

Event Participants and Verbal Semantics: Non-Discrete Structure in English, Spanish and Mandarin

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Abstract

Verbs are widely analyzed as functions taking a discrete number of arguments (e.g., *drink* has two arguments but *give* has three). Recent studies, however, suggest that English verbs encode Instruments as more or less salient (e.g., the Instrument is more salient for *slice*, less salient for *eat*). We conducted a judgment task with adult speakers of Spanish and Mandarin and found that verbs in these languages also encode Instruments as having a relative degree of salience, inconsistent with the discrete model of participant encoding.

Keywords: verbal semantics; argument structure; experimental semantics; thematic roles; event representation

Introduction

A fundamental debate in cognitive science concerns whether mental representations have discrete vs. non-discrete structure (Aarts, 2007; Bod, Hay & Jannedy, 2003; Rosch, 1975; Smolensky & Legendre, 2006). This debate arises for theories of verbal semantics. Verbs convey relationships between event participants: *eat*, for example, involves someone who eats and a substance that is eaten. Such relationships have commonly been modeled in logical terms: that a verb is a function taking a discrete number of arguments: *die* has one, *eat* has two, and *lend* has three (Dummett, 1981; Jackendoff, 1972). Theorists have long noted, however, the limits of this logical analogy (Carlson & Tanenhaus, 1989; Parsons, 1990; Williams, 2015). *Eating*, for example, seems to require that the eater have a mouth – is the mouth then one of the arguments of the function *eat*? Although there is broad consensus that verbs encode relations between participants, how precisely these relations are represented is unresolved.

A second unresolved question is whether participant relations are the same for semantically similar verbs across languages. As described by Bowerman and Brown (2008: 10), there is a widespread assumption that "languages will agree on the number of semantic participants there are in events of various types (e.g., one for 'laughing', two for 'pushing', three for 'giving')". There is reason to question this assumption: Wilkins (2008) argues that whereas the English verb *see* has two arguments, in the aboriginal language Arrernte, the translationally equivalent verb *are-* has three: the person who sees, the thing that is seen, and the place where the thing that is seen is located. While differences in

argument realization are well-documented across languages (Levin & Rappaport-Hovav, 2005), variability such as described by Wilkins (2008) has received little attention. If variability in how verbs encode participants is widespread, then the mapping from conceptual to linguistic structure is less constrained than previously thought, posing an additional learning challenge to children.

In this study, we address whether discrete argument structures are good models for how verbs encode event participants, as well as whether verbal participant relations are variable across languages. We report the results of a judgment experiment with speakers of Spanish and Mandarin and compare these results with English data previously reported by Rissman, Rawlins and Landau (2015).

Previous Evidence for Semantic Gradience

One of the benefits of the discrete model of verbal participant encoding is that it fits well with syntactic theories of how event participants are overtly expressed: isomorphic mappings can be drawn between a verb's arguments and the surface constituents in a clause. For example, in *Jodi lent a book to her sister*, the arguments <Source, Theme, Recipient> map to the phrases <DP, DP, PP>. The distinction between a verb's arguments and its non-arguments (or "modifiers") is not dichotomous, however (Croft, 2001; Dowty, 2003; Vater, 1978), one reason being that verbal semantics and syntax are sometimes not isomorphic (Haspelmath, 2014; Koenig, Maurer & Bienvenue, 2003). Consider, for example, instrumental participants, as in *Jodi sliced the broccoli with a knife*. Verbs such as *slice* and *chop* activate an Instrument concept during sentence comprehension (Andreu, Sanz-Torrent & Rodríguez-Ferreiro, 2016; Koenig et al., 2003). Nonetheless, instrumental *with*-phrases pattern like modifiers (i.e., not like arguments) given syntactic argument diagnostics (Rissman et al., 2015; Schutze, 1995). For example, *what Jodi did with the knife was slice the broccoli* is acceptable but not **what Jodi did to her sister was lend a book*.

