Event participants and linguistic arguments

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Abstract

Although there is a clear and intuitive mapping between linguistic arguments of verbs and event participants, the mapping is not perfect. We review the linguistic evidence that indicates that the mapping is imperfect. We also present the results of a new experimental study that provides further support for a dissociation between event participants and linguistic arguments. The study consists of two tasks. The first task elicited intuitions on conceptual event participants, and the second task elicited intuitions on linguistic arguments in instrument verbs and transaction verbs. The results suggest that while instrument phrases and currency/price phrases are considered necessary event participants, they are not linguistic arguments.

Keywords: event participants; linguistic arguments; syntax; semantics; psycholinguistics

Introduction

The relation between events and event participants is expressed in language as the relation between verbs and their arguments (Rissman, Rawlins, & Landau, 2015). This paper discusses the mapping between event participants and linguistic arguments. We argue that certain phrases (e.g., instrument and currency/price phrases) are difficult to classify as arguments or adjuncts because they are conceptualized as event participants but are not syntactically required.

When a verb is used in a sentence, that verb is typically accompanied by words or phrases that express who or what was engaged in or affected by the activity denoted by the verb. Consider, for example, the verb *praise* as it is used in (1):

(1) Lisa praised the child last evening.

In (1), *Lisa* and *the child* are directly involved in the *praising* activity, and those noun phrases are referred to as *arguments*. The noun phrase *last evening* is not directly involved in the activity denoted by the verb, and it is referred to as an *adjunct*.

The number and type of a verb's arguments partly depends on the nature of the event that the verb denotes. For example, a *running* or *strolling* event involves fewer participants than a *throwing* or a *putting* event.[1] Similarly, a basic motion verb such as *run* or *stroll* is likely to have fewer arguments than a caused motion verb like *throw* or *put*. The arguments of a motion verb refer to someone moving (*Karim* in (2)) and perhaps also a goal or a path (*to the store*). The arguments of a caused motion verb refer to whoever (or whatever) caused the motion (*Linda* in (3)), the entity moved (*the potatoes*) and perhaps the goal or path (*in the bucket*).

(2) Karim ran to the store.

(3) Linda threw the potatoes in the bucket.

Despite the clear and intuitive connection between arguments and event participants, the two notions are independent: there is not always a perfect mapping between linguistic arguments and event participants. We will provide a short review of work from the theoretical linguistics literature that illustrates this point. We then present the results from a new psycholinguistic study with two tasks. One task elicited intuitions about how many and what type of people or things are conceptually needed for different events to take place. The other task gauged how many and what type of people or things are syntactically needed in order for a sentence to be considered linguistically complete. The two tasks yielded different results, and the study thus provides experimental support for a separation between the concept of event participants and the concept of linguistic arguments, assuming that linguistic arguments are syntactically needed for the sentence to be complete (we revisit this assumption later). Before we turn to our experiment, we discuss the difference between arguments and adjuncts, and we also present linguistic evidence that verbal arguments are different from event participants.

Linguistic arguments

Tallerman (2005, 98) defines linguistic arguments as phrases that are selected by the head (often a verb) and that have an especially close relationship with the head. This definition is similar to other characterizations in the literature, but there is no universally agreed upon definition of argumenthood. However, scholars of language generally agree that verbs come with restrictions concerning their argument structure. This assumption is shared among theoretical linguists, descriptive linguists, psycho- and neurolinguists, computational linguists, and philosophers of language. By argument structure, we mean a set of elements linguistically required by the verb. There is debate on exactly how to determine what the argument structures of different verbs look like, and what information needs to be included in the structures.

Argument structure has been given distinct formal treatments within different strains of formalist/generative frameworks. Examples include SUBCAT lists in Head-Driven

[1] By participant, we do not necessarily mean a person. Here, we use the word in a general sense. For our present purposes, a participant can be a person or a thing, or perhaps a place or a time.

