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ARTICLE

Numbers skyrocket in English but increase in Spanish: metaphoric conceptualization and manner expression in translations

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Abstract

This study investigated the differences in the expression of numerical motion metaphors in English and Spanish. We evaluated 1472 English-to-Spanish translations in which a manner of motion verb (e.g., *skyrocket, plummet*) was used to metaphorically express numerical change (e.g., *unemployment is skyrocketing*). For each of the translations, we annotated (1) the type of metaphor used in Spanish, (2) whether the manner of motion and path information was present in Spanish, and (3) whether the path and manner information in Spanish were conflated in a single word or indicated via adjuncts. There were three main findings. First, Spanish translations shifted from the motion domain to a quantity domain in almost half of the translations (e.g., *skyrocket* translated as *aumentar*, Eng. *increase*). Second, Spanish translations omitted manner of motion in half of the cases (e.g., *prices surging* translated as *alza de los precios*, Eng. *rise in prices*). Third, the path of motion was always present in the Spanish translations. This translation analysis provides evidence that the typological differences reported for the encoding of literal motion are also observed in the expression of numerical, metaphorical motion and that the choice of metaphorical mappings depends on language typology.

Keywords: metaphor; motion; number; translation; typology

1. Introduction

1.1. Physical motion and language typology

Languages vary in the ways they tend to grammatically encode motion events (Ibarretxe-Antuñano, 2017; Lewandowski, 2021; Talmy, 2000a). On the one hand, some languages (such as English) tend to express motion events with verbs that incorporate in their lexical meanings both the motion itself and the manner in which the motion is produced (e.g., *Joe walked/limped/crawled/tip-toed across the room*),

while the direction or path of the motion is expressed with an element external to the verb, known as a satellite (e.g., *go in, go up*). These languages are thus referred to as satellite-framed (S-framed) languages. In contrast, other languages (such as Spanish) tend to express motion with verbs that incorporate the path of the motion (e.g., *subir* 'go up', *bajar* 'go down', *entrar* 'go in', *cruzar* 'go across'), while the information about manner is most often expressed separately, typically using an adverbial (e.g., *José pasó por la habitación caminando/cojeando/arrastrándose/de puntillas*). These languages are referred to as verb-framed (V-framed) languages[1].

This distinction in how different languages encode motion events inspired Slobin's 'Thinking for Speaking Hypothesis' (Slobin, 1991, 1996, 2004). Slobin observed that, in the course of describing a physical motion event, each language directs the attention of the speaker to different facets of the scene, which are contingent on the relative accessibility of grammatical resources to express certain meanings in that language. S-framed languages contain a wealth of verbs to describe motion that also includes manner, making the expression of manner easier and predisposing speakers to attend to details of the manner of motion when describing a motion scene to a greater extent than speakers of V-framed languages (see Narasimhan, 2003; Özçaliskan & Slobin, 2003; Slobin et al., 2014; Verkerk, 2013 for an analysis across multiple languages)[2].

The tendency for speakers of different languages to attend differentially to manners has also been observed to affect translation processes. Analyses of parallel translations of physical motion events reveal that translators increase the number of manner expressions they produce when translating V-framed languages (Spanish) into S-framed languages (English), and decrease the number of manner expressions they produce when translating S-framed languages (English) into V-framed languages (see Molés-Cases, 2016, 2019; Slobin, 1997). These differences in the expression of manner associated with typological differences between V-framed and S-framed languages can be crucial in some translation contexts. For instance, Hijazo-Gascón (2019) points out that inaccuracies in the translation of physical motion events may arise in police interview interpreting due to challenges related to typological differences and these inaccuracies can have undesired informational consequences. In a study demonstrating this point, Filipović (2008) analysed several Spanish-to-English translations of police interviews with witnesses and suspects. She observed that when Spanish original interviews used path-conflating verbs (e.g., *salió de la tienda*, '*exited the shop*'), the English translations sometimes added manner information that was not present in the original (e.g., *salió de la tienda* is translated as *ran out of the shop*), thus altering drastically the way in which the scene is described, with potentially important consequences for the attribution of guilt. She states that

[1]Even though this broad distinction is generally agreed upon, multiple studies have also shown that there is within-language variation. Research on languages such as Serbian (Fagard et al., 2017; Filipovic, 2007), Polish (Lewandowski, 2021), Basque (Ibarretxe-Antuñano, 2004) and Turkish (Özçalişkan, 2009) suggest that there is a more nuanced distinction between language typologies, rather than a totally binary S-frame or V-frame distinction. In fact, Slobin, (2004) suggested a third group of equipollently-framed languages, such as Chinese, which express path and manner equivalently.

[2]Studies on the Thinking for Speaking hypothesis have also been conducted in other areas, including gesture studies (Kita & Özyürek, 2003; Özyürek et al., 2008), second language acquisition (Andria & Hijazo-Gascón, 2018; Cadierno, 2008; Hijazo-Gascón et al., 2019; Lewandowski, 2022; Lewandowski & Özçalişkan, 2021) and translation (Filipović, 2008; Hijazo-Gascón, 2019; Rojo & Cifuentes-Férez, 2017).

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"language-specific lexicalization patterns […] can affect information content if a different perspective that comes with a different lexicalization pattern needs to be assumed" (p. 37). Finally, Rojo and Cifuentes-Férez (2017) conducted three experiments that tested the influence of the loss of manner information in English-to-Spanish translations of crime accounts. When translations omitted manner, there was a decrease in the importance attributed to the criminal act. Their results demonstrated that "the loss of manner information can affect the audience's assessment of crime, and thus have significant implications in certain contexts (e.g., courtroom verdicts)" (p. 22).

