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Lexical Decomposition in Understanding Italian and English Motion Verb

In this paper, we combine linguistic analyses based on Event Templates (Rappaport Hovav and Levin 1998a) and psychological proposals on the complexity of verb meanings to develop an analysis of the proposed complexity differences in motion verbs in English (as a satellite–framed language) and Italian (as a verb–framed language). The key prediction from this analysis is that for both languages manner–of–motion verbs take longer to be processed than path–motion verbs: that is to say, independently of the language specific lexicalization patterns, the more complex the structure, the longer the time to process it. We also outline some recent findings that have a bearing on this prediction.

1. Introduction

One of the long–standing bugbears for psycholinguistics, notably starting with Chomsky's transformational grammars, has to determine which parts of a given linguistic analysis have measurable psychological consequences (e.g., in reading times, errors, etc.) and which do not. Often excellent linguistic analyses become tainted by their failure to feed through to measurable psychological consequences. In this paper, we revisit this broad issue in the context of complexity analyses of verbs of motion, with a cross–linguistic twist. The key question is whether linguistic analyses of the structural complexity of motion events can be shown to have measurable processing costs in psychological experiments.

There is some evidence – from studies using a single language (usually English) – that the structural complexity of event verbs can be shown to have measurable impacts on processing costs (McKoon and MacFarland 2000,

2002; Gennari and Poeppel 2003; Mobayyen and de Almeida 2005). Other work has shown that coercion and type–shifting operations incur additional processing overheads (Traxler et al. 2005, Piñango et al. 2006, Bott 2008, Brennan and Pylkkänen 2008, Malaia et. al. 2013). However, the present focus is on cross–linguistic studies. Such studies present very different opportunities for assessing the impact of structural complexity in event structures. In the cross–linguistic context, one can exploit the contrasting differences between the treatment of events across several languages, with a view to determining whether there are differential overheads in different languages. However, such work requires the bringing together to several diverse literatures. This is the theoretical goal we set ourselves in this paper as we elaborate a coherent cross–linguistic analysis of motion verbs in English and Italian that makes processing predictions by merging three very different literatures.

Various linguistic analyses have proposed that there are cross–linguistic structural differences in motion verbs that should have consequences for the processing of these structures within and across different languages. To bring these ideas together and show how they may be productively explored, in this paper we merge three relatively distinct literatures. First, we review the psychological literature on verb complexity and how it has been shown to impact ease of comprehension (section 2). Second, we review linguistic analyses of manner–of–motion verbs, detailing how they used to elucidate cross–language differences between English and Italian verbs of motion (see sections 3 and 4). Third, we review a recent study that uses plausibility judgements to explore the psychological implications of these linguistic analyses (see section 5). Thus, our aim is to convey that there are productive synergies to be explored on the issue how linguistic analyses may be shown to manifest themselves in novel psychological tasks.

2. Psychological Studies of Verb Complexity

An important question in cognitive science concerns how word meanings (or lexical concepts) are internally represented. Although considerable progress has been made in the domain of nominal concepts since the groundbreaking work of Rosch and colleagues (Rosch 1973, 1975), the nature and the organization of verb concepts is a lot less well–understood. Early studies on verb meanings investigated whether verbs had internal semantic structure, as proposed in linguistic theories, but failed to find evidence supporting such a view (e.g., Fodor et al. 1980, Kintsch 1974, Rayner and Duffy 1986). These findings led Fodor and colleagues (Fodor 1975, Fodor et al. 1980, Fodor and Lepore 1998) to propose that verb meanings were atomic and lacked internal structure. However, more recent psycholinguistic studies have suggested that verb concepts *do* have internal semantic structure.

Several sentence processing experiments have shown that lexical semantic properties such as selectional restrictions and verb–specific thematic roles (agent vs. patient) are quickly accessed by the processor when parsing syntac-

tic ambiguities (e.g., Trueswell et al. 1993, Trueswell et al. 1994). McRae et al. (1997) found that thematic roles of verb concepts have internal conceptual structure (as object categories do) and that their feature structure is quickly accessed by the parser when resolving syntactic ambiguities. Other work has shown how the lexical properties of the verb can contribute to aspectual interpretation. Gennari and Poeppel (2003) examined stative verbs, such as *know*, and eventive verbs, such as *build*, in both self–paced reading and lexical decision experiments. Based on linguistic theories of the lexical semantic representation of verbs, eventive verbs are considered to be more complex than stative verbs (Dowty 1979; Parsons 1990; Rappaport Hovav and Levin 1998a; Vendler 1957), and thus should result in longer processing times due to the recovery of their more complex structure. In both lexical decision and self–paced reading studies, Gennari and Poeppel (2003) found that eventive verbs incurred longer processing times compared to stative verbs, suggesting that event information is retrieved from the lexicon online and affects verb processing.