Phrase Structure Grammar, argument lists in Lexical-Functional Grammar, and theta grids in Principles and Parameters Theory. Yet other theoretical conceptualizations of argument structures are presented in Valency Grammar, Dependency Grammar, and Role and Reference Grammar. We will not make an attempt to review the vast literature where these topics are treated, but Levin and Rappaport Hovav (2005) is a good starting point. We turn instead to the distinction between arguments and adjuncts.

Consider again example (1), *Lisa praised the child last evening*, which includes two arguments (*Lisa*, *the child*) and one adjunct (*last evening*). Unlike arguments, adjuncts are not selected by the head; they are modifiers and added to clauses more freely. Example (1) is relatively straightforward, but it is sometimes difficult to determine whether a phrase is an argument or an adjunct.[2] For example, there is evidence that *to the park* is an argument in *Sandy ran to the park*, but *in the park* is not an argument in *Sandy ran in the park* (Van Luven, 2014; Kearns, 2011, 39), although this is not immediately obvious. Another tricky case is the passive *by*-phrase (e.g., *by Tara* in *the book was read by Tara*).

There is a battery of syntactic tests sensitive to whether a given phrase is an argument or an adjunct. The tests are useful, but do not always give consistent results (Christie, 2015; Needham & Toivonen, 2011). The two most commonly used diagnostics are conceptual necessity and syntactic obligatoriness. Phrases that are conceptually necessary in order for the event to take place are arguments. The syntactic counterpart to the conceptual necessity requirement states that arguments are obligatorily present in the linguistic string. We will argue below that there is an important distinction between event participants and linguistic arguments, and the two tests, conceptual necessity and syntactic obligatoriness, actually target different notions. However, the two notions often align, and when they do, they successfully differentiate between arguments and adjuncts. For example, the conceptual necessity and syntactic obligatoriness tests work well for (1): in order for a *praising* event to take place, it seems necessary that a praiser and something praised be present. It does not seem necessary to know about the point in time when the praising took place. Of course, most events take place at some time, but *praise* is not a verb that directly concerns time (by contrast, the verb *last* requires a temporal complement: *the meeting lasted one hour*). The time phrase is also not syntactically obligatory (overly expressed) in conjunction with *praise*: *last evening* can be omitted from (1).

What is conceptually necessary is not always expressed. For example, in order to *yell*, there has to be something that you yell, but it is nevertheless fully grammatical to say *Joe was yelling* without mentioning *what* he was yelling. The two tests thus do not always align. Jackendoff (2002, 138–149) argues that the conceptual necessity test is semantic and the obligatoriness test is syntactic. We take a slightly different position: conceptual necessity concerns how we understand different types of events and is not a linguistic notion.

Syntactic obligatoriness is, however, a linguistic notion, but it is not foolproof. Adjuncts are not obligatory (though see Goldberg & Ackerman, 2001 for some interesting potential examples of obligatory adjuncts). Arguments may be optional, but if a complement is obligatory, then it is an argument. The experiment we report in this paper taps into the different intuitions behind these two tests. We focus specifically on phrases that have been identified as difficult to classify with respect to argumenthood. We are not directly concerned with optional direct objects of verbs like *eat* and *wash*.

There are several other syntactic diagnostics that distinguish arguments from adjuncts (at least in English). These tests involve manipulating the structure of the sentence in ways sensitive to whether phrases are arguments or adjuncts. For example, *pseudo-clefting* is possible with adjunct but not argument targets (Hedberg & DeArmond, 2009):

(4) What Lisa did last evening was praise the child.

(5) *What Lisa did the child was praise last evening.

According to this diagnostic, if a phrase can occur after *do* in a pseudo-cleft, then that phrase is an adjunct. If the occurrence of a given phrase after *do* renders the phrase ungrammatical, then that phrase is an argument. Similarly, adjuncts but not arguments can appear after *do so* in VP anaphora:

(6) Lisa praised the child last evening and Bob did so today.

(7) *Lisa praised the child and Bob did so the teenager.

