) and (10-b) is the same, but they exemplify different coordination strategies, as *híkií mut* 'each person' is present only in (10-b). The strategy S in (10-a) has only a ND-interpretation and S+β in (10-b) has a D-interpretation.

3.3 Theoretical consequences

While (**A**) and (**B**) are analogous in that some kind of formal 'markedness' is associated with D-interpretations, but not with ND-interpretations, they differ in their theoretical consequences.

As opposed to (**A**), (**B**) relates to formal correlates of the two readings of C-predicates, rather than formal correlates of the two readings of conjunction, since predicate-level D-markers are not part of the coordinate structure itself. Its impact on our initial question concerning the cross-linguistic semantics of COORD is thus indirect – it will help us determine the theoretical consequences of (**A**). Namely, (**B**) suggests that cross-linguistically, the D-interpretation of C-predicates always involves an additional syntactic operator, which is absent in the case of a ND-interpretation. More precisely, we submit that predicate-level operators like D_2 in (5-c) are available in all languages that allow for D-interpretations of C-predicates. Languages differ in whether they have to spell out D_2 overtly: In a language like English in which D_2 is only optionally realized, (11-a) must have a structure like (11-b), with an overt realization of D_2, while (1-a) can correspond to either of the two structures in (11-b) and (11-c). In languages like Basa'a, on the other hand, distributivity operators like D_2 must be realized overtly whenever they are present, and are spelled out as the additional marking β that is needed for a distributive interpretation. In such languages, a sentence with a C-predicate lacking an overt D_2 will thus be unambiguously ND (assuming a ND-interpretation of the coordinate structure itself).

(11) a. *Mary and Sue each earned 100 euros.*
b. [[Mary COORD Sue] [D_2 [earned 100 euros]]]
c. [[Mary COORD Sue] [earned 100 euros]]

With the assumption that predicate level D_2 is indeed available cross-linguistically, we can specify the theoretical predictions of (**A**).[9] Both analyses allow us to derive a ND-meaning for conjunction patterns like English *A, B and C* or Serbo-Croatian *A, B i C* which, when combined with D_2, yields a D/ND ambiguity. To derive conjunction patterns that lack the ND-reading, we have to add an operator like D_1 (12-a). In a language like English, there is

[8] *http://test.terraling.com/groups/8/examples/16284*; *http://test.terraling.com/groups/8/examples/16285*

[9] [2] spell out the parameter settings that have an effect on these predictions and lay out the morpho-syntactic assumptions required to derive them without predicting a transparent markedness relation in every language.

no morphosyntactic evidence for this operator. But in languages where this operator always has an overt morphological reflex, but does not affect the morphological spell-out of COORD, we would get an additional marker that removes the ND-reading – a situation that seems to be attested in several languages including Serbo-Croatian, Hungarian and Turkish (cf. [10] and data on *test.terraling.com/groups/8*) (12).

(12) a. [A COORD B] D or ND (depending on D_2)
b. [D_1 [A COORD B]] D only **ND-analysis**

The D-analysis, on the other hand, predicts that the ND-reading requires the presence of the additional operators MIN and $\exists$. In this case, if a language required an overt realization of either of these operators, we would get an additional marker that adds the ND-reading to a structure lacking it – a situation unattested in our sample and ruled out by (**A**).

(13) a. [A COORD B] D only
b. [$\exists$ [MIN [A COORD B]]] D or ND (depending on D_2) **D-analysis**

Of course, the predictions of the D-analysis would change if our claim that D_2 is present cross-linguistically turned out to be false. But then we would still predict that additional marking can *remove* the D-interpretation – another unattested situation ruled out by (**A**). In summary, if the unattested markedness relations in our sample reflect real typological gaps, these gaps can be derived from the ND-analysis under certain morphosyntactic assumptions. Further, under the D-analysis the existence of D-only conjunction patterns that are marked relative to an ambiguous conjunction pattern – a situation found in several languages – would be unexpected.

4 Issues for the analysis of conjunction particles

The generalizations above suggest that the lexical meaning of COORD is ND and that a D-reading of the coordination is sometimes derived by means of additional morphology α inside the coordinate structure. So far, the only potential meaning for α we provided was the unary operator D_1 that modified the entire conjunction, but this assumption is at odds with the actual form of the marked patterns that display a D-reading: In several languages a particle – called μ in [6] – is affixed to each conjunct, as witnessed by e.g. (8) above and schematized in (14). This means that μ itself cannot spell out D_1. So how can we compositionally derive a D-reading for (14) while simultaneously maintaining a ND-analysis of COORD?

(14) A-μ COORD B-μ

While [6] and [10] each provide compositional analyses of the formal pattern in (14), neither takes the lexical meaning of COORD to be ND or tries to derive the D-reading from the ND-reading. Hence, neither proposal is compatible with our empirical results and their consequences. In the following, we discuss if these accounts can be adapted to fit our claims above.