Focusing specifically on events, McKoon and MacFarland (2002) examined the processing of externally–caused events, such as *break*, compared to internally–caused events, such as *bloom*. Externally–caused events are predicted to incur a processing cost compared to internally–caused events due to the number of event participants: two in externally–caused events, one in internally–caused events. Using comprehension and production measures, McKoon and Macfarland (2002) found that the more complex externally–caused events took longer to be processed than the less complex internally–caused events independent of transitivity. This work provides further evidence that event structure plays an active role in verb processing.

Taken together these studies suggest that the event semantics of the verb carries immediate consequences for processing. However, so far, the studies mentioned above have been conducted on only one language (English), largely looking at complex verb concepts versus simple verb concepts. The present paper discusses how the particular verbs, that refer to motion events[1], are processed and internally represented in two different languages: English and Italian.

1 In recent years, motion events have been a major focus for research exploring the interaction between spatial cognition and language; (Gennari et al. 2002; Levinson 2001; Lucy and Gaskins 2001; Munnich et al. 2001; Papafragou et al. 2002; Pederson et al. 1998; Pourcel 2005; Slobin 1996 a,b). There are many reasons why the motion–space domains have received such attention (see also Papafragou and Selimis 2010) for instance:

- the representation of motion and space is a fundamental human cognitive ability
- motion and spatial terms are acquired early by language–learning children around the world so they can be used in child and adult studies
- there exists a significant body of linguistic analysis on these terms and on how they are different in their linguistic and non–linguistic representations
- the linguistic encoding of motion, in different languages, is characterized by intense typological variability; so, they are obvious candidates for examining whether cross––linguistic differences predict corresponding differences in the way individuals represent motion.

3. Linguistic Analyses of Events and Motion Verbs

3.1. Event Templates

From a linguistic perspective, we would support the view that the syntactic structures in which a verb occurs are controlled by a part of the meaning of the verb (e.g., Beavers 2006; Beavers and Francez 2008; Jackendoff 1972; Levin 1993; Levin and Rappaport Hovav 1995; Pustejovsky 1991; Rappaport Hovav and Levin 1998a; Tenny 1994; Van Valin and LaPolla 1997); indeed, this part of a verb's meaning can be cast as a semantic decomposition of the events that a verb may denote. Semantic decompositions can take several forms (e.g., Dowty 1979; Levin and Rappaport Hovav 1995; Pinker 1989; see Section 4 below). We have found the 'event templates' decomposition, proposed by Rappaport Hovav and Levin (1998a), to be particularly useful.

Indeed event templates are intended to lay out the parts of a verbs' meanings that are relevant to syntax in a way that explains the constructions in which a verb can partake. Event templates are lexicon–semantic decompositions of verbal meaning and lay out the event structures that verbs may denote (e.g., Dowty 1979, 1991; Pinker 1989; Pustejovsky 1991; Rappaport Hovav and Levin 1998a; Tenny 1994; Van Valin and LaPolla 1997). Semantic analyses by lexical semanticists (e.g., Dowty 1991) suggest that there are four possible event templates:

(I) x(act), where an entity (x) engages in some activity (e.g., *walk*, *hit*).
(II) x(state), where an entity exists in some state (e.g., *live*, *survive*).
(III) x(become in state), where an entity comes to be in some new state (e.g., *bloom*, *arrive*).
(IV) y cause x(become in state), where an external cause (y) results in an entity coming to be in some new state (e.g., *break*, *bend*).

Event structures take the form of predicate decompositions, built from a limited set of primitive predicates; thus, there is a limited inventory of possible event types defined by the possible predicate decompositions. The most important distinction is between complex and simple event structures. Complex event structures are composed of two sub–events, each of which is itself a well–formed simple event, as in (1), while simple event structures, consist of a single subevent, as in (2) (see Rappaport Hovav and Levin 1998a):

(1) [[x ACT<MANNER>] CAUSE [BECOME [y <*RES–STATE*>]]]
(2) [x ACT<MANNER>]

In addition to the activity template in (2), two other types of simple event structure templates are relevant, stative and inchoative templates, as in (3a) and (3b), respectively.