As a result of this mismatch between semantic and syntactic argument diagnostics, researchers cannot rely on syntactic diagnostics to understand how verbs semantically encode event participants. Alternate methods for probing verbal semantics include studies of sentence processing, sentence completion and semantic judgments (Barbu &

Toivonen, 2016; Boland, 2005; Koenig et al., 2003; Rissman et al., 2015; Wittenberg & Snedeker, 2014). In the judgment task in Rissman et al. (2015), English speakers read a paragraph stating that verbs have "arguments," defined as something "essential to the meaning of a verb but not part of the verb itself." This category was elaborated through positive examples, e.g. that *want* has two "arguments" because wanting involves someone who wants and something that is wanted. We distinguish the experimental category "argument" from the theoretical notion of argument.

Following this instruction, subjects judged which of the words in a sentence constituted the "argument" of the verb, for untrained verbs and participant types. Subjects read sentences such as in (1) and had to choose whether either the first or second bracketed phrase was an "argument" of the verb, or whether neither phrase was an "argument":

- (1) a. [Last Tuesday] Martha SLICED something [with a steak knife].
- b. Tania TAUGHT something [to the students] [in the classroom].

Rissman et al. (2015) hypothesized that if verbs like *slice* and *chop* discretely encode three arguments, an Agent, Patient and Instrument, then they are in an equivalence class with dative verbs such as *teach* and *lend*, which encode a Source, a Theme and a Recipient (Larson, 1988). By prediction, subjects would therefore be equally as likely to choose "with a steak knife" in (1a) as to choose "to the students" in (1b).

Instead, subjects selected Instruments less often than Recipients. In addition, there were differences across the instrumental verbs: an Instrument was selected more often for *slice* and *chop* than for *eat* and *break*, for example. Thus *slice* patterned like neither a 2-argument verb nor a 3-argument verb. Rather, Instruments appeared to have a moderate degree of salience: more salient than a time or a location, but less salient than a Recipient, inconsistent with the discrete model of participant encoding.

A variety of evidence indicates that this judgment task reflects abstract knowledge of verbal meaning. First, on control trials with prototypical arguments and modifiers, subjects almost always chose the Theme in sentences such as "John CARRIED [the books] [in a tote bag]" and almost never chose one of the modifiers in sentences such as "Martha CHOPPED something [on Monday] [in the forest]. Subsequent experiments showed: 1) that the difference between the Recipient and Instrument judgments was likely not driven by the difference in animacy (Recipients were animate whereas Instruments were inanimate), 2) that the Instrument judgments were not correlated with estimates of how often people use tools for these events, and 3) Instrument and Recipient judgments for each verb did correlate with how often people produce Instruments and Recipients in a corpus. Finally, Rissman (2018) found strong positive correlations between Instrument and Recipient judgments for each verb and rates of producing Instrument/Recipient completions for sentence fragments such as *Martha sliced the bread _____* and *Tania taught the material _____*.

Current study

We ask whether Spanish and Mandarin speakers also judge Instruments as having a moderate degree of salience. Such a finding would provide additional evidence against the discrete model of participant encoding. Investigating verbal semantics across multiple languages helps ensure that theoretical developments are not based on English alone.

We also ask whether non-discrete encoding of participants is itself cross-linguistically variable. Although *slice* patterns neither as a 2-argument nor a 3-argument verb, this does not preclude semantically similar verbs in other languages (e.g., Spanish *cortar*) from discretely encoding the Instrument. Languages differ widely as to which semantic role properties are relevant to syntactic argument realization (Bornkessel, Schlesewsky, Comrie & Friederici, 2006; Croft, 2001; Levin & Rappaport-Hovav, 2005). Verbal semantics is also highly variable across languages, with verbs in the same semantic space bundling semantic features in different ways (see Majid, Boster & Bowerman, 2008 for cutting and breaking events and Talmy, 1985 for motion events). In Mandarin, for example, the verb *jie4* encompasses both English *borrow* and *lend*. In the current study, we ask whether instrumental verbs in Spanish and Mandarin encode the Instrument in a discrete way, unlike in English.

For each of the verbs studied by Rissman et al. (2015), we selected semantically similar verbs in Spanish and Mandarin. For these similar verbs, we asked three questions:

- 1) Do judgments of Instrument salience parallel judgments of Recipient salience, unlike in English?
- 2) Do some verbs highlight an Instrument more strongly than other verbs, as is true for English?
- 3) Do verbs with similar meanings across languages give rise to similar judgments of Instrument salience?

