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TOGETHERNESS

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Abstract

This paper investigates the notion of 'togetherness' expressed by adverbials like *together* in English or *ensemble* in French. We show that the natural division between the main uses of these adverbials is aspectual: whereas achievements impose no significant restrictions, non-achievements demand that the eventualities that are grouped 'together' be causally controlled or coordinated. In particular, contrary to what is frequently assumed in the literature, it is not sufficient that they occupy the same spatio-temporal location. This leads us to propose a new picture of togetherness, which accounts for the intuitions of 'grouping' (Lasersohn) or 'integration' (Moltmann) but puts them in a different perspective.

1 Introduction

In this paper, we offer a preliminary study of what we call 'togetherness', that is, an association between events or objects often expressed by an adverbial or a preposition, such as the following ones, encountered in well-studied Indo-European languages: *together* and *with* in English, *samen* and *met* in Dutch, *zusammen* and *mit* in German, *insieme* and *con* in Italian, *juntos* and *con* in Spanish, *ensemble* and *avec* in French. We will focus on the English and French adverbials *together* and *ensemble*. Roughly speaking, these adverbials have essentially three values. They can express summation (1), spatio-temporal colocalization (2) and eventuality coordination (3).

(1) a. The three directors together earn 1.000.000 euros
b. Les trois directeurs (ensemble) gagnent (ensemble) 1.000.000 euros

(2) a. John and Mary are sitting together
b. Jean et Marie sont assis ensemble

(3) a. John and Mary are walking together
b. Jean et Marie marchent ensemble

It might sound strange to propose a 'preliminary' study on *together* in view of the existence of at least three substantial contributions (Lasersohn 1998, Moltmann 1997, Moltmann 2004). However, we argue that the algebraic analysis of events that these two approaches adopt is insufficient to do justice to the 'intensional' character of *together*. Specifically, the paper defends two claims.
1. From an empirical point of view, the difference between achievement and non-achievements has been overlooked. We show that togetherness is not aspectually uniform: states and processes (i.e. activities or accomplishments) impose stronger requirements than achievements.

2. The role of causation and coordination has not been recognized, although it is crucial for telling apart togetherness from simple colocalization.

We first describe intuitively the difference between achievements (section 2) and non-achievements (section 3), showing that *together* can be licensed by simple spatio-temporal colocalization in the case of achievements, whereas non-achievements impose more stringent requirements, for which we propose a formal representation in section 4.

2 Achievements

With achievements, *together* and *ensemble* are licensed by spatio-temporal colocalization. In (4a,b), the two trekkers might climb independently and reach the summit at the same moment by pure chance. Nothing more, in particular no intentional control, is required (4c-h).

(4) a. The two trekkers reached the summit together
b. Les deux trekkers ont atteint le sommet ensemble
c. John and Mary sneezed together
d. Jean et Marie ont éternué ensemble
e. John and Mary jumped together
f. Jean et Mary ont sursauté ensemble
g. The two bombs exploded together
h. Les deux bombes ont éclaté ensemble

However, English and French do not completely coincide because French tends to avoid simple simultaneity.[1]

(5) a. All these events happened together [$\not\Rightarrow$ at the same place]
b. Tous ces événements se sont produits $^{??}$ensemble / en même temps
c. Then Susan began to laugh, and then she began to sneeze, and then she laughed and sneezed together [Google: http://www.gutenberg.net/dirs/1/0/3/2/10329/10329.txt]
d. Alors Suzanne s'est mise rire, et puis elle s'est mise à éternuer, et puis elle a ri et éternué $^{??}$ensemble / tout ensemble / en même temps

Predicates compatible with a summation interpretation (1) are in general not achievements, but there is no radical impossibility. E.g. (6) can refer to two simultaneous very short events of scoring.

(6) John and Mary together scored 50 points

3 Non achievements. Intuitive description

The main intuitive idea is expressed in (7).

[1] Note also the difference: *He has been smoking for years together* vs. *Il a fumé pendant des annes* $^{??}$*ensemble / de suite*.

(7) With states and processes, for *together* and *ensemble* to be appropriate, there must be something that keeps the entities under consideration 'together' (in the same place or within the bounds of some common evolution or activity).

3.1 Why is colocalization not sufficient?

Prima facie, many examples seem to be licensed by simple colocalization (8), as in the case of achievements .

