Against the single-domain constraint

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1   Introduction

Warglien et al. (2012) extends the theory of conceptual spaces (Gärdenfors, 2000) to the semantics of verbs. The basic proposal is that the representation of an event contains at least an object (called the patient) and two vectors, namely a result vector representing a change in the properties of the object, and a force vector representing the cause of the change, with the structure of the event being determined by the mapping from force vector to result vector. In order to capture the lexicalization constraint proposed by Kiparsky (1997) and Hovav and Levin (2010), Warglien et al. (2012) add the so-called single-domain constraint, which says that the meaning of a verb is a convex region of vectors that depends only on a single domain.

In the first part of this commentary we argue, both on theoretical and empirical grounds, against the single-domain constraint, by (i) pointing out that learnability considerations motivate at most a strong tendency for verbs to lexicalize either manner or result, and (ii) by arguing that some verbs expressing force dynamics (e.g. *überzeugen* 'to persuade', *zwingen* 'to force/compel') and some verbs involving conventional consequences (*buy, sell, inherit, bequeath*) lexicalize both a manner and a result component. In the second part of the paper we make some critical remarks on the prospects of vector-based theories of event structure. Basically, our complaint is that the reduction of events to vectors makes a sufficiently rich analysis of verbal meanings impossible, as it ignores the temporal contour. In effect, what the authors do is to represent only the result, and ignore the manner of an event.

2   Against the single domain constraint

Warglien et al. (2012) motivate the addition of the single-domain constraint with learnability considerations: "each domain contains an integral set of dimensions that is separable from other domains. A mapping between domains may be hard to learn and subject to many contingencies and sources of instability." (p.11) This motivation is, in our view, too weak, as it hinges on how "hard" it is to learn correlations between the force and result domain. If it is hard but not impossible to learn the mapping between manner/force and result domains, then one would expect to observe a tendency – not an exceptionless constraint – to lexicalize either manner or result components.

   Further, if as Warglien et al. (2012) argue, it is generally possible to lexicalize correlations between (changes in) different domains,[1] why exactly should it be impossible to lexicalize correlations between the force and result domain? Warglien et al. (2012) claim that "the coupling of force and change vectors is complicated since this concerns the way actions relate to their effects" and illustrate this point by claiming that the relationship between "the patterns of forces exerted by one's arms" and the "movement of an object in three dimensions" is "unstable, being subject to external counterforces and other uncontrollable factors." We are not convinced that this example is sufficiently representative for "coupling of force and change vectors": the existence of complex and unstable relationships between force and result vectors does not exclude cases where this relationship is simple and stable. In fact, in those cases where the result of a (possibly complex) force pattern can be formulated as a binary change (e.g. change of ownership) one would actually expect simple and stable relationships between force and result vectors. Not surprisingly, the verbs we shall discuss below all exhibit this property, i.e. lexicalize a simple (binary) change as a result of an action.

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[1] In footnote 21 Warglien et al. (2012) claim that "change in location of a fruit and change of its taste are not correlated. No corresponding domain combines these domains: consequently no verb exists that simultaneously expresses change in location and change of taste. On the other hand, the color of a fruit and its taste are strongly correlated: therefore it is cognitively economical to introduce the domain of ripeness to capture this correlation. Given this configurational domain (Langacker 1987, pp. 152-154), the verb "ripen" can be introduced to express the correlated changes in the domain."

3   Verbs of force dynamics

We now turn to two empirical domains, namely verbs of force dynamics and verbs involving conventional consequences, and provide some empirical evidence against the single domain constraint by arguing that some verbs in these domains lexicalize both a manner and a result component. We argue that while *drängen* ('to urge/push') lexicalizes only a manner/force component and *(dazu) bringen* ('to make sbd. do sth.') lexicalizes only a result component, *überreden* ('persuade') as well as *zwingen* ('to force') lexicalize both a manner/force and a result component, in violation of the single-domain constraint. We claim that neither the manner in which the persuading/forcing is done (insistent talking in the case of *überreden*, exertion of pressure in the case of *zwingen*) nor the result of the action (the antagonist prevails) can be analyzed as contextually determined aspects of meaning which are strongly inferred but not entailed.[2] Instead, both the manner and the result meaning components must be analyzed as being part of the lexicalized meaning.

   We begin by considering the force dynamic patterns involved in *drängen* and *(dazu) bringen*.[3] The verb *drängen* lexically specifies that the antagonist exerts some kind of pressure on the agonist, as witnessed by the fact that this aspect of interpretation is entailed in all contexts of use and cannot be canceled.