1.2. Metaphorical motion and language typology

The aforementioned studies have been exclusively devoted to the role of typology in the structuring of physical motion. This raises the question: are these differences also true in the case of metaphorical motion? Conceptual Metaphor Theory (CMT, Lakoff, 1987; Lakoff & Johnson, 1980) suggests that people systematically create mappings between a source domain, from which they extract conceptual information and vocabulary, and a target domain, to which they apply that conceptual information and vocabulary. Thanks to this process, people can, for example, talk about a relationship in terms of motion (e.g., *things are going very fast*, *let us slow down this relationship*). Metaphorical motion is used extensively across domains, as motion has a fundamental role in how cognition is structured (Majid et al., 2004) and is closely tied to concepts of space. For instance, the metaphor STATES ARE LOCATIONS, CHANGE IS MOTION, TIME PASSING IS MOTION, and ARITHMETIC IS MOTION may employ motion as the source domain (as related to the SPACE domain) while having very different target domains.

A few studies have contrasted metaphorical motion expressions across typologically different languages. Özçaliskan (2003, 2004, 2005) explored the possible role of typology in metaphorical motion by comparing English (S-framed) and Turkish (V-framed) and found that 'typological differences observed in the lexicalization of literal motion events extend to the metaphorical uses of the lexicon' (2004: 97), which means that S-framed languages also use a larger manner of motion lexicon than V-framed languages in metaphorical motion events. Caballero (2009, 2017) and Ibarretxe-Antuñano and Caballero (2014) found similar typological differences when looking at English and Spanish motion metaphors across different genres (e.g., architecture, wine tasting). On the other hand, Carter (2014) examined the conceptual metaphors in the English translation of a French novel and found that over one-third of the metaphors used in the source text were replaced by different metaphors. More recently, Lewandowski and Özçalişkan (2024) conducted a cross-linguistic study comparing translations of novels into typologically distinct languages (German versus Spanish) and typologically similar languages (German versus Polish). Similar to Carter (2014), they also observed that the translations of metaphorical motion presented a different target domain from the source text in more than one-third of translations. For the remaining two-thirds of the translations which preserved the motion metaphorical mapping, the authors found that there were systematic typological differences in how they were lexicalised (e.g., texts translated into Spanish contained more motion metaphors without manner than with manner). Overall, research on cross-linguistic metaphorical motion suggests

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that the typological differences between V-framed and S-framed languages observed in physical motion are also observed in metaphorical motion. Further, when translating these motion metaphors, a substantial proportion of the motion metaphors are replaced by other metaphorical mappings.

One of the limitations of the research on translations of metaphorical motion expressions across languages is that, even though studies explore metaphorical mappings that use motion as a source domain, the number of target domains is very heterogeneous. For example, Özçaliskan (2003) reports over 13 different metaphorical mappings that employ motion as a source domain). One metaphor that often relies on the domain of motion for its conceptualisation is the TIME IS SPACE metaphor. There is extensive research that shows that most temporal concepts can be expressed by means of spatial metaphors, particularly in English (i.e., Clark, 1973; Moore, 2006; Radden, 2003; see Núñez & Cooperrider, 2013 for a review). These spatial metaphors may include static descriptors of space that refer to spatial properties like location (e.g. *back in those days*), length (e.g. *a short week*) or distance (e.g *the near future*) as well as dynamic descriptors that employ motion (e.g. *time flies when you are having fun*). Similar to physical motion, some studies suggest that there are cross-linguistic differences attributable to typological differences, specifically between English and Spanish, in how temporal concepts can be expressed. For example, Valenzuela and Alcaraz-Carrión (2020) argue that the typological make-up of English (S-framed) facilitates the explicit mention of path information in static space – time metaphors via prepositions (e.g., *back in the past*), while this information is often lost in Spanish translations (V-framed) of these expressions (e.g., *back in the past* is translated as *entonces*, 'then').

In addition, while English tends to rely on spatial metaphors to convey temporal duration (e.g., *a long time ago*), Spanish uses quantity metaphors much more frequently (e.g., *hace mucho tiempo*, literally 'much time ago'). This difference in the type of time metaphors employed by S-framed and V-framed languages has also been reported in several psycholinguistic experiments. For example, Casasanto et al. (2004) showed English and Greek participants lines that grew from left to right (space metaphor) and disappeared after a set time. Participants had to calculate the amount of time that the line had been growing. English speakers overestimated the amount of time when the line was long (influenced by the DURATION IS LENGTH metaphor), and underestimated it when the line was short, while no effect was observed in Greek speakers, who tend to use the metaphor DURATION IS QUANTITY (*much time*, instead of *long time*). After that, a parallel version of the study was created which, instead of growing lines, used a tank being filled at different speeds (quantity metaphor). In this case, Greek speakers overestimated the amount of time when the tank was very full, and underestimated the amount of time when the tank was less full, while English speakers were not affected by this manipulation. This effect was later replicated by Bylund and Athanasopoulos (2017) with Swedish and Spanish speakers. In their task, Swedish speakers were misled by the length of the stimulus, while Spanish speakers were misled by the size/quantity of the stimulus. These studies suggest that there may be cross-linguistic differences in how temporal duration is (metaphorically) conceptualised.

Speaker's focus on space-based metaphors in S-framed languages (English and Swedish) and quantity-based metaphors in V-framed languages (Greek and Spanish) is reminiscent of another of the typological differences described by Slobin, termed 'rhetorical styles' (Slobin, 1991). According to Slobin, S-framed language speakers

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often describe motion scenes more dynamically, with abundant detail about the path and manner of motion, while V-framed language speakers tend to omit these details, creating more static descriptions of scenarios in which motion takes place, leaving the hearers to the concrete details of the motion. In this sense, the typological differences between languages lead to different lexicalisation patterns when expressing motion, which in turn may influence how motion is conceptualised by speakers of these languages.