(8) a. The glasses and the decanter are together (in the cupboard)
b. Les verres et la carafe sont ensemble (dans le buffet)
c. John and Mary are together in the waiting room
d. Jean et Marie sont ensemble dans la salle d'attente
e. John and Mary are waiting together
f. Jean et Marie attendent ensemble

In view of similar examples, Moltmann (2004) proposes that adverbial *together* is licensed whenever it groups events into a global event that has the properties of an *integrated whole* (IW), *à la* Simons (1987). An R–integrated whole X_R is a part structure $(X, \sqsubset)$ such that, for any two objects A and B, $R(A, B)$ or $R(B, A)$ iff $A, B \sqsubset X$. E.g. the books on a shelf make up an IW with respect to the relation of 'being on the same shelf as'.
For cases like (8), spatio–temporal proximity 'glues' the subeventualities corresponding to the spatio-temporal localizations of the two entities, which are close to each other and to nothing else (outside the reference location).

There are several problems with this approach, which stem from the fact that the notion of IW is actually too weak.
1. IWs seem to 'dissolve' in certain cases: in (5a), if t if the time point referred to, X_R = $\{e : e$ is at $t\}$, but this means that X_R contains an in(de)finite number of simultaneous events to be considered in addition to the events referred to.
2. One might simply weaken the closure condition of IWs, replacing Moltmann's condition by '*Together* is licensed whenever it denotes a *subset* of an IW'. However, this weaker version conflicts with (9). If we assume that the house and the park in (9a,b), and the library and the computer room in (9c,d), are close to each other, they form a subset of any IW that gathers entities located in the same area. Note also that, if there is no other building or noticeable area in the vicinity of the house and the park or the library and the computer room, the two pairs of entities form two IWs, according to the strong version of the definition, but this does not improve the sentences in (9) in any way.

(9) a. ?? The house and the park are together
b. ?? La maison et le parc sont ensemble
c. ?? The library and the computer room are together in building B5
d. ?? La bibliothèque et la salle d'informatique sont ensemble dans le bâtiment B5

3. There are also problems with coordinated actions. E.g. in (3) Mary and John must coordinate their moves. If John and Mary are two passersby who share a common path

by pure chance (3a,b) is weird.

3.2 Towards togetherness

Similar observations hold for *with* and *avec* (Mari 2003). The problems mentioned above affect also Lasersohn's (1998) analysis. This is not unexpected if one assumes that the mode of association between objects/events indicated by *together* and *with*, and their French counterparts, is stronger than spatio-temporal proximity. The question is: how much stronger?

From the examples reviewed up to this point, we see that there are at least three modes of licensing.
1. The first is causally controlled localization. What makes examples like (9) anomalous is the fact that, even if the house and the park were deliberately created in the same place, their locations cannot change anymore, since they cannot be moved (in contrast to mobile objects like in (8a,b)) or move (in contrast to living beings like in (8c,d)). (8a,b) is compatible with an interpretation in which the glasses and the decanter are intentionally kept in the same place (maybe with other objects) for some time; as long as this intention persists, it brings about the fact that the glasses and the decanter share a location. For (8c,d): the fact that the two persons wait for the same kind of event determines the fact that they share a location.
2. Another possibility is state or process coordination (e.g. 'being on the problem together', 'walking together').
3. Finally we have summation, as studied by Moltmann (2004).
Cases 1 and 2 can be 'unified' to some extent by seeing togetherness in space and time as the external manifestation of certain causal constraints.

3.3 Interaction of togetherness and aspectual status

Where does the difference between achievements and non achievements come from? Togetherness is a mode of *association* between events or, more generally, entities. This intuition informs approaches such as Lasersohn's, through the notion of group, and Moltmann's, through the notion of IW. One can associate entities in several ways, the most obvious being to group them together because they share a common property (see the notion of IW). Suppose that we consider the cluster of people that are currently taller than 8 feet on earth. Why is (10) strange? Because the property of being taller than 8 feet is not a property of the cluster but of the individuals taken separately.

(10) a. ?? These persons are taller than 8 feet together
b. ?? Ces personnes font plus de deux mètres quarante ensemble

Let us assume, then, that togetherness demands that the predication concern the cluster of entities. This would account for spatio-temporal localization: a cluster of eventualities can be located at a unique spatio-temporal point. However, togetherness cannot be reduced to predication on a complex event because it could not be distinguished from colocalization. It involves the idea that the entities are clustered for some reason and that their spatio-temporal proximity, if any, is the reflection of a certain unity. The idea that wholes have properties beyond those of their parts has driven research from Gestalt theory to recent work on whole-part structure (Meirav 2003). Whatever the details of the different theories may be, a common conception is that wholes must betray properties that cannot be predicated only of their parts. Although we do not consider here 'wholes' in a strong sense, but rather clusters (including simple pairs), it is clear that, in many cases, togetherness exhibits the sort of unity and/or integrity that is appealed to in Gestalt theory. For summation, the sum operation involves the totality of parts. Similarly, coordination cannot be reduced to the sequence of stages of one particular component. Another possibility is that a cluster maintains its structure as time goes along (integrity). Colocalized non-achievements illustrate this case: they get their stability from the existence of causes. For achievements, there is no noticeable time flow.[2] When the coincidence of the two events is a mere quirk of fate, the unity or integrity requirements cannot be met in a strong (realistic) sense. At this point, there are at least two possibilities. One might conclude that *together* is in such cases a mere spatio-temporal marker, and that the distinction between *together* with achievements and with non-achievements is on the verge of homonymy. On the other side, one might note that the coincidence of two very short events of the same type is epistemically striking and propose that the unity of the cluster is then epistemic. More precisely, the probability that two or several achievements of the same type coincide is felt as weak. Their cooccurrence is then perceived as an unexpected pairing, which thereby acquires a sort of epistemic integrity. The existence of a bridge between descriptive (realistic, factual) and epistemic value is frequently mentioned in the study of grammaticalization (see (Traugott and Dasher 2002) for a recent discussion) and is probably present in the distribution of comitative prepositions (Mari 2003). Summarizing, we propose that, with achievements, togetherness correspond to an epistemic grouping, that associates events with markedly weak probability of cooccurrence.