4.1 Conjunction particles introduce postsuppositions

Szabolcsi [10] assumes the underlying structure in (15-a) for (14) (adapted here to our examples). The conjuncts must be shifted to a t-conjoinable type (by $\uparrow$) and are each affixed by μ, which introduces a postsupposition requiring that the conjunct's denotation is asymmetrically entailed by the denotation of the entire conjunction X. The resulting expressions are then conjoined by COORD, which forms a pair of their denotations (15-b). Finally, the silent operator

$OP_\cap$ applies at the top-level of the conjunction and intersects the elements of the pair, (15-c).

(15) a. $[_X\ OP_\cap\ [_Y\ [[\uparrow \text{Mary}]\ \mu]\ [\text{COORD}\ [[\uparrow \text{Sue}]\ \mu]]]]$
b. $[\![Y]\!] = \langle [\![\uparrow \text{M}]\!], [\![\uparrow \text{S}]\!] \rangle = \langle \lambda P.P([\![\text{M}]\!]), \lambda P.P([\![\text{S}]\!]) \rangle$ (ignoring postsuppositions)
c. $[\![X]\!] = [\![\uparrow \text{M}]\!] \cap [\![\uparrow \text{S}]\!] = \lambda P_{\langle et \rangle}.P([\![\text{M}]\!]) \wedge P([\![\text{S}]\!])$ (ignoring postsuppositions)

How would we have to modify such a proposal to make it fit our generalizations and their consequences? Recall that we are trying to derive the D-reading of the more complex structure from the ND-reading of the simpler structure in (16). (16) cannot contain $OP_\cap$ (because it has a ND-reading)[10], which in turn means that we have to say something additional about the denotation of (16) to explain how it combines with predicates.

(16) [A [COORD B]]

As the meaning of COORD should remain constant across the less marked and the more marked patterns, and the lexical meaning of COORD in (16) must be ND, we have to generalize the ND-analysis to types ending in t if we want to maintain (15-a) above – otherwise, $OP_\cap$ cannot apply. Furthermore, this generalized ND-analysis must be such that the denotations of the individual conjuncts remain transparent for $OP_\cap$. For this purpose we employ a proposal for generalized sum-formation that is motivated independently in [9]: For any semantic domain D_a there is a set $AT_a \subseteq D_a$ of atomic elements of that domain, a binary operation $\oplus$ on D_a and a function $f_a : (\mathcal{P}(AT_a) \setminus \{\emptyset\}) \rightarrow D_a$ such that: 1) $f_a(\{X\}) = X$ for any $X \in AT_a$ and 2) f_a is an isomorphism between the structures $(\mathcal{P}(AT_a) \setminus \{\emptyset\}, \cup)$ and $(D_a, \oplus)$. Assuming that COORD occurring with conjuncts of type a always expresses the operation $\oplus$ on D_a, the constituent Y from (15-a) above thus has the denotation in (17-a) – which has the atomic parts $[\![\uparrow \text{M}]\!]$ and $[\![\uparrow \text{S}]\!]$. Accordingly, we have to generalize the denotation of $OP_\cap$ so as to apply to pluralities with arbitrarily many atomic parts, (17-b). Hence, we also derive the meaning in (15-c) for (15-a) above, but our assumptions about the semantic contributions of the individual operators differ from those made by [10].

(17) a. $[\![Y]\!] = [\![\uparrow \text{M}]\!] \oplus [\![\uparrow \text{S}]\!]$
b. $[\![OP_\cap]\!] = \lambda \mathcal{P}_{\langle\langle et \rangle t \rangle}.\bigcap\{\mathcal{Q} : \mathcal{Q} \leq_{AT} \mathcal{P}\}$

In addition, we must posit a syntactic agreement mechanism that ties the occurrence of $OP_\cap$ to that of μ, because we must exclude silent $OP_\cap$ from occurring in structures lacking μ, like (16). If it could apply in these cases, we would falsely predict that languages like Basa'a in (10), where C-predicates are unambiguous, should always allow for D-readings of conjunctions, irrespective of whether the predicate contains a D-marker or not.

Clearly, this adaptation of the proposal is not yet satisfactory. Without additional assumptions concerning the composition of quantifier pluralities with the predicate, $OP_\cap$ seems obligatory whenever COORD conjoins expressions of quantifier type and therefore, such conjunctions should be limited to D-readings – but it is well-known that they are not: One of the readings of (18-a) is the ND-reading in (18-b).

(18) a. *Two girls and five boys earned exactly 100 euros.*
b. 'A plurality consisting of two girls and five boys earned exactly 100 euros in total.'

Furthermore, the proposal relies on the availability of $OP_\cap$, which we would expect at least some languages to spell out overtly but which we have not encountered, yet, in our data set.

[10] Adding an additional operator on top of (15-a) which yields the ND-reading is incompatible with (**A**).