In choosing Spanish and Mandarin, we compared one language that is genetically related to English (Spanish) and one language that is genetically distant (Mandarin). These languages both differ from English with respect to argument production: Spanish is a pro-drop language, allowing subject omission, while Mandarin allows both subject and object omission. We can thus test whether in languages that allow pervasive argument omission, subjects are less likely overall to judge that a particular phrase is an "argument."

Experiment 1

Participants

35 native Spanish-speaking adults ($F = 22$) and 32 native Mandarin-speaking adults ($F = 23$) participated. Spanish speakers were tested in Chicago and in Baltimore; all Mandarin speakers were tested in Baltimore. All participants reported having some knowledge of English. The Spanish speakers originated from throughout the Spanish-speaking world; Mandarin speakers originated from throughout China and Taiwan. All participants had attended or were currently attending college. Participants received \$12 or course credit.

Design and Materials

Native speaker consultants translated the Rissman et al. (2015) materials into Spanish and Mandarin. The prior study tested two types of verbs: 1) verbs compatible with an Instrument ("Instrument verbs"), ranging from strongly to weakly instrumental (e.g., *slice, chop* vs. *eat, drink*), and 2) verbs compatible with a Recipient ("Recipient verbs"), ranging from strongly to weakly Recipient-encoding (e.g., *lend, teach* vs. *bounce, kick*). We selected Spanish and Mandarin verbs by describing to the consultants a set of events that exemplified core uses of each English verb (e.g., *chop* ~ chopping an onion, chopping wood). The consultants then provided the dominant verb in Spanish and Mandarin that would be used to describe these events. If no verb could be found that closely matched the meaning of the English verb and was compatible with the syntactic frames in (2-5), then no verb was tested. Tables 1-2 show the Spanish and Mandarin verbs that were tested, including omissions ("---").¹

Each sentence in the experiment featured a single verb and two bracketed phrases: participants' task was to choose one of the bracketed phrases as an "argument" of the verb, or to choose that neither phrase was an "argument." Example Instrument and Recipient sentences are shown in (2-3) and (4-5) with English glosses and translations.

(2) Rachel REBANÓ algo [con una hoja de afeitar] [en el puerto].
Rachel slice-3PST something with a razor blade in the port
"Rachel sliced something with a razor blade in the port."

(3) 【在去年復活節那天】小琴用【一把短柄小斧】
:砍了:一些東西。
in last Easter Sunday Xiaoqin use one hatchet chop-PFV something
"Last Easter Sunday, Xiaoqin used a hatchet to chop something."

(4) [A las 6 am] Ruby le PRESTÓ algo [al nadador].
At 6 AM Ruby 3SG lend-3PST something to the swimmer.
"At 6 AM, Ruby lent something to the swimmer."

(5) 克洛伊【在街上】:賣了:一樣東西【給演員】。
Chloe in street send-PFV something to actors
"In the street, Chloe sent something to the actors."
The two bracketed phrases constituted several contrasts between two possible participant types. In the main trials of interest, Instruments and Recipients were pitted against prototypical modifiers (location, time and manner phrases). If Instruments and Recipients are arguments, these should be chosen significantly more often than modifiers.

There were two types of control trials. In the first, Themes were pitted against various phrase types including participant locations (e.g. *Layla LLEVÓ [los comestibles] [en una cesta]*; "Layla CARRIED [the groceries] [in a basket]") and beneficiaries (e.g. *Jen LEYÓ [el mensaje] [para el detective]*; "Jen READ [the message] [for the detective]"). We predicted that subjects would choose the Theme as an "argument." In the second type of control trial, prototypical modifiers were pitted against each other, as in *Rachel REBANÓ algo [tristemente] [en el puerto]* ("Rachel SLICED something [sadly] [in the port]"). We predicted that in modifier vs. modifier trials, participants would judge that neither phrase was an "argument" of the verb. These control trials assess

Table 1: Instrument verbs

Eng	Span	Mand	Eng	Span	Mand
beat	golpear	qiao1 da3	eat	comer	chi1
hit	pegar	da3	drink	beber	he1
touch	tocar	peng4	break	quebrar	da3po4
poke	---	chuo1	open	abrir	da3kai1
stab	apuñalar	ci4	kill	matar	sha1
cut	cortar	qie1	attack	atacar	gong1ji2
chop	picar	kan3	paint	pintar	---
slice	rebanar	---	grow	---	zhong4
write	escribir	xie3	move	mover	yi2dong4
draw	dibujar	hua4	lift	levantar	ju2qi3
dig	---	wa1	clean	limpiar	qing1li3
stir	revolver	jiao3	wash	lavar	xi3