Interestingly, in parallel cases, comitative prepositions are not licensed by mere colocalization or simultaneity. This shows that togetherness and comitativity are distinct, though related, notions.

(11) a. Mary reached the summit with the other trekker [$\Rightarrow$they were together before reaching the summit]
b. Marie a atteint le sommet avec l'autre trekker [idem]
c. The Asian cyclone happened $^{??}$with the big storm in the Atlantic ocean [simultaneity intended]
d. Le cyclone en Asie s'est produit $^{??}$avec la tempête dans l'Atlantique [simultaneity intended]

4 The formal representation of togetherness

4.1 Causal control

Together and *ensemble* are appropriate to describe situations in which a given state of affairs (in most cases the existence of certain intentions) determines the fact that (at least) two entities share a (not necessarily fixed) location during a certain time. Assuming a

[2] At least, with respect to a relevant temporal scale.

simple modal version of causation in the style of Dowty (1979) and Lewis (1973, 1986), as in (12), the constraint on comitativity can be phrased as in (13).

(12) Let $\prec$ be a similarity linear ordering on worlds. w' is among the least w–similar worlds w.r.t. the proposition p iff w' satisfies p, $w' \prec w$ and, for some w'', every $w_i \prec w''$ satisfies p and every w_j such that $w \succ w_j \not\succcurlyeq w''$ satisfies $\neg p$.
p *causes* p' at w iff (i) the worlds w' where p & $\neg p'$ holds are the least w–similar w.r.t. p & $\neg p'$ and (ii) the worlds w' where $\neg p$ & p' holds are the least w–similar w.r.t. $\neg p$ & p'.

(13) *Together* and *ensemble* are appropriate at a time interval t and a world w w.r.t. a (complex) stative eventuality e of localization with participants $x_1 \ldots x_n$ iff there is a propositional schema $\phi[x]$[3] such that, for every $t' \sqsubset t$, $\phi[t]$ causes $loc(t', e, x_i) = loc(t', e, x_j)$ for any x_i, x_j.

For sentences like (9), no proposition $\phi[t]$ comes to mind. If the house and the park were constructed at t_0, the intention of locating them 'together' has causal power only at t_0. At any $t' > t_0$, the house and the park would be 'together', no matter whether this intention persists. Let us consider coordinated processes, for instance a situation as in (3), in which two people, say a and b, walk 'together' during a time interval t. If $loc(t, e, x)$ denotes the location of x at t in e, one can posit

[*intends-to-be*$(a, t', loc(t', e, a))$ & *intends-to-be*$(b, t', loc(t', e, b))$] CAUSES $[loc(t, e', a) = loc(t', e, b)]$

In this respect, one might say that each colocalization is caused by the joint intention of being at some place; however this causal relation holds 'piecewise', i.e. for each moment of the temporal interval. Condition (13) requires something much stronger, namely that the causal factor span the whole interval. It is very unlikely that such a causal factor exists for two independent walking processes. Even if two individuals intend to follow a given path, there is no necessity that they proceed at the same pace (thus occupying the same positions at the same moments).

One might object that 'unlikely' does not mean 'impossible'. For instance, if a and b enjoy a total control on planning, they might be able to have, during t, an intention of the general form *intends*$(x, t, \bigwedge_{i=1}^{n} loc(t_i, e, x) = f(t_i, e))$, where $f(t_i, e)$ returns a unique location for each moment of the eventuality e. What kind of predicate could suggest such an interpretation? Under the vast majority of circumstances, current motion predicates (*move*, *walk*, *run*, etc.) exclude the possibility of a perfect planning. Should such an interpretation emerge, it would certainly be associated with the kind of causal determination one finds in physical phenomena. E.g. supposing that we have two particles guided by a field, (14a) might mean that their successive positions are controlled by a constant factor (the intensity and orientation of the field). The same would be true for two persons gliding down a narrow bobsleigh track (14b). There is certainly no mental anticipation of every stage of the motion, but the physical properties of the track tend to adjust the otherwise independent motions, so that they are roughly parallel (the persons tend to occupy very close locations at the same moment, at least for some while). One may wonder, however, whether such cases really belong in the causal control or in the eventuality coordination category, described in the next section.