(1)   a.   *Die Diplomaten haben ihn gedrängt, die Botschaft zu verlassen.*
           The diplomats urged him to leave the consulat.
      b.   *#Die Diplomaten haben ihn gedrängt, die Botschaft zu verlassen,*
           ohne allerdings auch nur ein bischen Druck auszuüben.
           The diplomats urged him to leave the consulat without actually
           putting any pressure on him.

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[2]Levin and Hovav (to appear) defend the claim that the verb *cut* does not violate the manner/result complementarity hypothesis by (i) distinguishing lexicalized from nonlexicalized meaning components (the criterion for lexicalized meaning proposed by them is constancy of entailment across all uses of a verb), and (ii) by arguing that in its basic use the verb *cut* lexicalizes only a result component, while "the specifications of manner which are understood with result uses of the verb do not arise from the lexicalized meaning of the verb, but rather are inferred from context."

[3]For an analysis of the force dynamics of the English counterparts to some of these verbs, see Talmy (2000).

In contrast, *(dazu) bringen* does not specify whether or not the antagonist exerts pressure on the agonist, and is therefore compatible with antagonist actions which may or may not involve exerting pressure on the agonist.

(2) a. *Die Tiere werden meist mit Gewalt dazu gebracht bestimmte Kun-*
ststücke aufzuführen.
The animals are made to perform their tricks by use of force.

  b. *ob die Bürger durch positive Anreize dazu gebracht werden könnten,*
über das Rentenalter von 65 Jahren hinaus freiwillig weiter zu ar-
beiten.
whether the citizens could be made to work voluntarily after they reached the retirement age of 65 by means of positive incentives

Sentence (2-a) explicitly asserts that the animals were forced to perform their tricks, whereas in (2-b) the people are not forced to work beyond the age of 65, but given positive incentives to do so. We can therefore conclude that *drängen* lexicalizes a manner component (the antagonist exerts pressure on the agonist), whereas *(dazu) bringen* does not. Instead, *(dazu) bringen* lexicalizes a result component. While it is silent on how the antagonist action is performed, *(dazu) bringen* entails that the antagonist (force) prevails, in other words the antagonist succeeds in her aims or goals. Again, this inference cannot be canceled.

(3) #*Der Westen hatte den Iran seit Monaten erfolglos dazu gebracht, einen*
Vorschlag zur Urananreicherung in Frankreich und Russland anzunehmen.[4]
The West has unsuccessfully made Iran accept an offer to enrich uranium in France and Russia.

On the other hand *drängen* does not specify that the antagonist prevails, and is therefore compatible with situations in which the antagonist prevails (4-a), and with situations in which he does not prevail (4-b).

(4) a. *Sie wurde im Kindergarten auch (nach einigen Malen wo sie nix*
aß) erfolgreich gedrängt Geburtstagskuchen oder Muffins zu es-
sen.[5]

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[4]Source: http://www.mopo.de/news/atom-bewegung-im-atomstreit-mit-dem-iran, 5066732,5101722.html

[5]Source: http://www.schnullerfamilie.de/ernaehrung-ab-1-geburtstag-ins-kleinkind alter/209250-4-5-jaehrige-essen-probieren-zwingen-3.html

In kindergarten she was successfully pushed/urged to eat birth-day cake or muffins (even when she hadn't eaten anything).

b. *Der Westen hatte den Iran seit Monaten erfolglos gedrängt, einen Vorschlag zur Urananreicherung in Frankreich und Russland anzunehmen.*
The West has unsuccessfully urged/pushed Iran accept an offer to enrich uranium in France and Russia.

That is, *drängen* and *(dazu) bringen* conform to the lexicalization constraint, since *drängen* lexicalizes only a manner component, whereas *(dazu) bringen* lexicalizes only a result component.

We now show that *überreden* and *zwingen* lexicalize both a manner and a result component. A first hint that *überreden* and *zwingen* lexicalize a result component is given by the dictionary definitions, which explain both verbs in terms of *(dazu) bringen*. For example, the Duden[6] defines *überreden* as "durch [eindringliches Zu]reden dazu bringen, dass jemand etwas tut, was er ursprünglich nicht wollte" ('make somebody do something he did not want by (insistent) talking'). Secondly, the fact that *überreden* and *zwingen* pattern like *(dazu) bringen* in that they cannot be modified by the adverb *erfolglos* provides further evidence that these three verbs lexicalize a result component, namely that the antagonist was successful in his aim/goal. Put differently, if the result component is not part of what these verbs lexicalize but something that is strongly inferred in most contexts, then it should in some contexts at least be possible to say (5-b). In our view this is impossible, showing that the result component is actually lexicalized by these verbs.