(3) a. [x <STATE>]
b. [become [x <STATE>]]

The key property of a verb's root is its ontological type, chosen from a fixed set of types, which might include state, result state, thing, stuff, place,

means/manner, and instrument. Roots are integrated into event structure templates as arguments or as modifiers of predicates; the root has been referred to as the "constant" in some of Levin's previous work, precisely because it is often represented as a position associated with a primitive predicate. In event–structure representations, roots are italicized and represented in angle brackets as in (1), and notated via subscripts when they are modifiers, as in (2). A verb's root determines the basic event structure template for that verb on the basis of its ontological type. These associations between roots and event–structure templates are specified via canonical realization rules (Rappaport Hovav and Levin 1998a). Below are given examples of such rules together with some verbs relevant to each one. They are taken with slight modifications from Rappaport Hovav and Levin (1998a:109).

(4) means/manner [x ACT<MANNER>]
(e.g., jog, run, creak, whistle, . . .)
(5) thing/stuff [x CAUSE [BECOME [y WITH <*THING/STUFF*>]]]
(e.g., butter, oil, paper, tile, wax, . . .)
(6) place [x CAUSE [BECOME [y <*PLACE*>]]]
(e.g., bag, box, cage, crate, garage, pocket, . . .)
(7) internally caused state [x <*STATE*>]
(e.g., bloom, blossom, decay, flower, rot, rust, sprout, . . .)
(8) result (i.e., externally caused) state
[[x ACT] CAUSE [BECOME [y <*RES–STATE*>]]]
(e.g., break, dry, melt, open, split, . . .)

Event templates are particularly useful to our analysis since they represent the portion of the verb's meaning that is relevant to the determination of the syntactic structures in which the verb can appear and they lay out the verb's arguments and the relations about them. With this framework in mind, in the next section, we analyse motion verbs in terms of event templates and semantic complexity.

3.2. Complexity in Motion Verbs

Studies on the semantics of the verbs have taken into account state and event–denoting verbs that are the most general verb types. While event–denoting verbs such as *kill* have internal structure because they denote (and entail) a change from an initial state to a resulting one (*kill* = being alive; being dead), in contrast, state–denoting verbs such as *contain* lack such structure. They simply denote relations between their participants. Semantic theories explain this distinction by proposing lexical representations that differ in internal complexity: events are composed of multiple states, whereas states are not. We have seen that this difference in the representation, of multiple versus single states, suggests that each verb type may involve differential processing costs depending on internal complexity; state verbs may be processed faster than event verbs. With regard to motion verbs, according to Rappaport Hovav

and Levin (2010) path verbs, such as *go*[2] can be subsumed under result verbs, where result is an argument of the primitive predicate BECOME.

(9) [[x ACT] CAUSE [BECOME [y <*RES–STATE*>]]]
(*go*, *arrive*, *come*, *cover*, *die*, *empty*, *fill*, *put*, etc.)

Manner verbs are represented as in (10) where Manner is treated as a modifier of the primitive activity predicate ACT, represented in a subscript form;

(10) [x ACT <*MANNER*>]
(*jog*, *run*, *creak*, *whistle*, etc.)

Rappaport Hovav and Levin (2010) claim that a primitive predicate can only be associated with one argument and one modifier and that a verb can express either manner of motion or path of motion but not both. This complementarity distribution between manner and path of motion is an instance of the broader complementarity distribution between manner and result;

(11) MANNER/RESULT COMPLEMENTARITY: Manner and result meaning components are in complementary distribution: a verb lexicalizes only one.

The question is how to account for the manner motion verbs in goal of motion constructions. It is well known (Perlmutter 1978; Burzio 1986; Levin and Rappaport Hovav 1995) that the addition of a directional Prepositional Phrase (PP) creates a change in syntactic categorisation, turning an agentive movement verb (as in (12)) into an unaccusative construction (as in (13)):

(12) John runs

(13) John runs into the store.

This example suggests that the variable behaviour of manner of motion verbs could be analysed in terms of the *Template Augmentation* (Rappaport Hovav and Levin 1998a). According to this process event–structure templates may be freely augmented with respect to other possible templates in the basic inventory of event–structure templates. More precisely the basic activity template in (14) could be augmented into an accomplishment[3] as in (15).