[3] $\phi[x]$ denotes any formula with at most the variable x free.

(14) a. The two particles moved together for 3 nanoseconds
b. John and Mary accidentally glided together, down to the stop area

Another question concerns the status of the causal factor mentioned in (13) with respect to the participants in the eventuality. Suppose that (2) refers to the following situation: John and Mary are two patients who are perfect strangers and are sitting in a doctor's waiting room. $\phi[t]$ would then be the conjunction *intends*$(\text{John}, t, loc(t, e, \text{John}) = \ell)$ & *intends*$(\text{Mary}, t, loc(t, e, \text{Mary}) = \ell)$, which expresses the intention of John and Mary at t to stay at ℓ at t. This intention is not the same as the intention of John (and Mary) of being in the same place as Mary (and John) at t, i.e. *intends*$(\text{John}, t, loc(t, e, \text{John}) = loc(t, e, \text{Mary}))$ & *intends*$(\text{Mary}, t, loc(t, e, \text{Mary}) = loc(t, e, \text{John}))$. More generally, it is not required that colocalization be caused by an intention of colocalization.

Finally, it is not required either that the cause of the colocalization be of the same kind for each participant. For instance if Mary is deliberately waiting in a room, watching her prisoner, John, who is handcuffed to the wall, we may say that John and Mary are waiting 'together' in the room, although there is probably no shared intention to be in the room.

4.2 Coordination

Coordinated processes have been studied in *Channel Theory* (Barwise and Seligman 1997) and in different varieties of communicating process theory (Milner 1989, Milner 1999, Sangiorgi and Walker 2001, Stirling 2001). In this paper, we adopt channel theory because it seems slightly more general and is more intuitive. A channel is an abstract device that (i) selects parts of complex entities (objects, eventualities) and (ii) combine their respective descriptions. It can be interpreted as a very general form of *coordination engine* and, in most cases, provides a partial and idealized description of the causal system underlying a set of interconnected processes. Examples of channels are the causal system that relates different events in a computer, or the mixing up of intentional control and physical laws that underlies complex coordinated behaviors (e.g. communication and cooperation). See (Restall 1996) for an accessible introduction.

The ingredients of channels are three in number.

Classifications describe entities; the standard notation is $x \models \sigma$, meaning 'x satisfies the description σ, x has the type σ'. $\models$ is the classification. Types can be complex expressions (Boolean formulas, in general).

Morphisms fulfill two roles. (i) They select parts or aspects that are to be classified. A typical case is that of a function returning a part of a complex entity. E.g. $\mathsf{printer} \xrightarrow{f} \mathsf{button}$ selects the main button of a printer. (ii) They link the types of an entity to those of its parts or aspects.

Infomorphisms connect classifications. They associate pairs of morphisms (f, g) so that the part or aspect of an object o selected by f is of type σ if and only if o is of type $g(\sigma)$. Figure I,A shows the general form and I,B a computer-printer example. the f morphism selects the button of the printer. The coordination guaranteed by the infomorphism amounts to saying that the button can be described as PUSHED iff the printer can be described as being in an internal state (INTERNAL-PUSHED) corresponding to the description PUSHED for the button. In this example, the types PUSHED and INTERNAL-PUSHED are mere labels (informational black boxes). They could be decomposed into pieces of information. For instance, INTERNAL-PUSHED could be analyzed in terms of electronic circuitry.

FIG. I

(A)

$$\begin{tikzcd} \mathit{Types}_2 \arrow[r, "g"] \arrow[d, dash, dotted, "\models_2"] & \mathit{Types}_1 \arrow[d, dash, dotted, "\models_1"] \\ \mathit{Objects}_2 & \mathit{Objects}_1 \arrow[l, "f"] \end{tikzcd}$$

$f(o) \models_2 \sigma$ ssi $o \models_1 g(\sigma)$

(B)

$$\begin{tikzcd} \textsc{pushed} \arrow[r, "g"] \arrow[d, dash, dotted, "\models_2"] & \textsc{internal-pushed} \arrow[d, dash, dotted, "\models_1"] \\ \text{button} & \text{printer} \arrow[l, "f"] \end{tikzcd}$$

f(printer) $\models_2$ PUSHED iff printer $\models_1 g(\textsc{pushed})$
and $g(\textsc{pushed})$ = INTERNAL-PUSHED

Finally, channels connect infomorphisms through constraints. A constraint has the form $\Sigma \vdash \Sigma'$, meaning 'every entity that satisfies all the types in Σ satisfies at least one of the types in Σ''.[4] Constraint systems have different granularities, from symbolic black boxes to real-time systems. Note that, in simple cases, no constraints are necessary. In the summation example below, the infomorphisms take the coordination in charge.