(5) a. *Tim hat Tom überredet/gezwungen, das Auto zu verkaufen.*
Tim has persuaded/forced Tom to sell the car.
b. #*Tim hat Tom erfolglos überredet / gezwungen, das Auto zu verkaufen.*
Tim has unsuccessfully persuaded/forced Tom to sell the car.

Thirdly, without appealing to the result of the antagonist's action, i.e. its success, it is not clear to us how to describe the difference between *drängen* and *zwingen*. One could try and rescue the manner/result complementarity by claiming that *drängen* and *zwingen* lexicalize a force pattern where the force vector representing the actions of the antagonist overcomes the force vector representing the actions of the agonist, without actually lexicalizing also a result vector, but if this strategy is pursued we simply do not under-

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[6]Source: http://www.duden.de/rechtschreibung/zwingen

stand what the term 'result vector' is supposed to mean – in what sense is the force of the antagonist overcoming the force of the agonist not a result?

Next we argue that *überreden* and *zwingen* lexicalize a manner component as well. Again, the first hint that this is so is given by the dictionary definitions. *zwingen* is explained as making somebody do something by using threats or even force, whereas *überreden* is defined as making somebody do something by insistent talking. To see that these aspects of meaning are indeed lexicalised and not inferred in certain contexts note that these verbs cannot be modified by adjuncts contradicting the manner in which the action is performed.

(6)   a. #*Die Investoren wurden allein durch die Einführung positiver Anreize gezwungen, in Griechenland zu investieren.*
        The investors were forced to invest in Greece solely by the introduction of positive incentives.
     b. #*Durch jahrelanges Schweigen hat sie ihn überredet, ihr einen Brief zu schreiben.*
        Through years of silence she persuaded him to write her a letter.

Secondly, without postulating a lexicalised manner component it is not clear how to capture the difference between *zwingen*, *überreden* and *(dazu) bringen*, since these verbs have the same result component – the antagonist force prevails over the agonist force.

We therefore conclude that the verbs *zwingen* and *überzeugen* lexicalize both a manner and a result component and therefore provide evidence against the single-domain constraint.

4   Verbs involving conventional facts

Next we turn to a second empirical domain, namely verbs involving the establishment of conventional facts, and argue that in this domain too we find verbs lexicalizing both manner and result components, providing further evidence against the single-domain constraint. In particular, we argue that the transfer of ownership verbs *buy* and *inherit* (as well as *sell* and *bequeath*) lexicalize both manner and result component.

We begin by providing two arguments that *buy* and *inherit* lexicalize a result component. First, both *Mike bought a flat* and *Mike inherited a flat*

entail *A change of ownership took place*[7], and a change of ownership is clearly the result of some transaction. That this is an entailment and not a context-dependent inference is supported by the anomaly of (7), showing that this inference cannot be canceled:

(7)   #*John bought/inherited the house from his grandfather, although no change of ownership took place.*

Secondly, *buy* differs from *hire* precisely in the kind of result: *hire* specifies that the result of the transaction is a temporary transfer of possession/rights, whereas *buy* specifies a permanent transfer of ownership, so that without a lexicalized result component for *buy* and *hire* it would not be possible to specify wherein they differ.

But, against the single-domain constraint, we argue that *buy* and *inherit* also lexicalize a manner component. First, the difference between *buy* and *inherit* consists in how the result, i.e. the change of ownership, comes about: *buy* specifies that the change of ownership comes about as a result of a transfer of money from buyer to seller, whereas *inherit* specifies that the change of ownership of x from y to z comes about as a result of the will of y (or as a result of inheritance laws). Moreover, these specifications are part of the lexicalized meanings of these verbs and cannot be viewed as contextually-determined inferences, which explains why trying to cancel these meaning components leads to semantic anomalies:

(8)   a. #*He managed to buy the bag for free.*
      b. #*Tom inherited the house from his grandfather, by paying Susan, who was the legal heir, a sizable sum of money after the grandfather's death.*

In an analogous fashion it can be shown that *sell* and *bequeath* lexicalize both manner and result component. On the one hand the result component of these verbs, i.e. that a change of ownership takes place, is entailed in all contexts of use and cannot be canceled, and therefore has to be assumed to be lexicalized. On the other hand it is clear that the difference between *sell* and *bequeath* lies in the manner in which the change of ownership is achieved (by transfer of money on the one hand or by testament and/or inheritance law on the other), and this manner again is entailed in all contexts of use

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[7]*X bought Y* does not entail that *X owns Y* since *X* may have bought *Y* for somebody else.

and cannot be canceled.