The exact explanations for how these tests work vary depending on theoretical framework. However, the VP-anaphora test can be understood quite straightforwardly with minimal appeal to technical machinery: *do so* is an anaphor that refers back to a verb and its arguments (or a minimal VP). In (7), *do so* therefore refers back to *praise the child* and the sentence is ungrammatical for the same reason as **Bob praised the child the teenager*: arguments cannot be repeated.

The difference between linguistic arguments and event participants

The examples in (2–3) above illustrate that the type of event a verb denotes can be a predictor of how many and what type of argument(s) a verb takes. Basically, an event seems to involve (perhaps entail) certain participants, and the number and type of participants depend on the nature of the event. However, the mapping between participants and linguistic arguments is not deterministic, and different verbs denoting similar events do not necessarily take the same argument structure. We will illustrate this point with a few oft-cited examples.

The first example has to do with verbs used to describe the ingestion of food. Examples include *eat, devour, dine, munch, gobble*, and *nibble*. These verbs describe different types of

[2]The blurry line between arguments and adjuncts has been discussed by Forker (2014); Hedberg and DeArmond (2009); Tutunjian and Boland (2008); Dowty (2003); Koenig, Mauner, and Bienvenue (2003); Croft (2001); Schütze and Gibson (1999); Whaley (1993); Grimshaw (1990); and many others.

eating events, and seem to involve an eater and something that is eaten. All the verbs take a subject (the eater), but they differ in how the complement (what is eaten) is linguistically expressed. The verb *eat* takes an optional object (8) (as indicated by the parentheses), the verb *devour* takes an obligatory object (9–10), and *dine* cannot take a direct object (11–12).

(8) Mike ate (an apple).

(9) Sally devoured the pizza.

(10) *Sally devoured.

(11) Jasleen and Sam were dining.

(12) *Jasleen and Sam were dining a great meal.

The verbs *munch, nibble* and *gobble* can take a complement, but not as a plain noun phrase object directly after the verb. The preposition *on* is required for *munch* and *nibble*:

(13) Fiona munched/nibbled on some potato chips.

(14) *Fiona munched/nibbled some potato chips.

Similarly, the particle *up* is required for *gobble*. Together, the examples in (8–14) illustrate that classifying a verb as a verb of ingestion might tell you that the event described by the verb involves two participants (an eater and something eaten). However, it does not tell you the exact number or types of arguments the verb takes.

Another example concerns pairs of verbs that describe the same event from different perspectives: *flee* and *chase*, *win* and *beat*, *borrow* and *lend*, *receive* and *give*, etc. These pairs describe the same general events: a chasing event, a winning event, a lending event, or a giving event (see, e.g., Gleitman, 1990). However, the verbs that describe the same event differ in their argument structure. Compare *flee* and *chase*:

(15) The hare fled (from the fox).

(16) The fox chased the hare.

The verb *flee* requires the individual being chased (or expelled) to be expressed, but the individual or thing the subject is fleeing from is only optionally expressed as a prepositional phrase. The verb *chase* requires both the chaser and the fleer to be expressed, and both are expressed as noun phrases. In this case, the individual who is fleeing is a direct object and not a subject. We conclude, as we did with the ingestion verbs, that knowing what type of event the verb refers to is not enough to predict whether or how those participants are realized as linguistic arguments.

This is not to say the realization of arguments is completely arbitrary. Many interesting generalizations have been proposed connecting specific semantic characteristics to the syntactic realization of arguments. For example, verbal aspect can be signaled in the realization of arguments (see, e. g., the papers in Demonte & McNally, 2012; Levin & Rappaport Hovav, 2005 and Tenny, 1994). However, it is clear from that literature that only some distinctions are *linguistically* relevant: knowing what participants are involved in an event is not enough to pinpoint the precise characteristics of linguistic arguments. Examples of relevant work include Pylkkänen (2008); Grimshaw (2005); Levin and Rappaport Hovav (2005); Wechsler (1995); Tenny (1994); Marantz (1993); Bresnan and Moshi (1990); Bresnan and Zaenen (1990); Grimshaw (1990); and Jackendoff (1990, 1983).