In a similar fashion, in the case of temporal metaphors, there are differences in the types of metaphors employed to talk about temporal duration. English tends to use spatial (motion) metaphors to express temporal duration, which in turn evokes more dynamic metaphoric scenes. On the other hand, Spanish shows a different conceptualisation pattern, by preferring the use of quantity metaphors when talking about temporal duration, downplaying the role of motion. This claim was supported by a corpus study conducted by Alcaraz-Carrion and Valenzuela (2021), who examined the frequency of length and quantity metaphors in the expressions of time in English and Spanish. They found that English employs more length metaphors than Spanish, while Spanish employs more quantity metaphors than English. In this sense, the difference in the type of metaphor could also be linked to the preference for English to describe more dynamic scenes (motion metaphor) and for Spanish to describe more static scenes (quantity metaphor).

Overall, cross-linguistic research on time – space metaphors suggests that typology may be one of the factors that make S-framed (e.g. English) and V-framed (e.g. Spanish) languages encode space – time metaphorical mappings within a single metaphor or choose among different metaphorical conceptualisations.

1.3. Current study: number metaphors and language typology

If typology plays a role in how speakers linguistically encode motion-based metaphors, as it seems to do in the domain of time, we may be able to observe similar patterns for other spatial metaphorical mappings. In this research, we focus on another domain that heavily relies on motion: the domain of numbers.

Similar to time, many aspects of numbers are conveyed by means of space. In fact, several studies have suggested that the close linguistic and conceptual connections among the domains of space, time and number might be due to the existence of a common, shared magnitude system (see A Theroy of Magnitude; Üstün et al., 2022; Walsh, 2003; Winter et al., 2015). Research on the relationship between the representation of numbers and space is prolific. People mentally represent numbers by means of a mental number line (de Hevia, 2016; Fias et al., 2011), in which small numbers are located to the left and larger numbers are located to the right. This association is supported by the SNARC (spatial-numerical association of response codes) effect, which refers to the phenomenon by which small-number responses are faster with the left hand and large-number responses are faster with the right hand (Dehaene et al., 1993). Plenty of studies have also addressed the possibility of spatial-numerical association taking place in a three-dimensional space, with smaller numbers being associated with the lower part and the near side of space, and larger numbers with the upper part and far side of space (Aleotti et al., 2020; Greenacre et al., 2022; Wiemers et al., 2014; Winter, Matlock, et al., 2015). The space-number association is also conventionally used when visualising numerical quantities in

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graphs, in which numerical quantities typically increase from the bottom to the top along the y-axis and from left to right along the x-axis (Hartmann et al., 2014; Winter & Matlock, 2013). The association between space and number is not limited to the spatial location of the numbers on the number line, but it also can extend to motion along a number line. For example, people sometimes overestimate the outcomes of addition operations and underestimate the outcomes of subtraction operations when estimating the results of arithmetic operations, as if 'overshooting' when moving along a mental number line (termed the operational momentum effect; McCrink et al., 2007; Pinheiro-Chagas et al., 2018). This phenomenon is also observed in mental arithmetic with movements of a computer mouse, with deflections to the left for subtraction and to the right for addition (Marghetis et al., 2014).

The association between space and number has also been addressed by Conceptual Metaphor Theory (Lakoff & Johnson, 1980; Lakoff & Núñez, 2000). Many languages associate the concept of numerical increase with an upward direction, just as adding more books to a pile would make its level go up (MORE IS UP metaphor). Conversely, the concept of numerical decrease is associated with a downward direction. When linguistically encoding this information, speakers of English often use motion metaphors to describe both numerical increase (e.g. *numbers go up*) as well as numerical decrease (e.g. *numbers go down*). Other languages, such as Spanish, also employ this mapping to convey numerical change (e.g. *los números suben; los números bajan*). Overall, space plays a crucial role in the representation of numerical information, and speakers of languages such as English and Spanish often use spatial metaphors to describe (and conceptualise) numerical quantities.

Even though there is plenty of evidence for the metaphorical structuring of numbers in terms of space, it is not clear whether and to what extent the typological make-up of a language influences how numerical information is linguistically encoded. Do typologically different languages rely on different numerical metaphors, related to their 'rhetorical style' (Slobin, 1991), as they do for time? Is the manner of motion in number metaphors translated differently when looking at typologically different languages? One way to test this idea would be to examine whether sentences describing similar content – such as translations – in typologically different languages rely on different conceptual metaphors. Even if translations maintain the metaphorical domain of motion, they may focus on different elements of motion. We might expect that, given that Spanish is V-framed, manner information might frequently be lost in translation, even when motion metaphors are used in the source language, while path information will be kept. This would result in a less dynamic description of numerical motion, as well as a loss of part of the information that was included in the original language. To the extent that we find shifts in the metaphorical domain and variation in the expression of motion elements, we also want to explore the extent to which these vary across verbs, more specifically verbs that depend on the direction (that is path) of the motion. Understanding such variation could lead to refinement of hypotheses about what semantic factors of motion may lead to different patterns of the metaphorical expression of numbers.

This study investigates whether translations of numerical motion expressions from a satellite-framed language (English) to a verb-framed language (Spanish) involve downplaying motion and using more static, quantity expressions. To address this question, we conducted an informational gain or loss analysis to check what semantic information was added or removed during the translation process (Valenzuela & Alcaraz-Carrión, 2020; Verkerk, 2013) of 8 manners of motion verbs

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that describe the numerical change (*skyrocket, surge, spike, soar, drop, plummet, plunge*, and *fall*). We hypothesise that similar to the domain of physical motion and the domain of time, typological differences between English and Spanish will impact the resulting translations in the following ways: (1) Similarly to the domain of time, Spanish translations be more likely to use of quantity expressions to describe numerical change, downplaying the role of motion and creating more static scenes, (2) the path information present in the English expressions will mostly be maintained in the verb in the Spanish translations, and (3) the manner of motion present in the English verbs will sometimes be lost in the Spanish translations, or will be included via adjuncts. Additionally, we explore possible variations in the use of metaphor, the translation of path, and the translation of manner of motion across verbs that employ different directions.