To be fair, Warglien et al. (2012) anticipate that verbs like *give, buy, sell*, which in their view involve intentional actions, are a challenge to the single-domain constraint. Nevertheless, they conclude that "verbs involving intentional actions are not really counterexamples to the single-domain constraint". Their argument is this: "Many events involving goals can be construed from either of two perspectives: the physical action on an object or the intentional action leading to the fulfillment of a goal. Such a situation can still be expressed with the aid of a verb, since the fulfillment of the intention *presupposes* a physical action."p. 15.

We are not convinced. First, we doubt that the intention to buy something is part of the lexicalized meaning of *buy*. In other words, the intention to buy something is not an uncancellable context-invariant aspect of the meaning of *buy*. To us it appears that the actions that are constitutive for buying a certain product can be performed without the intention to actually buy. Think, for example, of mistakenly/unintentionally clicking the "Buy now" button on a website, or of scratching one's head at an auction at the wrong moment. Secondly, and more problematically, *buy* does not actually presuppose a particular course of action leading to a change of ownership – it asserts it. And therefore the particular course of action leading to a change of ownership is part of the lexicalized meaning of *buy*. If the action leading to the change of ownership was indeed presupposed, then this presupposition should survive embedding under negation. So if (9-a) presupposes that Christian performed some action involving exchange of money, then so should (9-b). But, of course, (9-b) does not presuppose any action whatsoever, so (9-a) cannot be said to presuppose that Christian performed some action involving money exchange.

(9)   a.   *Christian bought an apple.*
       b.   *Christian did not by an apple.*

5   Vector model theories of event structure

Let us now zoom in on the representational issues surrounding the model. As the authors explain, their intention is to show that the idea of conceptual structures known from the nominal domain can be carried over to the verbal domain. Recall that the leading idea was that objectual concepts form convex

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domains in the state space. The question now is whether this is the case for events as well. To make that work, the authors reduce the continuous change to a summary change, which allows them to reduce the meaning of a verb to (at most) a pair of vectors. It is this part however that we are skeptical about. For simplicity, we focus in this section on motion events, but the discussion carries over to other domains as well. The authors suggest a two vector approach, whereby one vector specifies the location at the onset of the event and the second the change. Equivalently, the information we have is the location at the onset and the location at the end. Mathematically, if the location is represented by a time dependent vector $x(t)$, then we are given either the vectors $x(t_0)$ and $x(t_1)$, where $I = [t_0, t_1]$ is the time interval of the event, or we are given the vectors $x(t_0)$ and $x(t_1 - t_0)$ (which we call here the *resultant vector*).

Thus, the encoding is enough to represent result states, but whether it also is enough to represent manner of motion is open to doubt. For as stated explicitly in Section 3.1, time is not represented. The authors suggest, though, that the temporal unfolding of the event can be calculated from the resultant path. If path is the set of points traversed, i.e. if it is the set $\{x(t) : t_0 \leq t \leq t_1\}$, this is clearly false. Without some representation of time, it is impossible to reconstruct essential aspects of a motion event (e.g. velocity). If you are moving in a circle, one cannot distinguish running the circle once, or twice, and so on. Worse, when the authors talk about the aspectual approach in 5.2 they talk about the distinction between an extended vector and a punctual vector. An extended vector is said to be decomposed (or decomposable?) into a sequence of vectors. The only way to make sense of this is to say that the resultant vector of a motion event within an interval I is the sum of the resultant vectors of the subevents over some chosen partition of subintervals I_1, through, I_n. So, that John ran three miles between 10 am and 11 am can be due to his running 1 mile from 10:00 to 10:30 and 2 miles between 10:30 and 11:00. And yet it can also be the effect of his running 1 1/2 miles between 10:00 and 10:30 and also between 10:30 and 11:00. Which one it is, we do not know of course when we only know the resulting vector. The terminology employed here is misleading. For the explicit representation uses only one (resultant) vector, not the sequence. Unfortunately, this blurs an important distinction. Recall that there is distinction between momentary change and a change over some time. Basically, the velocity vector is the derivative of the location, $\dot{x}(t)$, and is tangential to the path. Unless you are moving in a straight line, the

velocity vector is not on the path itself. E.g. if you are moving in a circle, then the velocity vector can only be followed for an infinitesimal increment of time, never for an extended stretch. In other words, the path is obtained by integrating over the velocity vector. In real life, motions can however be rather complicated, and so there is no hope of representing the velocity by a single unchanging vector, for it too is time-dependent. Namely, $\dot{x}(t)$ is not constant, but it too changes (the result of forces acting on the particle in motion).