(14) [x ACT <*MANNER*>]
John runs

(15) [[x ACT <*MANNER*>] CAUSE [BECOME [y <*RES–STATE*>]]]
John runs into the store

In our own work on English and Italian motion verbs, we represent the motion verbs in line with Ouhalla's (2012: 55) modifications of the formalism developed by Rappaport and Levin. So, the event structure of *run,* in constructions such as (15), is assumed to include the understood path component in

2 *Go* is considered a result verb denoting motion in a specified direction (Rappaport Hovav and Levin (2011)).

3 Accomplishments (according to Vendler 1967) involve a process with transitions from one state to another state.

the form of a variable, as it essentially expresses that *x* is moving in a running manner along a path which culminates in an endpoint. The manner component is a constant (lexicalised) while the path component is a variable that can project as an independent syntactic constituent[4] (as in (16)). The primitive predicate of the relevant motion form is MOVE which selects an argument represented as *x*.

(16) RUN [x MOVE $_{<RUN>}$ [GOAL <y>]]

Path verbs, such as *go*, have a representation that lacks a manner component in which the direction component is a constant with a value *thither* (as in (17)) ("away from a contextually determined reference point such as speaker"). *Come* has the same representation as *go*, except that the direction component has the value *hither*:

(17) GO [x MOVE [GOAL <*THITHER*>]]

We can provisionally conclude that manner–of–motion verbs in goal–of–motion constructions are more complex than path–of–motion verbs, since the event structure of the former includes a manner modifier of a lexicalised constant, that is missing in the event structure of the latter. Having clarified these general issues, in the next section, we describe the typology framework that can be used to account for the cross linguistic differences between Italian and English.

4. Cross–Linguistic Differences between English and Italian

Another key construct for the analysis is the binary typology proposed by Talmy[5] (1985, 1991, 2000) between (a) verb–framed languages, in which path is encoded by the main verb of a clause, (as in Romance languages (see (18)),

4 Essentially, with this representation we claim that a manner of motion verb can express direction in addition to manner. This claim is consistent with different studies (Folli 2002, Folli and Ramchand 2005, Mateu and Rigau 2002, 2010, among others). Additionally Beavers and Koontz–Garboden (2010) pointed out that manner of death verbs lexicalise both the manner in which an action is carried out (e.g. for *electrocute*, *electrocution*) and the resultant state of an entity (e.g. for *electrocute*, *the state of being dead by electrocution*) ad neither meaning component can be dropped out.

5 Talmy describes a motion event as a situation "containing movement or maintenance of a stationary location" (1985: 61). He argues that motion events are analysable into a set of six basic semantic elements or components, the first four constituting the central or 'internal components' while the last two are associated or 'external co–event components'. These are:

Figure: the moving object

Ground: entity or entities that the Figure is moving in relation to

Path: the course followed (and trajectory) of the Figure

Motion: the presence of motion per se

Manner: the way in which motion is performed

Cause: what originates the motion itself.

and (b) satellite–framed languages, in which path is encoded by an element associated with the verb (as in Germanic languages (see 19)).

(18) Maria **entra** in ufficio
'Mary enters in the office'

(19) Mary goes **into** the office

According to this distinction verb–framed languages have verbs that conflate motion and path but any component of manner has to be expressed separately, typically in a subordinate clause (as in (20)), or is left out entirely. In contrast, verbs in satellite–framed languages conflate manner and motion and the path is described by additional elements like Prepositional Phrases or particles (as in (21)).

(20) Maria **va** a scuola **camminando**
'Mary goes to the school walking'

(21) Mary **walks** to school

Moreover, Romance languages, unlike the Germanic ones, in general obey to the *Boundary Crossing* constraint (Slobin and Hoiting 1994). This constraint implies that Manner verbs cannot be used when the path crosses a boundary, that is, manner verbs cannot be used to express an end point displacement (see (22) vs (23)).

(22) *Maria **cammina** a scuola
(23) Mary **walks** to school

4.1. Analyses of English Motion Verbs

English is classified as a satellite–framed language in Talmy's framework, meaning that it typically expresses manner in the main verb and path on predicate elements other than the verb (24).