Table 2: Recipient verbs

Eng	Span	Mand	Eng	Span	Mand
serve	servir	duan1	kick	patear	ti1
teach	enseñar	jiao1	throw	tirar	ren1
send	enviar	ji4	toss	---	tou2
tell	decir	---	roll	---	gun3
sell	vender	mai4	push	empujar	tui1
lend	prestar	chu1zu1	slide	---	---
pay	pagar	fu4	take	llevar	na2
offer	ofrecer	ti2gong4	bounce	---	---

¹ In Mandarin, serial verb constructions are common and productive (Li 1990). In Table 1, the verbs *da3po4* ('break'), *da3kai1* ('open'), *yi2dong4* ('move') and *ju2qi3* ('lift') are compound constructions rather than non-compound multi-character verbs.

These verbs were included to maintain a close equivalence between the numbers of verbs and the semantic space of the verbs tested in English and Mandarin.

whether subjects distinguish prototypical arguments from prototypical modifiers.

The order of the bracketed phrases was counterbalanced such that some participants saw a trial such as in (2), whereas others saw a structure with a sentence-initial modifier such as [*En el puerto*] Rachel REBANÓ algo [*con una hoja de afeitar*] ("[In the port] Rachel SLICED something [with a razor blade]"). Each Instrument and Recipient verb appeared six times. In addition, each verb was paired with six unique Instrument/Recipient tokens (e.g., *con una hoja de afeitar* ("with a razor blade"), *con tijeras* ("with scissors")). There were both typical and atypical tokens for each verb. Summing across the experiment, Spanish/Mandarin participants saw a total of 312/318 trials.

Procedure

Participants received a Spanish/Mandarin version of the "argument" instructions from Rissman et al. (2015); the category labels *argumento* and *lun4yuan2* were used in Spanish and Mandarin, respectively. The instruction consisted of two phases: in the first, participants read a prose description about "arguments." Participants were told, for example, that "arguments" are essential to the meaning of a verb but are not part of the verb. Participants were given primarily positive examples, e.g. that *querer/yao4* ('want') has two "arguments," someone who wants and something that is wanted. Participants were also told that "arguments" are not necessarily syntactically required in a sentence. Participants read two negative examples, e.g. in *John ran until he was sick*, the phrase *until he was sick* is not an "argument". In the second phase of the instruction, participants completed practice trials where they read a verb and were asked to indicate the "arguments" of the verb. For example, Spanish participants read the sentence *Jim estaba cocinando* ("Jim was cooking"), were told that *cocinar* has two "arguments," and had to indicate which "argument" of *cocinar* was present and which was absent in the sentence. In another type of practice trial, Mandarin participants were asked to list the "arguments" of "看" ('look'); where the correct answer is two "arguments," someone who looks and something that is looked at. Feedback was given on all practice trials in the second phase of training. Across the entire instruction, explicit information was not given about the verbs or participant types that participants would be tested on. The instructions/practice trials were administered by native or near-native speakers of Spanish/Mandarin.

Results and Discussion

Spanish and Mandarin speakers performed as expected on the two types of control trials. For Theme trials (e.g., English ~ *John CARRIED [the books] [in a canvas bag]*), Spanish speakers chose the Theme as an "argument" on 93% of trials

² In pilot studies, some Spanish-speakers reported that a Recipient phrase was incompatible with some Recipient verbs. Given this intuition, Spanish participants completed an acceptability questionnaire after the judgment task. If an individual participant

(CI₉₅ = 1%), and Mandarin speakers chose the Theme on 95% of trials (CI₉₅ = 1%). For modifier vs. modifier trials (e.g., English ~ *John CUT something [carefully] [last night]*), Spanish speakers chose the "neither" option on 89% of trials (CI₉₅ = 1%) and Mandarin speakers chose "neither" on 96% of trials (CI₉₅ = 1%). Thus speakers of Spanish and Mandarin, like the English speakers tested in Rissman et al. (2015), sharply distinguish prototypical arguments from prototypical modifiers in their judgments.