(15) A channel is a family of infomorphisms that share a classification (the 'core' of the channel) and a (possibly empty) set of constraints. The infomorphisms and the constraints coordinate the different classifications outside the core.

For instance, in figure II, the two infomorphisms share the core comprised of the printer and its internal states. The internal state corresponding to the description PUSHED for the button entails the internal state corresponding to the description ON for the light. Externally, this means that whenever the button is pushed the light is on.

Although the construction of channels can be very complex in principle, there is a simple rule of thumb: the actions/states of the participants may be in general put outside the core and the coordination engine inside. Moreover, the most frequent types of coordination engine are causation, communication (intentionally coordinated processes) and mathematical and physical regularities.

[4]This the meaning of $\vdash$ in Gentzen systems for classical logic.

$$\begin{tikzcd}
\textsc{pushed} \arrow[r, "g_1"] \arrow[d, dash, dotted, "\models_1"] & \textsc{int-pushed} \arrow[d, dash, dotted, "\models"] & \textsc{int-pushed} \vdash \textsc{int-on} & \textsc{on} \arrow[r, "g_2"] \arrow[d, dash, dotted, "\models_2"] & \textsc{int-on} \arrow[d, dash, dotted, "\models"] \\
\text{button} & \text{printer} \arrow[l, "f_1"'] & & \text{light} & \text{printer} \arrow[l, "f_2"']
\end{tikzcd}$$

$$\begin{tikzcd}
\textsc{pushed} \arrow[r, "g_1"] \arrow[d, dash, dotted, "\models_1"] & \textsc{int-pushed}\,,\,\textsc{int-on} \arrow[d, dash, dotted, "\models"] & \textsc{on} \arrow[l, "g_2"'] \arrow[d, dash, dotted, "\models_2"] \\
\text{button} & \text{printer} \arrow[l, "f_1"'] \arrow[r, "f_2"] & \text{light}
\end{tikzcd}$$

FIG. II

Let us consider now a few examples.

1. A coarse analysis for *John and Mary walk together*.
The objects are the complex eventuality of John and Mary walking, e, and the subeventualities of John (Mary) walking, $f_J(e)$ ($f_M(e)$). The types are: *move*(x, ℓ_i, ℓ_j), going from ℓ_i to ℓ_j, *control-move*(x, ℓ_i, ℓ_j), controlling the move from ℓ_i to ℓ_j. The morphism g is defined by:

$$g(\textit{move}(x, \ell_i, \ell_j)) = \textit{control-move}(x, \ell_i, \ell_j).$$

The infomorphism is: $f_x(e) \models \textit{move}(x, \ell_i, \ell_j)$ iff $e \models g(\textit{move}(x, \ell_i, \ell_j))$.
The constraint is: *control-move*$(x, \ell_i, \ell_j) \dashv\vdash$ *control-move*(y, ℓ_i, ℓ_j).
So, the channel says simply that John and Mary adjust mutually their moves (by simultaneous control).

2. A less trivial example: *John and Mary work together*.
The objects are: e, the eventuality of John and Mary working, $f_{J,t}(e)$ ($f_{M,t}(e)$) the eventuality of John (Mary) working during t; the morphism g_t is defined by:

$$g_t(\textit{work}(x, s_i, s_j, t)) = (\textit{send}(x, y, s_j, t') \;\&\; t' > t) \vee (\textit{receive}(y, x, s_i, t') \;\&\; t' < t).$$

The types are: *work*(x, s_i, s_j, t), going from a state s_i to a state s_j by working during interval t, *send*(x, y, s_i, t), sending information about a state to another participant (y) during t, *receive*(x, y, s_i, t) receiving information about a state from another participant (y).
The infomorphism is:
$f_x(e) \models \textit{work}(x, s_i, s_j, t)$ iff $e \models \textit{send}(x, y, s_j, t') \;\&\; t' > t \vee \textit{receive}(y, x, s_i, t') \;\&\; t' < t$.
The constraint is: *send*$(x, y, s_i, t) \vdash$ *receive*(y, x, s_i, t).
Here, the analysis is slightly more complex. Subevents are temporally situated. An agent may work and communicate information about her work, or receive information and work, starting from the information state she received.