Experiment

The aim of the study was to explore speakers' intuitions about event participants and linguistic arguments. On the one hand, we wished to explore how many and what participants were considered *conceptually* necessary in order for events of different types to take place. On the other hand, we wanted to gauge what participants were considered *linguistically* necessary in conjunction with the verbs corresponding to the different events. Our experiment is similar to those of Rissman et al. (2015) and Koenig et al. (2003), as they also explore the status of instruments by eliciting speakers' intuitions.

Our studies differed in methodology: Rissman et al. (2015) explored speakers' semantic judgements; however, they instructed speakers with respect to what arguments are. Koenig et al. (2003) instructed speakers to add something that makes sense and is grammatical to the end of a phrase. Koenig et al. (2003), Rissman et al. (2015), and our study all yielded similar results.

Methods

Seventy-nine students with no background in Linguistics were recruited from Carleton University, using the school's psychology recruitment system. As compensation for participating in the experiment, students received 0.75% class credit towards a psychology or neuroscience course. All students were English speakers between the ages of 18 and 24.

The experiment consisted of two tasks. In task 1, speakers were instructed to think about an event such as *writing* and to state the participants required for the event to occur. Specifically, speakers were instructed to imagine a *verb*-ing event taking place in a large box and were asked to answer the following question: What needs to be in the box (people, objects, places etc.) for the *verb*-ing event to take place? Before beginning the experiment, speakers were provided with two sample events, *eating* and *dancing*. To accentuate the open-ended nature of the task, speakers were provided with a series of answers ranging in the number of participants such as *a person*; *a person* and *food*; *a person*, *food*, and *place* for an eating event.

In task 2, speakers were presented with the beginning of a sentence and asked to complete the sentence however it made most sense to them. Once again, they were provided with sample answers in order to illustrate the range of possibilities. Given the phrase *the woman ate*, possible ways to complete it include but are not limited to: not adding anything; *an ice cream; an ice cream with a spoon; an ice cream from Vito's Gelateria; an ice cream sitting on her balcony*.

This study focuses on two particular classes of verbs which we call *instrument verbs* and *transaction verbs*. Instrument verbs denote events that typically require some kind of tool or instrument. The verbs included in this task were *cut*, *draw*, *paint*, *scrape*, *scratch*, *scrub*, *sketch*, and *write*. It is not clear whether instruments are arguments or adjuncts of verbs such as *cut* or *draw* (see Rissman et al., 2015; Rissman, 2013; Koenig et al., 2003; and others). For example, in a sentence like (17), it is not clear whether *with her new knife* is an argument or an adjunct:

(17) Rita cut the bread with her new knife.

We wanted to test whether the unclear status of instruments might be due to a misalignment between conceptual participants and linguistic participants. For example, perhaps instruments are conceptually necessary in order for the event to take place, but they are not necessary as syntactic arguments in the clause.

Transaction verbs describe activities where the possession of an object changes from person A to person B, and person A receives something in exchange. The transaction verbs included in the study were *sell*, *buy*, and *purchase*, and these verbs are exemplified in (18–19):

(18) Bo sold the bags (to Jay) (for $870).

(19) Jay bought/purchased the bags (from Bo) (for $870).

The goal and price phrases are usually considered optional for the verb *sell*. Similarly, the source and price are optionally mentioned in clauses headed by the verbs *buy* and *purchase* (Stamenov, 1997).

It is important to note that some verbs allow an instrument or a price as a subject or an object, and we did not include such verbs here. Examples include *the key opened the door* where *the key* is an instrument, and *this book costs $20* where *$20* is a price.

Speakers' responses were coded based on the expected results. For task 1, we predicted someone performing the action, something the action was performed on, an instrument, and new categories were added as needed (e.g., time, place, manner). Given a *scrubbing* event, answers coded as having one conceptual participant include *sponge*; *a brush*; *cleaning materials*. Answers coded as having two conceptual participants include *something used to scrub, and something to be scrubbed*; *dirty dish and soap*; *a person, a scrub*. Answers coded as having three conceptual participants include *scrubber, a mess, an item to scrub*; *surface, person, and sponge*; *person, something to be scrubbed, an object to scrub with like a sponge*.