Figure 1 shows the main results, how often Spanish and Mandarin speakers judged Recipients and Instruments to be "arguments" for each verb.² The English-*with* data were previously reported in Rissman et al. (2015). These data suggest that Recipients are better examples of "arguments" than Instruments. To test whether Spanish and Mandarin speakers judged Instruments as having the same level of salience as Recipients, and whether these judgments varied across English, Spanish and Mandarin, we modeled the probability of choosing the Instrument or the Recipient (i.e., the *Target*) as an "argument" using mixed-effects logistic regression. Participants almost never selected one of the modifiers as an "argument;" we therefore collapsed the modifier and "neither" responses and modeled these data as a binary choice: whether or not participants chose the Target as an "argument." We fit regression models in R using the *glmer* function in the *lme4* package (Bates & Maechler, 2009); models were evaluated through nested model comparison. Possible fixed effects in the model were Language (English vs. Spanish vs. Mandarin), Target type (Instrument vs. Recipient) and Competitor Type (location vs. time vs. manner); Subject was a possible random effect.

The best-fitting model of the data in Figure 1 contained the Subject random effect and the Target fixed effect: participants selected Recipients more often than Instruments ($\beta = 2.53$, SE = .05, $p < .001$). None of the following contributed significantly to the model fit: Language, Competitor Type, interaction between Language and Target Type and interaction between Target Type and Competitor Type (p -values for χ^2 tests all $> .1$). This analysis shows that in both Spanish and Mandarin, Recipients are more prominent for Recipient verbs than Instruments are for Instrument verbs, as in English.

We also observed variation across the individual Instrument verbs, in both Spanish and Mandarin. In Spanish, the rates of selecting the Instrument ranged from 11% (*comer*, 'eat'; CI₉₅ = 7%) to 38% (*picar* 'chop'; CI₉₅ = 9%). The 95% confidence intervals for these verbs do not overlap, indicating significant variation across verbs. Similarly, for Mandarin, Instrument judgments ranged from 19% (*chil*, 'eat'; CI₉₅ = 9%) to 41% (*ci4*, 'stab'; CI₉₅ = 10%). The 95% confidence intervals for these verbs do not overlap.

Finally, we tested the relationship between individual verb judged a verb to be "unnatural" in the Recipient frame, this participant's data for this verb were excluded from analysis. The following percentages of trials were excluded for each verb: *patear* ('kick'): 49%; *empujar* ('push'): 74%; *llevar* ('take'): 11%; *tirar* ('throw'): 14%.