3. Summation: *John and Mary together earn* n *euros*.
As evidenced by (Moltmann 2004), the summation case is complicated because it may involve measurements in a covert way, that is, through an association between a property and a measure function. For simplicity, we assume that measurement functions can be as-

sociated with certain VPs (*outnumber those of John, have seen four students, are heavier than John*, etc.).[5] E.g. *are heavier than John* has an associated measure function μ_{weight} that returns the weight of John. For *earning* n *euros*, the measure function μ_{earn} returns simply $\langle n, \text{euro}\rangle$, i.e. a couple measure + measure unit.
The central object is a sum of individuals John $\sqcup$ Mary, whose type is the relation $\mu_{\text{earn}}(\text{John} \sqcup \text{Mary}) = m$.
The subobjects given by the f-morphism are John and Mary, typed by $\mu_{\text{earn}}(\text{John}) = m_j$ and $\mu_{\text{earn}}(\text{Mary}) = m_m$.
To ensure that a summation-based coordination takes place, we do not need any constraint; it suffices to posit an infomorphism of the general form:
$f_{x_i}(\bigsqcup_1^n x_i) \models \mu_{dim}(x_i) = m_i$ iff $\bigsqcup_1^n x_i \models \mu_{dim}(\bigsqcup_1^n x_i) = \sum_1^n \mu_{dim}(x_i)$.
Note that it would be possible to construct an eventuality-based version of this channel. Let us consider a sentence like *John and Mary together are heavier than Paul*. the central eventuality is the state e corresponding to the sentence. The substates $f_{x_i}(e)$ represent the eventualities of John (Mary) having a certain weight. They are typed by $e_{x_i} \models \mu_{dim}(e_{x_i}) = m_i$. The g morphism returns a condition $R(m_i + \sum_{j=1...n}^{j\neq i} m_j, m)$, where R is the quantitative relation (here superiority) and m the second term of R (here the measure of Paul's weight).

The channel-oriented approach calls for two comments. First, it applies to the summation case, which provides a certain unification of seemingly different uses of *together* and *ensemble*. Second, it leads one to reconsider in a new perspective Lasersohn's (1998) contribution. Lasersohn mentions the *social accompaniment* reading exemplified by (16). He uses a new primitive (function) π defined in (17).

(16) John and Mary went to the movies together

(17) Let g be a group and e an event, $\pi(e)$ returns the set of groups ('parties') that participate collectively in the event.

For instance, in (16), the two subevents of Mary going to the movies and John going to the movies share a party, which is the group $\ll j, m \gg$. Lasersohn proposes a similar solution for coordination. If John and Mary work together, the group $\ll j, m \gg$ will be a 'team' of the event of John working and that of Mary working. One might object that this proposal uses opaque primitives. However, Lasersohn argues that the notions we have been considering in this section are not amenable to any logical representation: "Social accompaniment is a non–logical notion which is not amenable to a formal definition in model–theoretic terms", (Lasersohn 1998:289).

We agree that social relations are essentially non-logical, in that they are not driven by standard logical inferences and pertain to the general field of action. However, it does not follow that formal techniques are irrelevant. To clarify the contribution of channels, or similar tools, two comments are in order. First, as in many other domains, *idealization* plays a central role. Systems of actions and causes are notoriously complex and multidimensional. In our present state of knowledge, nobody is really able to do justice to their detailed structure. The general strategy one adopts is to *partialize* the domain under study.

[5]The simplification here comes from the fact that we do not distinguish the contribution of the verb and of the complement(s) or adjunct(s).

This may be done by selecting a particular layer or area of phenomena and focusing on it (domain restriction) or by assuming that one has a very abstract model that could, in principle, be developed to provide a detailed rendering of all the relevant observations (underspecification). The fact that a formal study is subject to domain restriction and/or underspecification does not entail that it is useless. In a sense, most models used in cognitive science and theoretical computer science present such limitations. Yet, they are not considered as gratuitous or insignificant. More specifically, process coordination has given rise to many notions (bisimulations, channels, process communication, etc.) that help us to construct an abstract image of coordination. This might not be enough, but it is certainly better than nothing, if only because it dissipates the impression that coordination is a totally vague concept.

A second aspect relevant to Lasersohn's view is compositionality. There is probably no way to generate a channel-theoretic representation (or any other similar representation) from the lexicon in a compositional way.[6] This is a lethal objection only for those who believe that semantics can simply ignore encyclopedic knowledge. Considering an example like (3), the ways in which co-walkers can coordinate their motions is certainly not coded *in* the lexicon. However, this does not entail that it is not visible *from* the lexicon. Mastering the verb *walk* supposes being able to use it appropriately, that is, to describe real or imaginary circumstances that satisfy the constraints associated with the verb. To take Lasersohn's slightly more complex example of 'social accompaniment', consider (18). It is not necessary that John and Mary have each bought shoes for (18) to be true. What *is* necessary, is that the activity of buying shoes leads John and Mary to coordinate some of their actions: e.g. they could discuss the different offers, share the expense, or just stay together while one of them buys the shoes. Certain versions of coordination may be felt too light to motivate a sentence like (18), but, in any case, the absence of coordination would make the sentence misleading.