2. Methodology

2.1. Materials

The linguistic searches for the translation analysis were carried out using the corpus tool Sketch Engine (Kilgarriff et al., 2014). This online software provides access to a wide variety of tagged corpora in several languages and can perform customised linguistic searches (i.e., part of speech, word lemmas). We employed a subset of the parallel corpora offered by Sketch Engine, with English as the source language and Spanish as the target language. This subset included 5 different corpora: (1) the United Nations Parallel Corpus, which consists of official records and other parliamentary documents from the UN (650 million words); (2) the EUR-LEX corpus, which contains documents from the European Union (630 million words); (3) EUROPARL7, a parallel corpus of the European Parliament proceedings (50 million words); (4) OPUS2 English, an open source parallel corpus of texts from the internet (1 billion words); and (5) the OpenSubtitles 2018 corpus, which includes translations of movies and TV series (circa 1 billion words). With these parallel corpora, researchers can search for a linguistic expression in the source language (English), and obtain all the hits together with their equivalent translations in the target language (Spanish) for a direct comparison.

2.2. Linguistic expression selection

The selection of the linguistic expressions for this study was based on the work of Alcaraz Carrión (in preparation). In that work, the author analysed over 200 clips extracted from the television repository NewsScape in which speakers described the numerical change in topics such as healthcare (e.g., number of COVID-19 cases), economy (e.g., employment, GDP, salaries) and politics (e.g., number of votes, approval ratios). From these clips, the author extracted 458 verb tokens that described numerical change and identified a list of 47 manners of motion verb types that expressed numerical change through motion metaphors:

> Manner of motion (47 types): boom, bounce, break, climb, crater, creep, crowd, crush, dip, drift, drive, drop, dwarf, edge, explode, fall, flatline, flatten, hover, jump, lag, level, mount, peak, pile, plateau, plummet, plunge, push, rampage,

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roll, shoot, shove, skyrocket, slow, soar, spike, stall, stampede, surge, swing, take, tick, track, trail, trickle, turn.

To select search items for the Sketch Engine parallel corpora for this study, we selected the four most frequent manner of motion verbs that convey a steep increase in quantity and the four most frequent manner of motion verbs that convey a steep decrease in quantity. These verbs combine two key spatial elements to metaphorically express numerical change: the path of motion, to indicate whether there is an increase or a decrease in the given quantity, and manner of motion, which represents the rate at which this quantity changes. These two spatial elements are often employed to visually plot numbers in data visualisations (e.g., line graphs), with the y-axis representing a bottom-to-top increase in magnitude, and the x-axis representing a left-to-right change over time (Woodin et al., 2022). The combination of these elements results in the representation of numerical change by means of lines with several degrees of steepness that represent the direction and the rate of the numerical change. For the group indicating a steep increase, the most frequent verbs were *skyrocket*, *surge*, *spike*, and *soar*. All of these verbs contain path information (i.e., upwards movement), as well as manner information (i.e., rapid motion). For the group indicating steep decrease, the most frequent verbs were *plummet*, *plunge, drop*, and *fall.* All of these verbs contain path information (i.e., downwards movement). The presence or absence of manner information requires further comment. Most scholars agree that the verbs *plummet* and *plunge* contain path information (i.e., downwards movement) and manner information (i.e., rapid motion). However, there is no consensus for the verbs *drop* and *fall.* Some scholars categorise these verbs as path verbs, since they do not describe a particular manner of motion (see Cifuentes Férez, 2008; Ibarretxe-Antuñano, 2004; Özçaliskan, 2003, 2004; Slobin, 1996; Slobin et al., 2014), but other scholars (see Garrudo Carabias et al., 1996; Zlatev et al., 2010), categorise them as the manner of motion verbs, since they indicate a rapid and uncontrolled motion. In this study, we consider *drop* and *fall* as manner of motion verbs. However, we include all findings disaggregated for each verb so that readers can consider *drop* and *fall* as distinct from *plummet* and *plunge* if they wish to do so.

2.3. Data collection

For each of the 8 linguistic expressions, we sought to gather 200 English-to-Spanish translations using the parallel corpora. We designed the searches so that we obtained only cases in which the expressions were used in their verb form in the English text (e.g., *spike* as noun was not included). We searched for the lemma of each of the target expressions (i.e., all the word forms, such as *surge, surges, surged* or *surging*). For every verb, we annotated their different translations.

In order to ensure that the meaning of the verbs was associated with the domain of number in the sampled cases, we prioritised the UN, EUROPARL7 and EUR-LEX corpora in our searches. Since the topics in these corpora often rely on numerical information (e.g., economics, politics), we expected these motion verbs to be often used to describe numerical quantities. Cases that included a non-numerical sense of the selected verbs (e.g., *the assailant **spiked** her drink with a knockout pill*; *the export prohibitions provided for the distribution agreements were **dropped***) were discarded. If our goal of 200 translations per verb was not achieved after reviewing these corpora, we extended the search to the OPUS2 and Open Subtitle 2018 corpora. Even though

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these corpora are larger, they also include a wider range of uses for the target linguistic expressions unrelated to quantity and number (often including cases of physical motion or non-numerical metaphorical motion), which resulted in a large number of translations from these corpora being discarded.

2.4. Informational gain or loss analysis

For each of the translations, we performed an informational gain or loss analysis (Valenzuela & Alcaraz-Carrión, 2020; Verkerk, 2013). We annotated three features in the Spanish translations: (i) the source domain used in the translated metaphor, (ii) the presence (or absence) of path and manner information, and (iii) the location of the path and manner information, that is, whether they were conflated in the target verb or added as an adjunct in the surrounding text.