Since the speakers were given the beginning of the sentence in task 2, one linguistic participant (the subject) was already provided. An answer was coded as having only one linguistic participant if the speaker did not add any linguistic material to the phrase provided (e.g., *Mike scrubbed*). Answers interpreted as having two linguistic participants typically include the object, such as *the floor*; *toilets*; *the window*. Answers interpreted as having three linguistic participants include *mud off the floor*; *the vomit off the classroom floor*. For more detail about the method, please see Barbu (2015).

Results

Instrument verbs We expected responses to tasks involving instrument verbs such as *scrub* to include some sort of tool or instrument such as *sponge* in addition to someone doing the scrubbing and something being scrubbed. We were interested in whether speakers would be more likely to mention instruments in one of the two tasks. Recall that task 1 was designed to gauge what participants are conceptually necessary for the event to take place, whereas task 2 specifically targeted what arguments should naturally be expressed in the linguistic string.

In task 1 speakers' responses averaged out to 1.97 conceptual participants per event. In task 2, speakers mentioned 2.24 linguistic participants on average, so the average is slightly higher than the average for conceptual participants provided in task 1. While the number of conceptual and linguistic participants did not vary greatly between the two tasks, the specific participants listed did. Interestingly, there was a striking difference between the two tasks. While instruments were mentioned for each event in task 1, this was not the case in task 2, where an instrument was mentioned for only one of the events, *drawing*, and only by 5% of the speakers. Table 1 illustrates the number of mentions of an instrument in task 1 (conceptual participants) and task 2 (linguistic participants). The responses are given per verb. For example, when presented with a *writing* event, 90% of the speakers mentioned an instrument (e.g., *pencil, pen*) in task 1, while no speakers mentioned one in task 2.

Table 1: Mentions (%) of instruments as conceptual participants (Task 1) and linguistic participants (Task 2)

Event	Conceptual	Linguistic
scratch	39%	0%
scrape	47%	0%
paint	80%	0%
sketch	85%	0%
write	90%	0%
scrub	95%	0%
cut	95%	0%
draw	100%	5%

In sum, while speakers often mentioned instruments as necessary in order for a particular activity (e.g., *scrubbing*) to take place, they did not provide instrumental phrases (e.g., *with a sponge*) as linguistic material to complete sentences headed by the verb *scrub*.

Transaction verbs For transaction events, expected responses include two people (someone selling, buying, or purchasing something to or from someone else), the transferred

item, and some sort of monetary compensation. Answers coded as having one conceptual participant include *money*; *products*; *credit cards*. Answers coded as having two conceptual participants include *something to buy, someone to buy it*; *shopaholics, items for sale*; *someone purchasing something*. Answers coded as having three conceptual participants include *a person, something to sell, someone to sell it to*; *items to sell, money, people*; *people, items, place*. Answers coded as having four conceptual participants include *objects to sell, seller, buyer, place*. In task 1, speakers mentioned on average 2.8 conceptual participants per event.

Recall that one linguistic participant (e.g., the car dealer) and a verb were already provided for task 2. Answers coded as having two linguistic participants include *a car*; *a broken car*; *12 cars*. Answers coded as having three linguistic participants include *20 cars throughout the day*; *10 Ferraris today*; *a car for more than he thought it was worth*. In task 2, speakers provided an average of 2.3 linguistic participants per event.

The number of conceptual and linguistic participants did not vary greatly between the two tasks, but the types of participants listed did. For example, there was a significant difference between the two tasks with respect to currency. While in task 1 at least some speakers mentioned some form of currency, almost none of the speakers did in task 2. For example, when asked to list the participants involved in a *buying* event, 47% of the speakers listed some form of currency in task 1, while none of the speakers listed currency in task 2. Table 2 summarizes the mentions of currency for tasks 1 and 2.