4.2 Conjunction particles introduce type-shifts

Mitrović and Sauerland [6] do not posit a silent operator at the top node of the conjunction but rather put the semantic workload on the particles μ and silent morphemes $\Uparrow_{\langle e\langle et\rangle\rangle}$ which each conjunct combines with first (19-a). $\Uparrow_{\langle e\langle et\rangle\rangle}$ maps any individual x to the singleton $\{x\}$, whereas μ shifts expressions from $\langle et\rangle$ to $\langle\langle et\rangle t\rangle$ (19-b). For the meaning of COORD, [6] assume the D-analysis, so that X in (19-a) has the same denotation as (15-c) above.

(19) a. $[_X$ [[Mary $\Uparrow_{\langle e\langle et\rangle\rangle}$] μ] [COORD [[Sue $\Uparrow_{\langle e\langle et\rangle\rangle}$] μ]]]
b. $[\![\mu]\!] = \lambda P_{\langle et\rangle}.\lambda Q_{\langle et\rangle}.P \subseteq Q$

If we want to preserve the structure in (19-a) and the meaning for μ assumed by [6], we have to depart significantly from their analysis of COORD: We require a generalized meaning for COORD that gives us the ND-reading for (16) and also combines with quantifiers. For this purpose, we use a simplified version of the proposal by [9]: Working with the ontology and the denotation for COORD introduced in section 4.1, we add a compositional rule '$\bullet$' of pointwise application, which applies in two kinds of situations: (i) If an argument plurality $a \oplus b$ combines with a (non-plural) function f that itself does not take pluralities as its argument, the result will be the plurality of values $f(a) \oplus f(b)$. (ii) If a function plurality $f \oplus g$ combines with a (non-plural) argument, the result is again a plurality of values $f(a) \oplus g(a)$. Assuming that sentential pluralities are true iff all of their atomic parts are true, this analysis, partially spelled out in (20-a), correctly derives the D-reading for sentences with the pattern in (19-a). The unmarked pattern in (16), on the other hand, will denote a plurality of individuals $(m \oplus s)$. In order to prevent $\bullet$ from applying in (20-b), where the unmarked pattern occurs with a C-predicate that does not contain D_2, we must assume that such predicates primitively take pluralities as their argument and thus combine with the subject plurality by means of functional application. Accordingly, the difference between the marked and the unmarked pattern lies in the type of the coordinates and the assumption that some predicates primitively hold of pluralities.[11]

(20) a. $[\![$[[[[Mary $\Uparrow_{\langle e\langle et\rangle\rangle}$] μ] [COORD [[Sue $\Uparrow_{\langle e\langle et\rangle\rangle}$] μ]]] [earned 100 euros]]$]\!] =$
$(\lambda P_{\langle et\rangle}.\{m\} \subseteq P \oplus \lambda P_{\langle et\rangle}.\{s\} \subseteq P) \bullet [\![\text{earned 1000 euros}]\!] =$
$= (\{m\} \subseteq [\![\text{earned 1000 euros}]\!]) \oplus (\{s\} \subseteq [\![\text{earned 1000 euros}]\!])$
b. $[\![$[[Mary COORD Sue] [earned 100 euros]]$]\!] = [\![\text{earned 100 euros}]\!]\ (m \oplus s)$

This adaptation also runs into a number of problems. One obvious obstacle is that as in section 4.1, we falsely predict only D-readings for conjunctions in which the conjuncts are of type $\langle\langle et\rangle t\rangle$. Furthermore, our current proposal breaks down in configurations where – according to the assumptions made here – both of the expressions that need to combine with one another denote pluralities, as e.g. in (21) (see [9] for independent arguments supporting this).

(21) *Mary and Sue sang and danced.*

Since (21) has a ND-reading (where it is true if Mary sang and Sue danced), we cannot expand pointwise application to (21). We could introduce a composition rule that combines two pluralities and gives rise to a cumulative reading, as in [9], but given our assumption that COORD forms pluralities cross-categorially, it would be unclear why this mechanism could not apply to quantifier conjunctions like (19-a) and generate a ND-reading for such examples.

[11] Note that as in section 4.1 – and for the very same reasons – we have to make sure that the mechanism associated with the presence of μ is limited to those contexts where it actually occurs. This raises interesting questions wrt. the formal marking of type-shifts in other contexts, which we omit here for reasons of space.

5 Conclusion and Outlook

We considered two theories concerning the lexical meaning of COORD in *e*-conjunctions – the D-analysis and the ND-analysis. Crucially, each of these analyses has to assume additional operations in order to derive some of the readings of sentences containing such conjunctions. We considered whether cross-linguistic formal markedness patterns match the additional operations that each analysis has to posit. We presented two generalizations in our preliminary data set which, in combination, strongly support the ND-analysis. In addition, they suggest that distributivity is the result of additional operations. We then raised the question how we could implement this claim compositionally for structures with conjunction particles. The most interesting empirical questions for future research concern various aspects of the scope of our generalizations: Do (**A**) and (**B**) remain valid once . . . (i) we consider more languages? (ii) we expand our data set, e.g. by including *e*-conjunctions in object position? (iii) we consider conjunctions with conjuncts other than individual denoting ones, e.g. predicate conjunctions?

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