First, we annotated the conceptual domain used in the Spanish translations to describe numbers. All the English expressions that we selected relied on the domain of motion to refer to numbers, but this was not the case in the Spanish translations. Thus, we annotated whether the Spanish translation (1) relied on a motion-based linguistic expression (e.g., *skyrocket* translated as *elevar*, 'raise'), (2) employed a quantity-based linguistic expression (*surge* translated as *aumentar*, 'increase'), or (3) employed a different linguistic structure (*spike* translated as *encarecer*, 'become more expensive'). Two coders analysed the conceptual domain that was used in the Spanish translations, reaching almost perfect agreement (κ = .98). The cases for which there was no agreement were removed from the final analysis.

Second, we annotated whether the path and/or the manner of motion was mentioned in the Spanish translation. For example, the Spanish translation of *plummet* could contain just the path (*bajar*, '*go down*'), could conflate path and manner (*desplomar*, '*collapse*') or could mention both separately (*caer abruptamente*, '*fall abruptly*'). The translations that employed quantity-based expressions did not contain a path, since they had no motion (e.g., *disminuir*, '*diminish*'). However, these expressions could include what we will call a 'manner of quantity change', which are adverbs or other modifiers that describe the manner of the increase or decrease of quantity. For example, translations such as *aumentar rápidamente* ('*quickly increase*') or *incrementar mucho* ('*increase a lot*') include information about the speed or the scale of the increase in quantity. Finally, the translations that used other strategies did not involve motion, though they occasionally contained modifiers related to the original manner of motion (e.g., *encarecimiento vertiginoso*, '*become dramatically more expensive*'). Two researchers coded for the presence of path (κ = 0.97) and the presence of manner of motion or manner of quantity change (κ = 0.98) in the Spanish translations, reaching almost perfect agreement. The cases for which there was no agreement were removed from the final analysis.

Third, we annotated whether the path and manner information in the Spanish translation were conflated in a single word or were indicated via adjuncts (i.e., adverbs or adjectives). Path information was always expressed in one word (e.g., *subir*, '*go up*'). Manner information could be expressed in one word (e.g., *disparar*, '*shoot up*'), or via an adjunct (e.g, *descender bruscamente*, '*descend abruptly*'). Two researchers coded for whether path information was indicated in a single word or via adjuncts, reaching perfect agreement, and whether manner information was indicated in a single word or via adjuncts, reaching almost perfect

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Table 1. Corpus frequency, total translations and number of translation types.

	Linguistic expression	Corpus frequency (pmw)	Final translations	N of different translations	Type/ Token ratio	Most frequent translations
Steep increase	*skyrocket*	0.07	200	91	45.5%	*dispararse (shoot up)*
	surge	0.39	199	69	34.67%	*aumentar (increase)*
	spike	0.19	198	55	27.77%	*subir (go up)*
	soar	0.71	200	98	49%	*aumentar (increase)*
Steep decrease	*drop*	16.09	198	20	10%	*disminuir (decrease)*
	plummet	0.1	200	82	41%	*desplomar (plummet)*
	plunge	1.25	80	40	50%	*desplomar (plummet)*
	fall	77.78	197	20	10.15%	*disminuir (decrease)*

agreement (κ = 0.98). The cases for which there was no agreement were removed from the final analysis.

3. Results

We collected 1481 translations of expressions about numerical change, with 200 translations for each verb except for *plunge*, which yielded only 81 valid translations after reviewing all the hits contained across the different corpora.[3] There were 9 disagreements between the coders regarding the path and manner coding of the translations (e.g., *declinar, rebrotar*, '*decline, resprout*' see Supplementary Appendix), and these cases were removed from the final analysis, resulting in 1472 translations. The type/token ratio of the translations ranged from 10% for expressions like *fall* and *drop* to over 50% for expressions like *skyrocket*, *soar*, *plummet*, and *plunge*, as shown in Table 1.

3.1. Conceptual domains in Spanish translations

The percentage of Spanish translations that used each metaphorical domain for each expression is shown in Figure 1 (raw numbers are available in Supplementary Appendix 1).

All the English verbs that expressed numerical change used the metaphorical domain of motion, but their Spanish translations could maintain the motion domain, switch to the quantity domain, or employ a completely different strategy. For steep increase verbs, the Spanish translations maintained the motion domain in 44% of cases, shifted to the quantity domain in 47% of the cases, and employed other strategies in 8% of cases. *Skyrocket* and *spike* showed a higher percentage of translations that maintained the motion domain (e.g., *dispararse*, English trans, *shoot up*),

[3] Although some of the verbs were frequently employed to indicate change in quantity (e.g., *skyrocket, soar* and *plummet*), other verbs were very frequently used for unrelated meanings. For example, *drop* was often used in the physical sense (e.g., *drop bombs*), as well as in constructions such as *drop out of school* or *drop charges. Spike* was used in the physical sense (i.e., *impale*), inject (e.g., *spike additives*) and in the sense of adding drugs or alcohol to contaminate a drink (e.g., *offences due to drink spiking*). *Fall* was often used metaphorically in constructions such as *to fall short of* or *fall within/under somebody's competence. Plunge* was used metaphorically to indicate a negative change in a current condition (e.g., *plunge the country into war, plunge the region into terrorism*), and occurred in its numerical sense with relatively low frequency.