We give a few examples of motion patterns to show that the distinctions are linguistically real. Recall from physics the idea of a state space. For each mass particle we need six coordinates, three for the location $x(t)$ and three for the velocity vector $\dot{x}(t)$ (indicating the direction of motion and its speed). In a similar vein the authors suggest what we need is the location and the resultant vector (which is the increment over the entire interval). Thus, the differential quotient is replaced by a simple difference, blurring over the distinction between momentary change and global change. Nevertheless, this is enough for many motion verbs.[8] Consider now the verb *sich drehen* 'to turn'. If an object is turning around an axis, the orientation is constantly changing.[9] So, we would like to represent that motion by a single vector. It is clear that the location plus the resultant vector do not wok. In the worst instance there is no increment (e.g. after a series of full turns), thus it cannot even be said the object has turned. In physics, however, one associated the so-called angular momentum, which points in this case in direction of the axis. Its size indicates the magnitude of the momentum, it is proportional to the frequency with which the object is turning around. Already this representation raises questions of its own, as it shows us that a representation by a constant vector is obtained only after reasonably complex coding is performed. But matters can get worse still. When referring to undulating motions of a ship three verbs are being used: *rollen* ('to roll'), *schlingern* ('to yaw') and *stampfen* ('to pitch').[10] Let us take the middle one, as it also is used in normal conversation with more or less identical meaning. Consider

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[8]They do so often irrespecive of whether we talk of momentary manner ascription or global manner ascription. To move fast, for example, can be uniform over an interval or not, and still the overall speed can be fast. We shall leave that point aside.

[9]Interestingly, though, this is not a motion verb (see Talmy (2000)). Independently of that issue, however, we need to be able to represent its meaning.

[10]See `http://en.wikipedia.org/wiki/Ship_motions` for an illustration of these motions.

a ship moving north. A motion of *schlingern* is such that while the average motion vector points north, the momentary motion vector oscillates between somewhat north-east and somewhat north-west. Thus, the ship is essentially turning back and forth around its vertical axis. The momentum vector keeps oscillating rather than being constant. There are always moments in time when it is of zero length (when rotation stops to give way to rotation in the other direction). It is hard to imagine a vector that is kept constant throughout this motion. More verbs can be adduced.[11]

What this suggests is that motion patterns can require a rather complex description, one that defies the use of a single vector in a state space. More precisely, as we indicated, such a coding actually is possible, though it often requires sophisticated methods. The resultant vector is inadequate to represent in particular manner of motion verbs.

6 Conclusion

To conclude, we have argued that the model of events proposed by Warglien et al. (2012) faces significant empirical and theoretical challenges. The postulation of the single-domain constraint raises the problem of accounting for verbs like e.g. *buy* which, on the face of it, entail both a manner in which the action is performed as well as a result of the action. We argue that the manner component of this type of verbs cannot be analyzed as being presupposed by the intention to achieve a certain result; it must be analyzed as part of the lexicalized meaning of the verbs. Commenting on the prospects of a vector-based analysis of events, we argued that the reduction of events to vectors makes a sufficiently rich analysis of verbal meanings impossible.

References

Gärdenfors, Peter. 2000. *Conceptual Spaces: On the Geometry of Throught.* Cambridge, MA: MIT Press.

Hovav, Malka Rappaport, and Beth Levin. 2010. Reflections on manner/result complementarity. In *Lexical semantics, syntax, and event struc-*

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[11]Also consider the English verb *to wiggle* for similar problems of representation.

ture, ed. Malka Rappaport Hovav, Edit Doron, and Ivy Sichel, 21–38. Oxford: Oxford University Press.

Kiparsky, Paul. 1997. Remarks on Denominal Verbs. In *Complex Predicates*, ed. Alex Alsina, Joan Bresnan, and Peter Sells, 473–499. Stanford, CA: CSLI Publications.

Levin, Beth, and Malka Rappaport Hovav. to appear. Lexicalized Meaning and Manner/Result Complementarity. In *Subatomic Semantics of Event Predicates*, ed. Boban Arsenijević, Berit Gehrke, and Rafael Marí. Dordrecht: Springer.

Talmy, Leonard. 2000. *Toward a cognitive semantics*. Cambridge, MA: MIT Press.

Warglien, Massimo, Peter Gärdenfors, and Matthijs Westera. 2012. Event structure, conceptual spaces and the semantics of verbs. *Theoretical linguistics*.