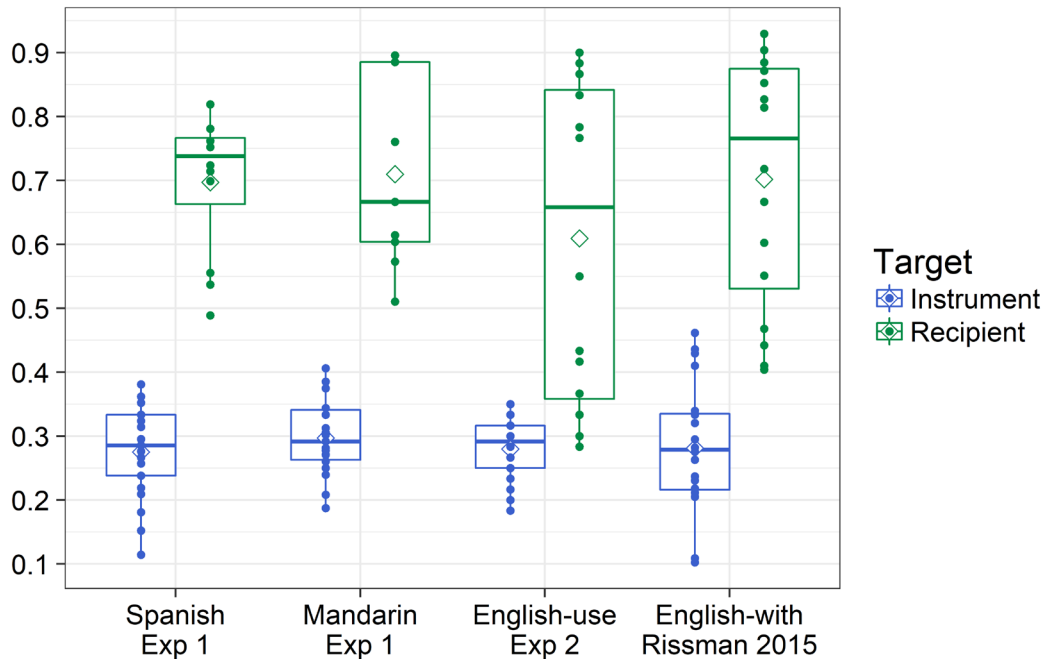


Figure 1. Rates of choosing the Instrument or the Recipient as an "argument" in each experiment. Box plots show median and second and third quartiles; diamonds show the mean; dots represent single verbs

meanings and "argument" judgments across languages, using the verb pairings shown in Tables 1-2. Judgments for individual verbs correlated significantly with each other for each verb category (Spanish-English Instrument verbs: $r(19) = .80, p < .001$; Mandarin-English Instrument verbs: $r(22) = .59, p < .01$; Spanish-English Recipient verbs: $r(11) = .79, p < .01$; Mandarin-English Recipient verbs: $r(11) = .72, p < .01$). These correlations show common trends in how verbal semantic features influenced the judgments in each language.

These results provide answers to the three questions raised above: in Spanish and Mandarin, judgments of Instrument salience do not parallel judgments of Recipient salience; some verbs highlight an Instrument more strongly than others; and verbs with similar meanings across languages give rise to similar judgments of Instrument salience. These findings support a gradient theory in which participants can have moderate degrees of salience, and suggest that verbs encode participants in similar ways across languages.

All participants had some knowledge of English. To assess whether English familiarity influenced the judgments, we calculated for each participant the correlation between that participant's judgments for each verb and the mean for the corresponding English verbs, combining Instrument and Recipient verbs. We then calculated correlations between the age at which a participant started learning English and the strength of their correlation with the English data. The correlation with age was non-significant for both Spanish ($r(33) = -.02, p > .1$) and Mandarin ($r(30) = -.08, p > .1$).

Experiment 2

In the English study, Instruments were introduced by the preposition *with*, whereas Mandarin Instruments were introduced by the verb *yong4*, 'use'. Thus in the English sentences, the Instrument was in the same clause as the main verb, while in the Mandarin sentences, the Instrument was in a separate clause. To assess a possible effect of these different syntactic structures, we collected judgments from English speakers who encountered Instruments in a *use*-frame.

Participants, Design, Materials and Procedure

Twenty English-speaking adults from Baltimore participated ($F = 14$). All subjects reported being native speakers of English. Subjects received \$12 or course credit.

Each of the *with*-sentences from Rissman et al. (2015) was converted to a *use*-sentence. As in Experiment 1, the verb *use* was not included in the Instrument bracket. We used two different word orders for each Instrument vs. modifier contrast, e.g., *Jordan used [a shotgun] [in the driveway] to ATTACK someone* and *[In the driveway] Jordan used [a shotgun] to ATTACK someone*. All other trials were the same as in Rissman et al. (2015), as was the instruction.

Results and Discussion

Figure 1 shows the rates of choosing the Instrument/Recipient as an "argument" for Experiment 2. In a mixed-effects logistic regression model of the *with* data from Rissman et al. (2015) and the *use* data from Experiment

2, frame type (*use* vs. *with*) did not significantly affect the likelihood selecting the Instrument ($\chi^2(1) = .04, p > .1$). In addition, there was a significant positive correlation between the individual verb means for the English *use* data and the Mandarin data: $r(22) = .76, p < .001$. These results show that viewing the Instrument in a *use* frame did not decrease English speakers' likelihood of selecting the Instrument, mitigating the concern that the Mandarin stimuli from Experiment 1 underestimate the extent to which Mandarin verbs highlight Instruments.

General Discussion

Our results suggest that in Spanish and Mandarin, a discrete model of verbal participant encoding does not adequately capture how verbs encode the presence of an Instrument. Some theorists distinguish syntactic arguments from semantic arguments (Jackendoff, 2002). Such a distinction does not help explain our results, however, as both types of argument structures are assumed to be discrete.