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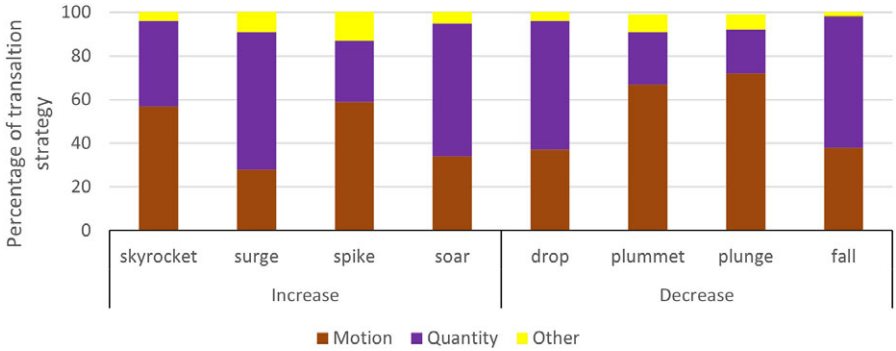

Figure 1. Percentage of cases that used each translation domain in each of the Spanish translations for each of the expressions.

whereas *surge* and *soar* showed a higher percentage of translations that shifted to the quantity domain (e.g., *aumentar*, '*increase*'). The use of other strategies (e.g., *quintuplicar*, '*quintuple*') was infrequent.

We examined whether there was significant variation across the steep increase verbs in the likelihood that translations maintained the domain of motion. To do so, we conducted a linear mixed model analysis in R, with the presence of metaphorical motion in the Spanish translation as the dependent variable, verb as a fixed effect, and corpus as a random intercept. The likelihood that translations maintained metaphorical motion varied across the four steep increase verbs, χ^2 (3) =17.65, p < 0.001. Considering translations of *skyrocket* as the baseline, translations of *soar* ($\beta = -0.77$, $z = -3.08$, $p = 0.002$) and *surge* ($\beta = -1.06$, $z = -4.13$, $p < 0.001$) were less likely to maintain metaphorical motion, whereas translations of *spike* did not differ in the likelihood of maintaining metaphorical motion ($\beta = -0.08$, $z = -0.26$, $p = .80$).

For the steep decrease verbs, the Spanish translations maintained the motion domain in 50% of cases, shifted to the size domain in 44% of cases, and employed other strategies in 5% of the cases. *Plummet* and *plunge* showed a higher percentage of translations that maintained the motion domain (e.g., *desplomar*, English trans, *plummet*), whereas *drop* and *fall* showed a higher percentage of translations that shifted to the quantity domain (e.g., *disminuir*, '*decrease*').

We also examined whether there was significant variation across the steep decrease verbs in the likelihood that translations maintained the domain of motion. To do so, we again conducted a linear mixed model analysis, with the presence of metaphorical motion in the Spanish translation as the dependent variable, verb as a fixed effect, and corpus as a random intercept. The likelihood that translations included metaphorical motion varied across the steep decrease verbs, χ^2 (3) =63.69, p < 0.001. Considering translations of *drop* as the baseline, translations of *plummet* ($\beta = 1.27$, $z = 6.02$, $p < 0.001$) and *plunge* ($\beta = 1.51$, $z = 5.19$, $p < 0.001$) were more likely to maintain metaphorical motion, whereas translations of *fall* did not differ in the likelihood of maintaining metaphorical motion.

Finally, we examined whether steep increase and steep decrease verbs varied in the likelihood that translations included metaphorical motion. To address this question, we conducted a linear mixed model analysis with presence of the metaphorical motion as the dependent variable and motion direction (increase or decrease) as a

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fixed effect. We included corpus and verb as random intercepts. This model revealed no effect of motion direction on the likelihood that translations maintained metaphorical motion, χ^2 (1) =1.12, p = 0.291.

3.2. Motion based-translations: path and manner information

3.2.1. Translating path information

All the Spanish translations that conveyed path information did so by expressing it in the verb. The motion translations followed three strategies: (1) they included only path information (e.g., *subir*, English trans, *go up*), (2) they conflated path and manner information in one word (e.g., *catapultar*, '*catapult*'), or (3) they did not include path information (e.g., *disparar*, '*shoot*'). The percentages of translations that used each of these strategies are shown in Figure 2 (raw numbers are available in Supplementary Appendix 1).

Overall, most of the Spanish translations maintained the path information that was included in the English original, either by including only path information or by including both path and manner of motion information in the verb. Consider the following examples:

Path.

1) **English original**: *International funds had been devoted to improving the living standard there, which resulted in prices surging.*
Spanish translation: *Se habían destinado fondos internacionales a mejorar el nivel de vida en esos lugares, lo que había producido un alza de los precios.*
English equivalent: *International funds had been devoted to improving the living standards in those places, which had yielded a rise of prices.*

Path + manner.

2) **English original**: *For example, as the crisis unfolded, stock market prices – a rough measure of the price of acquisitions – plunged.*

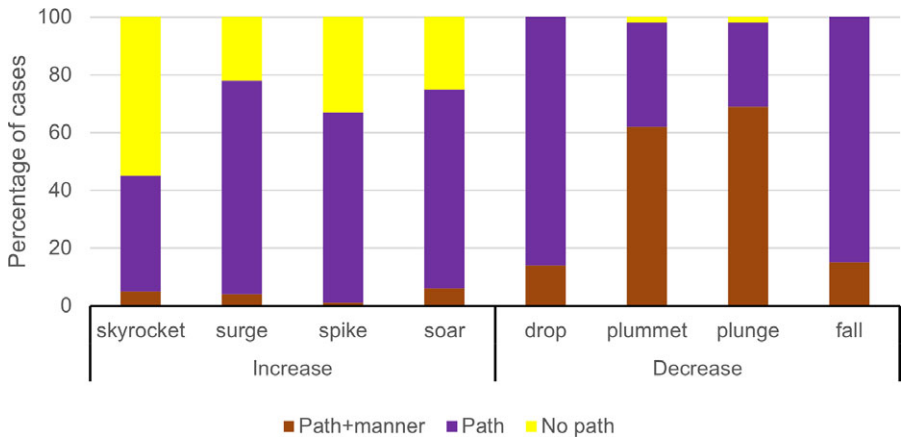

Figure 2. Percentage of path information translations for each expression.