(18) John and Mary have bought shoes together

Clearly, the action scripts that motivate the use of *together* cannot be read off the sentence form, no more than we can enumerate all the plans that would allow one to reach a certain goal expressed by a simple sentence. This does not make the notions of script or plan void, at least if we assume a relatively traditional division of labor between semantics and world knowledge. For instance, to take into account the fact that coordination is not necessarily total, we might impose the following condition for the definition of coordinated eventualities.

(19) An eventuality e with participants $x_1 \dots x_n$ is totally coordinated if there exists a channel that coordinates the subeventualities e_{x_i} for $i = 1 \dots n$. It is partially coordinated if some part of it is totally coordinated.

[6] We suspect that (possibly unconscious) considerations of compositionality explain the leading role of algebraic semantics in the study of togetherness.

4.3 Causal control and coordination compared

Should we view the two cases described in the last two sections as two variants of the same basic configuration? Causal control is clearly weaker than coordination since it does not involve any communication. However, in both cases, we find a certain dependency between the descriptions of the entity which are 'together'. With spatio-temporal proximity, the dependency is (quasi) identity: the two entities have approximately the same location. With channel-based coordination, the dependency is given by the constraints of the channel. The channel, *qua* system of constraints, acts as a 'cause' of the dependency.

This suggests that causal control and coordination could be unified by seeing togetherness in such cases as the consequence of certain causal factors over a time interval. Thus, we would have a definition parallel to (13). (20) says that there is a causal factor that brings about a dependency relation between the descriptions of the simultaneous x_i-subeventualities.

(20) Let $\Delta(t, e, x_i)$ denote the description of the subeventuality e_{x_i} at t. *Together* and *ensemble* are appropriate at a time interval t and a world w w.r.t. a (complex) eventuality e of with participants $x_1 \ldots x_n$ iff there is a propositional schema $\phi[x]$ and a function, f such that, for every $t' \sqsubset t$, $\phi[t]$ causes $\Delta(t', e, x_i) = f(\Delta(t', e, x_j))$ and $\Delta(t', e, x_j) = f(\Delta(t', e, x_i))$ for any x_i, x_j.

Three points prevent us from proposing (20) or its variants as a unifying definition. First, the properties of the function f remain to be studied. Additional constraints are perhaps necessary in order to narrow the field of reasonable dependencies. Second, a genuine unification would allow us to merge adnominal and adverbial *together*. In view of the many subtle points involved in the semantics of adnominal *together* (Moltmann 2004), it is not clear whether a general definition like (13) is sufficient.[7] Third, unification, whatever the details might be, would not spare us taking into account the distinction between achievements and non-achievements.

4.4 Syntax-semantics interface

In this section, we provide an elementary syntax-semantics interface for *together* and *ensemble*. There are different models of interface available; since the goal of this paper is not to defend any particular affiliation to one of them, we have chosen recent categorial grammar (Kruijff 2001, Steedman 2000) because it is extremely flexible and does not commit one to much more than assuming a small set of generally accepted categories for constituency. For similar reasons, we use Landman's (2000) ontology. The account is simplified in at least two respects. (i) We focus on the main cases and do not provide a complete coverage of the distribution; for instance, we ignore the contribution to small clauses (*I saw John and Mary together*). (ii) We also ignore fine-grained variations for

[7] Moltmann herself claims that she unifies the two constructions but she has to resort to the notion of integrated whole, criticized in section 3.1. Also, it is difficult to reconcile what she says in her definitions (30) and (31) with her final claim (p. 312) that adnominal *together* can only have access to the predicate (vs. the verb and its arguments).

scope possibilities and address only the cases that are accepted by all speakers.[8] For the summation case we will consider only the scope on subject NPs, for *together* and *ensemble*, and of scope on V for *ensemble*. For the causal and coordination cases, we will consider the cases of scope on V and VP.

Ontologically, we distinguish: individual atoms (of type AT), sums of atoms i.e. objects of the form $x_1 \sqcup \ldots \sqcup x_n$, and group atoms. If σ is a sum $d_1 \sqcup \ldots \sqcup d_n$, $\uparrow(\sigma)$ denotes σ as a group and $\uparrow(a) = a = \bigsqcup a$ if $\text{AT}(a)$.

The basic idea of categorial grammar is that a category comes with its combinatorial potential, an index and the semantic features that describe the event structure. For example, *see* is analyzed as $\langle$(S : e \ NP : x) / NP : y, *agent*(e) = x & *theme*(e) = $y\rangle$. We must add semantic constraints in order to connect the syntactic structure, the basic predicate-argument(s)/modifier(s) semantic structure and the specific restrictions that constitute the contribution of *together*. Accordingly, we define constraints for causation and channel types.