(24) Mary **danced to** the room
DANCE [x MOVE <DANCE>][GOAL <to>]

The semantics of the verb would therefore be expected to be of less importance in directional contexts; however, this is only true as far as expressions with directional prepositions, such as *into* and *onto,* are concerned. Indeed, experimental works by Thomas (2001, 2003) and Nikitina (2008) show that English prepositions such as *in* and *on* cannot be understood in a directional way in all contexts. The occurrence of *in* and *on* in directional expressions seems to depend on the verb type in a way that the occurrence of *into*, *onto* does not. Only certain verbs such as non–iterative *jump*, *throw*, *put*, and *fall*[6] (labelled by Gehrke (2007b) as "put verbs") can trigger a path reading (as in (25)).

6 Thomas (2003:96) speaks about "….a restricted set of verbs, including put, fall, throw, drop, ?run, ?come and possibly some others".

(25) Oscar **jumps in** the lake
JUMP [x MOVE <JUMP> [GOAL <y>]]

In the case of motion verbs with a strong manner component like *crawl, walk, swim* ("swim verbs" according to Gehrke (2007b)) *in* and *on* can only set a non–directional reading (as in (26)):

(26) Oscar **swims in** the lake
SWIM [x MOVE <SWIM>]

In order to derive a goal reading with "swim verbs" we need a goal phrase such as *into*.

4.2. Analyses of Italian Motion Verbs

Italian could be said to be a verb–framed language, with some satellite–framed tendencies; that makes it particularly useful for cross–language tests with English. Italian uses some manner verbs as the main verbs in clauses describing bounded displacement. Even if Italian lacks inherently directed prepositions, according to Folli (2002, 2008), the goal reading is possible by the use of a complex preposition (*fino a*, 'as far as') and by the use of a subset of manner of motion verbs. Those Italian manner–of–motion verbs that favour a directional reading are intransitive verbs that take the auxiliary verb *essere*, 'to be', when they express a goal of motion, (as in (27)) and the auxiliary *avere* 'to have' when they express activity (as in (28)):

(27) Maria è corsa a casa
'Mary is run to home'
RUN [x MOVE <RUN> [GOAL <y>]]

(28) Maria ha corso per due ore
'Mary has run for two hours'
RUN [x MOVE <RUN>]

Having described the most salient characteristics of the motion verbs in both languages, it is now time to outline the main differences from a cross–linguistic perspective.

4.3. Important Differences between Italian and English Manner of Motion Verbs

Slobin (2000, 2004) maintains that Talmy's typological split between the lexicalization patterns of spatial–localization events in verb–framed and satellite–framed constructions has important psycholinguistic implications. Specifically, Slobin has shown that speakers of the two types of languages tend to describe the same localization events differently; speakers of satellite–framed languages (like English or German) tend to differentiate the manner[7] in

7 Here, *manner* in Slobin's (2004) sense, can refer to the motor pattern (e.g., *hop, jump, skip*), often combined with the rate of motion (e.g., *walk, run, sprint*) or the force dynamics (e.g., *step tread, tramp*) or attitude (e.g., *amble, saunter, stroll*), and may sometimes even encode the instrument (e.g., *sled, ski, skateboard*).

which the events take place in more subtle ways than speakers of verb–framed languages (like Italian or Spanish). As such, this *manner of motion* aspect appears to be useful for exploring the impact of the different typological characteristics of languages on discourse and cognition. Languages of the verb–framed lexicalization–type seem to have smaller inventories of lexical types expressing manner of movement such as *clamber, climb,* and *tumble* in English. As noticed before, the preferred adverbial encoding of the path in satellite–framed languages allows the expression of the manner of movement in the verbal root, whereas in verb–framed languages verbal roots are mostly reserved for the expression of the path of displacement, as in Italian *salire* 'go up' and *scendere* 'go down' and manner is expressed in adverbials (as in *correndo* 'running', *a piedi* 'on foot', velocemente '*quickly*'). In conclusion, while for satellite–framed–language speakers there is no additional "cost" to adding manner expression, for verb–framed–language speakers the "… optional slot for MANNER expression … has some "cost", in that it adds an element or phrase to the sentence…" (Slobin 2000:113).