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Spanish translation: *Por ejemplo, a medida que la crisis fue tomando cuerpo se hundieron los precios de las acciones en el mercado de valores, que son un indicador aproximado del precio de adquirir una empresa.*
English equivalent: *For example, as the crisis unfolded, the prices of the actions in the stock market, an approximate measure of the price of acquiring a company, plunged.*

However, while steep decrease expressions almost always maintained the path information, steep increase expressions showed a loss of path information in more than a third of the motion translations, particularly for the translations of skyrocket. Consider the following example:

No path.

3) **English original:** *…at a time when women in Europe are threatened by the aftermath of a devastating economic crisis, as their unemployment is skyrocketing, as conservative governments cut back on social services…*
Spanish translation: *…en un momento en que las mujeres se ven amenazadas en Europa por las secuelas de una crisis económica devastadora, con un desempleo galopante y la introducción de recortes sociales…*
English equivalent: *… in a moment in which women are threatened in Europe by the sequelae of a devastating economic crisis, with galloping unemployment and the introduction of social cuts…*

We examined whether steep increase and steep decrease verbs varied in the likelihood that translations included path information. To address this question, we used a linear mixed model with the presence of path information as the dependent variable, and motion direction (increase or decrease) as a fixed effect, and corpus and verb as random intercepts. This model revealed a significant effect of motion direction on the presence of path information, $\chi^2(1) = 23.31$, $p < 0.001$, with decreased expressions being more likely to include path information than increased expressions.

3.2.2. Translating manner information

The Spanish translations followed four strategies when conveying the manner information that was present in the English original text: (1) the manner was included both in the main verb and with an adjunct (e.g., *desplomar bruscamente*, '*collapse abruptly*'), (2) the manner was included in the main verb (e.g., *hundir*, '*sink*'), (3) the manner was added as an adjunct (e.g., *subir a toda velocidad*, '*go up quickly*'), or (4) the manner was not included (e.g., *descender*, English trans *descend*). The percentage of translations of each verb that used each strategy is shown in Figure 3 (raw numbers are available in Supplementary Appendix 1):

The translations of the expressions *skyrocket, plummet* and *plunge* tended to maintain the manner of motion that was present in the original (either conflated in one word or via adjuncts), with more than 80% of these translations containing manner information. For example:

Manner in verb.

4) **English original**: *Bank runs, plummeting house prices, gyrating currencies, food riots…*

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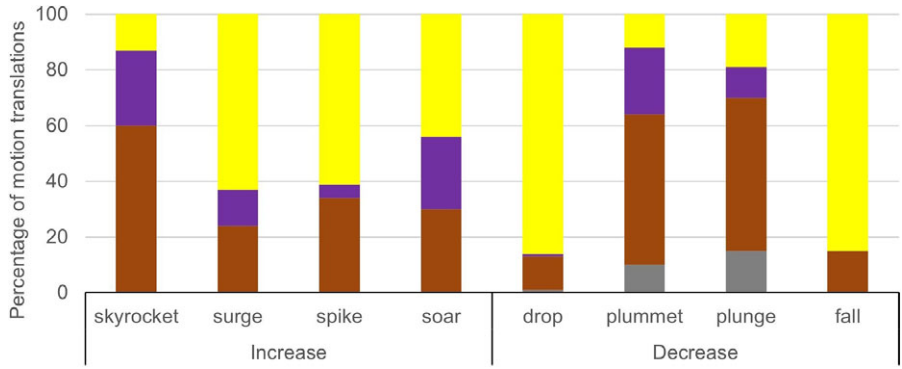

Figure 3. Percentage of motion translations for each expression that used each type of strategy for expressing manner information.

Spanish translation: *Las corridas bancarias, el hundimiento de los precios de la vivienda, los desequilibrios monetarios, los disturbios por falta de comida…*
English equivalent: *bank runs, the plummeting of house prices, the monetary unbalance, the riots for the lack of food…*

Manner in adjunct.

5) **English original**: *Indeed, skyrocketing commodity and oil prices have been affected not only by China, but also by Brazil, the Russian Federation and India…*
Spanish translation: *De hecho, las ingentes subidas de los precios del petróleo y los productos básicos no sólo han venido dadas por China sino también por el Brasil, la Federación de Rusia y la India …*
English equivalent: *Indeed, the enormous rise of commodity and oil prices have been affected not only by China, but also by Brazil, the Russian Federation and India…*

On the other hand, the translations of surge, spike, drop, and fall showed the opposite pattern, with surge and spike maintaining manner information in around 40% of the cases and drop and fall in merely 15% of the cases. For example:

No manner.

6) **English original**: *He has the chills and his temperature's spiking.*
Spanish translation: *Tiene escalofríos y su temperatura está elevándose.*
English equivalent: *He has the chills and his temperature is rising.*

7) **English original**: *The illiteracy rate had fallen from 64 per cent in 1962 to 20 per cent in 1989.*
Spanish translation: *La tasa de analfabetismo bajó del 64% en 1962 al 20% en 1989.*
English equivalent: *The illiteracy rate went down from 64% in 1962 to 20% in 1989,*

Lastly, soar included mixed results, with 56% of the translations containing manner information, and the remaining 44% not containing manner:

No manner.

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8) **English original**: *…unemployment in the formal sector estimated at 70 per cent and prices soaring.*
Spanish translation: *…el desempleo en el sector estructurado se calcula en un 70% y los precios continúan en alza.*
English equivalent: *…unemployment in the formal sector is calculated at 70%, and the prices continue on the rise.*

Manner in adjunct.

9) **English original**: *as scrap prices were soaring again…*
Spanish translation: *Como los precios de la chatarra volvían a subir fuertemente…*
English equivalent: *as the prices of scrap strongly (lit) went up again…*

Finally, we examined whether steep increase and steep decrease verbs varied in the likelihood that translations included manner of motion information (in the verb, as an adjunct, or in both). To address this question, we conducted a linear mixed model with the presence of manner as the dependent variable motion direction (increase or decrease) as a fixed effect, and corpus and verb as random intercepts. Presence of manner did not vary with motion direction, χ^2 (1) = 0.30, p = 0.59.