1. Scope on subject NP
• Syntax: NP : $x \backslash$ NP : x_{tog}
• Semantics: the semantics takes advantage of the structure of sentence descriptions. A sentence description has a form $\bigwedge_1^n r_i(e) = a_i$, where the r_i's are thematic roles. We can then put a constraint on any sentence description that contains x_{tog}. This constraint has the general following form, where r is an appropriate role:

$$\forall e(r(e) = x_{tog} \ \Rightarrow \ \phi)$$

ϕ is a complex condition that we can decompose in two parts:
1. x must be a sum or a group,
2. for any e' such that the description of e', $\Delta(e')$, is identical to that of e except that x replaces x_{tog}, $\Delta(e')$ entails the existence of a certain dimension dim, a certain comparison relation R and a certain entity y such that the measure of x entertains collectively or distributively the relation R to the measure of y. E.g., in *John and Mary are heavier than Paul*, we may have the distributive interpretation ('John is heavier than Paul and Mary is heavier than Paul') or the collective one ('John and Mary as a group are heavier than Paul'). This information is not determined by *together* and is, accordingly, declared as an implication of the description of e', the alternative of e.
3. The specific contribution of *together* is the last underlined part of the formula and consists in asserting that the additive measure of x entertains the relation R to the measure of y.

(21) **Constraints on the summation use of *together***

$$\forall e([x_{tog} = \textit{agent}(e) \vee x_{tog} = \textit{theme}(e) \vee x_{tog} = \textit{experiencer} \vee x_{tog} = \ldots] \Rightarrow \\ \exists X[\\ (x = \bigsqcup X \vee x = \uparrow(\bigsqcup X)) \ \& \\ \exists dim, y, R\,(R \in \{<, >, =, \leq, \geq\} \ \& \\ (\forall e'((\Delta(e') = \Delta(e)[x_{tog} \leftarrow x]) \Rightarrow (e' \models (x \in \text{AT} \ \& \ R(\mu_{dim}(x), \mu_{dim}(y))) \vee \forall x_i \in X(R(\mu_{dim}(x_i), \mu_{dim}(y)))))) \ \& \\ \underline{e \models R(\textstyle\sum_{x_i \in X} \mu_{dim}(x_i), \mu_{dim}(y)))}])$$

[8] This might leave out, in particular, variations that reflect the differences between written and spoken usage.

Note that a more complete treatment would have to put constraints on the measure dimension dim. However, the nature of these constraints is unclear at this stage; for instance, salary is a possible candidate (*John and Mary together earn more than Sally*) whereas speed is not (?? *John and Mary together run faster than Sally*).[9]

2. Scope on V
In French, *ensemble* can follow immediately the V in its three main uses (see (1b) for summation).
a. Summation: ((S : e \ NP : x_{tog}) / α) \ ((S : e \ NP : x) / α)
b. Causal control: ((S : e \ NP : $x_{causcont}$) / α) \ ((S : e \ NP : x) / α)
b. Channel-based control: ((S : e \ NP : $x_{channel}$) / α) \ ((S : e \ NP : x) / α)
The semantics is defined in (22) and (23) and is driven by the subject, in a way quite similar to (21).

(22) **Constraints on the causal control use of *together***
For every e such that $r(e) = x_{causcont}$ for some r, x must be a sum or group end e a causally controlled eventuality with respect to the members of x.

(23) **Constraints on the channel-based use of *together***
For every e such that $r(e) = x_{channel}$ for some r, x must be a sum or group end e a channel-based eventuality with respect to the members of e_{x_i}.

3. Scope on VP
• Syntax: (S : e \NP : $x_{causcont}$) \(S : e \NP : x) or (S : e \NP : $x_{channel}$) \(S : e \NP : x).
• Semantics: as above.

5 Conclusion

In this paper we have shown that *together* and *ensemble* have different licensing conditions depending on the aspectual type of the eventuality referred to. We have also introduced a causal and channel-based analysis to deal with cases of spatio-temporal proximity and coordination. Although sum operations ($\sqcup$) familiar from algebraic semantics are necessary, we have cast serious doubt on the idea that they could suffice to capture notions that are rooted in our categorization of causality and, more generally, dependency between processes. We leave the comparison with other similar lexical items (*with* and *avec*) and with alternatives techniques of representation (communicating processes) to further work.

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[9]Before assuming hastily that there must be some trivial difference (but which one, exactly?) between *earn* and *run*, the reader might want to keep in mind less ‘trivial’ pairs, like ?? *John and Mary together shouted more strongly than Sally* and *John and Mary together produced more decibels than Sally in the shouting competition*.

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