On a syntactic level, the main difference between Italian and English manner–of–motion verbs, resides in the inability of Italian to encode end–point motion by means of the combination of a manner–of–motion verb and a simple preposition. Indeed, in Italian the encoding of goal–of–motion depends on the particular choice of verb; for instance, the goal–of–motion interpretation in (30) is not available in (29):

(29) La barca **galleggia sotto** il ponte (only a non–directional reading)
'The boat floats under the bridge'
FLOAT [x MOVE <FLOAT>]

(30) La palla **rotola sotto** il tavolo (non–directional/goal–of–motion reading)
'The ball rolls under the table'
ROLL [x MOVE <ROLL> [GOAL <y>]]

Conversely, taking the English manner goal–of–motion constructions (as (31)) and substituting a different preposition (as (32)), reverses the interpretation of the sentence: for instance, with a locative preposition only the non–directional motion reading is possible and the goal–of–motion interpretation disappears:

(31) Mary **walks to** the school (goal–of–motion reading)
WALK [[x MOVE <WALK>][GOAL <to>]]

(32) Mary **walks in** the school (non–directional reading)
WALK [x MOVE <WALK>]

So, goal of motion in Italian is not dependent on the choice of preposition but on the choice of verb. In English, on the other hand, the variation seems to be blind to the particular motion verb chosen, but depends on the type of PP with which it is combined. However, as we saw in section 3, the "put–verbs" in English can express path even in presence of locative prepositions, this means that both languages have a set of motion verbs simultaneously

encoding manner and path. In the next section, we consider whether recent psychological evidence supports these theoretical, linguistic analyses.

5. Processing Differences between English and Italian Motion Verbs

We have recently completed a study that has a bearing on the proposed complexity differences in motion verbs, from a cross–linguistic perspective (see Bandecchi and Keane 2013). This study was framed by different theoretical considerations to those elaborated here, but some aspects of it do actually address the present analysis. Bandecchi and Keane examined the differences between English (as a satellite–framed language) and Italian (as a verb–framed language) motion verbs using a new task – a sensibility or plausibility judgement task – that has a mix of linguistic and cognitive processes.

5.1. Using Plausibility

Plausibility judgements have not been used before to test for verb complexity or cross–linguistic differences, but they have been extensively used in language research (Pickering and Traxler 1998; Connell and Keane 2004, 2006). This previous research has shown that people's plausibility judgements of sentence descriptions are affected by the surface/syntactic form of the sentence (e.g., specific co–locations of the words used) as well as the deeper cognitive structure of the events being described. For example, Connell and Keane (2004) found that people's plausibility ratings of simple descriptions involving causal relations (between events in the description) were judged to be more plausible than paired descriptions that merely involved temporal sequence with no causal dependence. So, assessments of plausibility appear to take the relational structure between events into account, as much as they do the surface form of the sentences. In Bandecchi and Keane's (2013) first experiment, people were asked to judge plausibility in a simple "yes/no" task where the dependent measure was their response time to make this decision. Response time was measured from the presentation of the sentence, to pressing of the key to indicate the "yes/no" judgement made. The response times for all target sentences were analysed irrespective of whether the participant judged the target sentence to be plausible or not plausible.

5.2. The Motion Verbs Used in the Plausibility Task

In Bandecchi and Keane (2013, Experiment 1) two groups of native English speakers (Number = 18) and Italian native speakers (Number = 18) made plausibility judgements of sentences, in their respective languages; the sentences involved path or manner verbs (e.g., "I ran into the office and I darted into my room"; for sentence lists see Bandecchi and Keane 2013).

Each participant received 50 items on which to make plausibility judgements; 18 target sentences and 32 filler sentences. Each sentence was presented using SuperLab software (version 2.0 Cedrus), on the screen of a

Toshiba laptop computer. Instructions indicated that participants would be shown "sentences describing everyday events" and that they should read each sentence carefully and judge "whether the whole sentence makes sense". After the instructions were read and 12 practice trials completed, participants were asked to indicate if each subsequent sentence "makes sense". For each item, participants read the sentence carefully and pressed an "F" key if they thought it plausible and "K" key if they thought it was not (using their dominant hand). When they had completed this task for one sentence they progressed to the next sentence by pressing the space–bar. All items were randomly re–ordered for each participant.

The target sentences seen by the two language groups were translations of one another and were balanced by proportionally more implausible fillers ("The tree melted under his eyes and she squeezed into the elevator"), to ensure that people continued to assess plausibility. The filler items were designed to be obviously implausible, so that most of the time participants were judging sentences that were not plausible (we felt this would heighten the judgements made when the sentences *were* plausible).

All the sentences used consisted of two phrases, joined by a conjunction, involving two motion events. For a given language, half the target sentences used manner verbs (e.g., the preferred lexicalization pattern in English) and half used path–of–motion verbs (e.g., the preferred lexicalization pattern in Italian). Furthermore, to avoid the surface form of the sentences having a characteristic pattern, the two parts of the targets sentences were systematically varied in several ways, so that all of the targets did not have the same surface form.