It is possible that the gradient judgments we observe reflect probabilistic retrieval of discrete semantic structures (see Hale, 2001; Levy, 2008; among others). This approach, however, does not make an explicit connection between the semantics of a verb and the degree to which an Instrument is salient. Verbal semantics appears to matter: *picar*, 'chop' but not *comer*, 'eat' specifies that the Instrument has a particular physical form (a bladed/pointed shape). If *comer* and *picar* are both associated with 2 and 3-place frames, it is unclear how the semantic difference between the verbs accounts for the different rates of frame retrieval.

An alternate possibility is that the representation wherein verbs encode participant relations is itself gradient. This possibility has been characterized in multiple ways. Langacker (1987) proposes that verbs are conceptually dependent, and dependence is a gradient notion. For example, in *Jim sliced the bread with a knife*, the verb *slice* is dependent on the instrumental phrase *with a knife* because the instrument elaborates a salient substructure within the meaning of *slice*, the bladed-object feature. This salient substructure is not as salient, however, as the substructure indicating the entity that gets sliced, leading to gradient patterns of intuitions.

Similarly, Williams (2015) proposes that the "participant roles" of a verb are given by the "sketch" associated with that verb, a "psychological perspective...engaged by default" (85). Participant roles are entailed, explicit constituents within the sketch. Although Williams does not explicitly describe the sketch as non-discrete, he characterizes the elements of the sketch as psychologically "prominent." The results of Experiments 1-2 could be explained within this framework if: 1) an Instrument is a participant role for verbs such as *picar*, 'chop' and *ci4*, 'stab', and 2) the Instrument is less prominent in the sketch for these verbs than the Recipient is prominent in the sketch of dative verbs.

Rissman et al. (2015) propose a distinction between "primary" and "secondary" participants in event representation: the former are contributed by a discrete

argument structure, whereas the latter are generated by the root semantics of the verb. Slicing events, for example, have two primary participants: the agentive causal force and the patient that becomes sliced. Through its root meaning, *slice* encodes that a bladed object comes into contact with the patient, and this bladed object is therefore a secondary participant within the event structure required by the verb. See Rissman and Rawlins (2017) for a proposal for how the instrument-phrase meaning interacts with this event structure.

More recently, Kim et al. (2019a,b) propose that the argument/adjunct distinction is gradient based on an idea from Dowty: certain phrases describing event participants can be *gradient argument/adjunct blends* in the framework of Smolensky et al (2014), i.e. they can be both arguments (to some degree) and adjuncts (to some degree). Kim et al. establish empirically that many prepositional phrases illustrate gradience in terms of whether native speakers categorize them as arguments or adjuncts. Their main aim is to explain variation and gradience in judgments about specific linguistic diagnostics that are supposed to provide evidence for the argument/adjunct distinction, e.g. that adjuncts allow pseudoclefts and that adjuncts are always omissible. Across all of the types of PPs they look at, lexical effects coming from particular verbs are a major factor in determining this gradience, and in particular, verbs vary in the degree to which they prefer for some potential event participant role to be filled; different syntactic frames vary in how much they prefer adjunct phrases. While this proposal makes no specific claims about instrument marking, it does generally predict that verbs will have gradient representations in terms of how they license event participants, something consistent with our results. An open question is whether the very general kinds of verb preferences that Kim et al. show across many PP types can explain the role-specific preferences demonstrated here and in Rissman et al. (2015).

Argument omission is more widespread in Spanish and Mandarin than in English. We did not, however, find a main effect of Language on the judgments. In addition, English speakers' judgments were largely unchanged when they encountered Instruments in a *use*-frame rather than a *with*-frame. These results suggest that the judgments reflect verbal meaning rather than syntactic prominence per se. Given this hypothesized dissociation between syntactic and semantic prominence in this task, we predict that if participants judged whether *the key* is an "argument" in [*The key*] OPENED *the door*, they would be unlikely to do so.

Across Spanish, Mandarin and English, we observe similarity rather than variability: there are verbs in all three languages where the Instrument has an intermediate level of salience (e.g., *picar*, 'chop,' and *ci4*, 'stab'). We leave future research to explore the interaction of discrete and non-discrete structures that give rise to these gradient judgments.

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