Table 2: Mentions (%) of currency as conceptual participant (Task 1) and linguistic participant (Task 2)

Event	Conceptual	Linguistic
purchase	83%	0%
buy	47%	0%
sell	21%	5%

Table 2 illustrates that currency was mentioned much more in task 1 than in task 2, and on our interpretation, this means that currency is a necessary event participant at a conceptual level, but is not a linguistic argument.

Discussion

A simple analysis based solely on the number of participants/arguments mentions suggests that the results of the two tasks of this study are quite similar. However, a more careful analysis reveals important differences between the two tasks, both for instrument verbs and transaction verbs. For instrument verbs, instruments were commonly mentioned in task 1, while being nearly absent in task 2. These results suggest that an instrument is perceived as being a necessary component of events such as *writing* and *scrubbing*, but the instrument phrase is nevertheless not a syntactic argument of the verbs used to describe those events. Similarly, transaction events are perceived as involving some form of money, yet phrases that refer to money are not syntactic arguments.

Despite the fact that at least some speakers mentioned an instrument for each of the verbs in this class, there is a difference between verbs. This is expected, as conceptual participants are strongly related to the meaning of the verb, and explanations for these differences might be found in the lexical semantics of the specific verbs used to elicit judgments. For example, all subjects listed some kind of instrument for a *drawing* event, but only 39% of subjects listed an instrument for a *scratching* event. This difference might be due to body parts not being conceptualized as instruments (see, e.g., Rissman et al., 2015; Carlson & Tanenhaus, 1989). When asked to think about a *scratching* event, it is quite likely that speakers thought of fingernails or claws. However, it is more difficult to think of *drawing* events where a body part is used as an instrument, although it is of course possible to draw with your finger on a steamed up window.

The syntax of instrument and currency phrases

Our results suggest that speakers view instruments for verbs like *scrub* and payments for verbs like *buy* as conceptual event participants, even though they are not linguistically necessary complements of the verbs. Recall that obligatory phrases are arguments, but arguments are not necessarily obligatory (e.g., the optional object of *eat*). Are instrument and currency phrases arguments, even though they are not obligatorily expressed? In order to answer this question, we would need a full linguistic investigation. Here, we will simply present a tentative answer based on the syntactic argumenthood tests introduced above, pseudo-clefting and VP-anaphora. Introspective judgements of the grammaticality of pseudo-cleft and VP-anaphora examples suggest that instrument and currency phrases are not syntactic arguments.

Example (20) shows a pseudo-clefted version of *Suzie scrubbed the floor with a brush* and is grammatical. The VP-anaphora example in (21) is also grammatical. Arguments cannot appear in these syntactic frames, so these examples suggest that instruments are adjuncts, assuming that *with a brush* in this example is representative of instruments.

(20) What Suzie did with the brush was scrub the floor.

(21) Suzie scrubbed the floor with a brush and Tom did so with a sponge.

Examples (22–23) target the currency phrase *for $500*. Example (22) is a pseudo-clefted version and (23) is a VP-anaphora version of *Tom bought a bike for $500*. The grammaticality of these examples indicates that currency/price phrases are adjuncts, not arguments.

(22) What Tom did for $500 was buy a bike.

(23) Tom bought a bike for $500 and Sue did so for $1000.

The syntactic diagnostics based on pseudo-clefting and VP-anaphora point to the same conclusion as the results of task

2 in our experiment: instrument and currency phrases are not linguistic arguments, even though they are conceptually necessary event participants.

Conclusion

This paper addressed the following question: Is there a distinction between event participants and linguistic arguments? We revisited arguments from the linguistics literature that have previously pointed to an imperfect mapping between the two notions. We also presented the results of a new study consisting of one task targeting conceptual event participants and another task targeting syntactic arguments. The results can be interpreted as capturing differences between conceptual and linguistic participants in instrument verbs and transaction verbs. Despite the open-ended nature of the tasks, there was agreement across speakers that while instruments and currency are conceptual participants, there is no need for them to be overtly stated. On our interpretation, the experimental data presented here suggests that while instruments and currency are conceptualized as event participants and potential semantic arguments, syntactically they behave as adjuncts. This conclusion is supported by the results of two traditional syntactic argumenthood tests.

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