In both languages, half of the target sentences used path verbs to describe the event in the first part of the sentence (see 33a and 33b) and half used manner verbs to describe the first event (see 34a and 34b)8; the focus was on the event described in the first part of the sentence, as the event described in the second part of the sentence was matched in variants of the targets:

(33) a. The ball went to the right and rebounded to the pavement. [English, Path]
b. La palla è andata a destra ed è rimbalzata sul pavimento. [Italian, Path]

(34) a. The ball bounced to the right and rebounded to the pavement. [English, Manner]
b. La palla è balzata a destra ed è rimbalzata sul pavimento. [Italian, Manner]

Note, that in all the Italian manner verbs sentences, the key motion verb was always selected from the subset of manner verbs that uses simple prepo-

8 The path–manner variants of the target sentences were matched on length. All the variants of a given sentence were written to be roughly the same length in both English and Italian, so that reading time was controlled.

sitional phrases, akin to those found in English (i.e. those verbs that simultaneously encode manner and path; see section 4).

Furthermore, the second clauses of the sentence, in these path/manner targets, were varied systematically so they did not have a predictable surface form. If all of the target sentences had the same surface form with two consistent motion verbs (e.g., *run* and *dart*), people might begin to guess which items were intended to be targets or fillers. Hence, we varied the second clause of the sentence to vary its surface form. So, a third of the targets were versions with a *consistent* second clause (see 35a and 36a), a third had an *inconsistent* second clause (see 35b and 36b), and a third had a *neutral* second clause (see 35c and 36c). English samples of these sentences are shown below:

(35) a. I went to the office and I darted into my room.
[Consistent, Path]
b. I went to the office and I loitered in my room.
[Inconsistent, Path]
c. I went to the office and I was happy in my room.
[Neutral, Path]

(36) a. I ran to the office and I darted into my room.
[Consistent, Manner]
b. I ran to the office and I loitered in my room.
[Inconsistent, Manner]
c. I ran to the office and I was happy in my room.
[Neutral, Manner]

In the consistent targets the first and second clauses of the sentence were syntactically consistent, in that both used a motion verb (path/manner) in a goal–of–motion construction. In the inconsistent targets, the first and second clauses of the sentence were syntactically inconsistent, as the second clause used a verb in a non–goal–of–motion construction (in contrast to the goal–of–motion structure of the first clause). In the neutral targets, the first and second parts of the sentence were semantically and syntactically neutral, as the second clause used a non–motion verb expressing a neutral fact with respect to the first clause. This manipulation of the target sentences (which was labelled as a Sentence–Type variable) showed no significant effect in the results found. In itself, this finding is important because it means that people were really attempting to recover the conceptual structure of the events described and to assess if they were plausible based on their past experience. That is, there was no "simply" responding to the surface forms of the sentence (e.g., the fact that the consistent sentences used two verbs with the same syntactic structure).

5.3. Verb Complexity Effects on Plausibility

The foregoing linguistic analyses detailed earlier maintain that cross–linguistic differences between English and Italian propose that non–linguistic representations of motion might be affected by the different ways the two

linguistic systems package motion events. Since manner and path components of motion events are differentially accessible to speakers of English–manner and Italian–path languages, even in situations that do not involve linguistic communication, it might be predicted that an interaction between the language used by speakers and the type of verb (manner or path) would occur, as speakers would find easier to process their preferred lexicalization patterns. Alternatively, since manner–of–motion verbs in goal–of–motion constructions are more complex than path verbs – as they have the manner modifier in their event templates representation (the representations we assume are repeated in (37a and 37b)) – an alternative prediction is that irrespective of the language used by speakers, the main effect we should see in plausibility judgements might come from the type of verb used (manner or path). Stated simply, that both language groups would find the more complex constructions harder to process.

(37) a. RUN [x MOVE <RUN> [GOAL <y>]]
b. GO [x MOVE [GOAL <*THITHER*>]]

This is essentially what Bandecchi and Keane (2013) found in their first experiment. The results showed that the type of verb impacted the response time on plausibility judgements not the native language of the speaker. Specifically, their 2 x 2 mixed analysis of variance of response times for the plausibility judgements involving the within–subject variable of Verb–Type (path–verbs versus manner–verbs) and the between–subject variable of Language (English versus Italian) showed a main effect of Verb–Type with the sentences involving path–verbs (Mean = 5250ms, Standard Deviation = 1757ms)[9] being judged reliably faster than manner–verbs (Mean = 5579ms, Standard Deviation = 2360ms), $F(1, 34) = 5.06$, $p < 0.05$.[10] Furthermore, there was no statistically reliable effect for the Language and neither was there a reliable interaction between the Verb–Type and Language. So, overall this result supports the prediction that the complexity of the structure of the verb has the major effect on the event processing cross–linguistically. In other words, the more complex the structure of the motion verb, the longer the time to process it, and this occurs independently of the language–specific lexicalization patterns.

9 Note that the mean (average value) along with a measure of variability (standard deviation(s) or standard error of the mean) are the statistical outcomes relevant for experimental studies. In particular the standard deviation shows how much variation or dispersion from the average exists.

10 In order to account for the noise in results, prior to data analysis outliers were removed; outliers are defined as any data point that was 2 standard–deviations above or below an individual participant's mean response time for all the target items. This resulted in 5% of the data being excluded, roughly equally distributed across both language groups (respectively, 4.3% of the English data and 5.6% of the Italian data).

6. Conclusion

In this paper we have advanced an extensive linguistic analysis of the complexity of motion verbs and how they might differ between two languages from different language groups, English and Italian. We have also reviewed the past and recent research on the processing overheads for these verbs and shown, that in these cases, the complexity predictions made in the linguistic analyses are borne out by the evidence found. Of specific importance, is the recent work of Bandecchi and Keane (2013) which, though formulated on different grounds, shows that in both languages, Italian and English, the goal–of–motion sentences with manner–of–motion verbs take longer to be processed than the sentences with path–of–motion verbs. Significantly, this finding cannot be attributed to the plausibility relation between the first and the second clause (because varying the relation between the sentence parts showed no effect in the Sentence–Type variable), but is rather clearly due to the event–structure differences among verbs; specifically, to the fact that accessing verb meanings entails accessing properties of the corresponding event representations. The difference in processing costs observed suggests that verb meanings must include information about events that goes beyond participant slots and that there are processing correlates of semantic complexity manifested during the lexical representation of verbs rather than during the integration with prior context.

So, differences in lexicalization patterns in typologically distinct languages, such as satellite–framed English and verb–framed Italian, do not have any impact on the structural complexity that affects the event processing. More generally, these results present strong evidence in support of the decomposition of the verb meaning in event templates. Current work in lexical semantics has provided a fine–grained and broad–based approach to the theoretical treatment of verbs. With such decomposition the syntactically relevant parts of verb's meaning are shown and the processing time differences found in recent experiments comes about because path–of–motion verbs have a simpler event template than manner of motion verbs in goal of motion structures. Notably the current analysis is quite different to the Fodorian claim that the meaning of such verbs is atomic (e.g., Fodor et al. 1975, Fodor et al. 1980, Fodor and Lepore 1998). Rather it seems quite feasible to find differences in the processing of manner–of–motion verbs and path–of–motion verbs in a goal–of–motion syntactic context cross–linguistically and, in so doing, to show evidence for the psychological reality of lexical decomposition.

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Leksička dekompozicija i razumijevanje glagola kretanja u talijanskom i engleskom jeziku

U ovome radu lingvistička analiza se temelji na predlošcima događaja (*Event Templates,* prema Rappaport, Hovav i Levin 1998a) i psihološkim pretpostavkama o složenosti glagolskih značenja. Autori kombiniraju navedene pristupe kako bi razvili analizu predloženih složenih razlika među glagolima kretanja u engleskome (*satellite-framed language*, odnosno S-jezicima) i talijanskome (*verb-framed language,* odnosno V-jezicima). Ključna je pretpostavka ove analize da se u oba jezika glagoli koji opisuju način kretanja sporije procesiraju od onih glagola koji opisuju put i kretanje. Neovisno o jezično specifičnim obrascima leksikalizacije, što je struktura složenija to je više vremena potrebno da je se procesuira. Ovaj rad istaknuo je i rezultate recentnih istraživanja koja su bitna za navedenu ključnu pretpostavku u ovome radu.

Key words: Motion Verbs, Lexical Decomposition, Lexical Semantics, Cognitive Psychology, English, Italian

Ključne riječi: glagoli kretanja, leksička dekompozicija, leksička semantika, kognitivna psihologija, engleski jezik, talijanski jezik