3.3. Quantity based-translations: manner information

The translations that shift to the domain of quantity lose path information (since there is no longer any motion), but they can maintain information about the original manner of motion that describes the speed or the magnitude of the change in quantity. Spanish translations followed three strategies when conveying manner of quantity change: (1) the manner of quantity change was expressed in a single word (e.g., *skyrocketing price* translated as *precio exorbitante*, '*exorbitant price*'), (2) the manner was added as an adjunct (e.g., *aumento drástico*¸ '*drastic increase*'), or (3) the manner was not included (e.g., *reducir*, '*reduce*'). The percentage of cases that used each strategy is shown in Figure 4 (raw numbers are available in Supplementary Appendix 1):

When translating *skyrocket*, *plummet*, and, to a lesser degree *soar* and *plunge*, the manner of quantity change was frequently included in the translations, as shown in the following examples:

Manner in adjunct.

10) **English original**: *Prices have skyrocketed and low-income developing countries…*
Spanish translation: *Los precios han aumentado vertiginosamente y los países en desarrollo de bajos ingresos…*
English equivalent: *The prices have very quickly increased and low-income developing countries…*

11) **English original**: *The level of overcrowding plummeted during the second half of the year, from 37% in July to 16% in December.*
Spanish translation: *El nivel de hacinamiento registró una disminución considerable, ya que de 37% en el mes de julio, pasó a 16% en el mes de diciembre.*
English equivalent: *The level of overcrowding registered a considerable decrease, since from the 37% in July, passed to 16% in December.*

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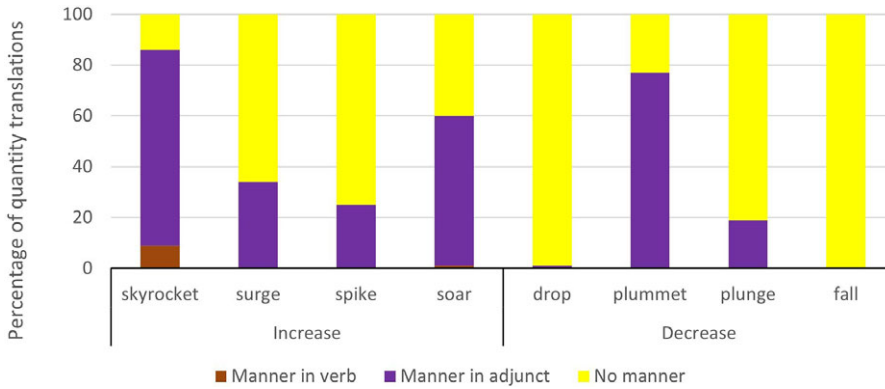

Figure 4. Percentage of quantity translations for each expression that used each type of strategy for conveying manner information.

However, the remaining 5 expressions showed the opposite tendency, expressing the manner of quantity change infrequently. The percentage of cases that included manner of quantity change ranged from 25% for spike, to 34% surge; manner of quantity change was never included for fall or drop:

No manner.

12) **English original**: *Your fever has spiked to 102.*
Spanish translation: *La fiebre se ha incrementado a 102.*
English equivalent: *The fever has increased to 102.*

13) **English original**: *Investment […] dropped by nearly 10 percentage points between 1981 and 1987.*
Spanish translation: *La inversion […] disminuyó en casi 10 puntos porcentuales entre 1981 y 1987.*
English equivalent: *investment […] decreased by almost 10 percentage points between 1981 and 1987.*

Finally, we compared the distributions of translations that contained manner of quantity change information (whether in the verb or as an adjunct) and translations that did not include manner of quantity change information used for steep increase and steep decrease quantity translations. We built a linear mixed model with the presence of manner as the dependent variable motion direction (increase or decrease) as a fixed effect, and corpus and verb as random intercepts. Presence of manner did not vary with motion direction, $\chi^2(1) = 2.09$, $p = 0.15$.

4. Discussion

4.1. Spanish translations of English numerical expressions frequently shift from motion metaphors to quantity

Our data show that, among Spanish translations of English motion-based numerical expressions, 47% of the translations preserve the motion domain, while 46% shift to

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the quantity domain. There was no evidence that the tendency to preserve motion depended on motion direction. However, there was substantial variation across specific verbs. More precisely, *skyrocket*, *spike*, *plummet*, and *plunge* show a preference for the motion domain, while *surge*, *soar*, *drop*, and *fall* show a preference for the quantity domain. Even though Spanish can also employ motion metaphors to describe numerical change, translators chose to shift to quantity expressions in almost half of cases.

A similar phenomenon has been reported in the domain of time, with both psycholinguistic evidence (Bylund & Athanasopoulos, 2017; Casasanto, 2008, 2010; Casasanto et al., 2004) and corpus evidence (Alcaraz-Carrion & Valenzuela, 2021; Valenzuela & Alcaraz-Carrión, 2020) suggesting that Spanish speakers show a preference for quantity-based metaphors over length-based metaphors to express temporal duration. Specifically, Spanish tends to construe temporal duration in terms of quantity in a three-dimensional space (e.g., *mucho tiempo*, '*much time*'), whereas English tends to construe temporal duration in terms of length in a one-dimensional space (e.g., *a long time*). Although both languages are able to express temporal duration with both metaphors, Spanish is biased towards quantity metaphors, whereas English is biased towards length metaphors.

We hypothesise that the same might occur when people express a numerical change in English and Spanish. Although both languages can describe numerical change with both motion metaphors (e.g., *subir, go up*) and quantity expressions (e.g., *incrementar*, *increase*), Spanish tends to employ quantity expressions, whereas English tends to employ motion metaphors. This preference could be due to typological differences in the expression of motion between the languages, namely the use of different rhetorical styles when describing motion scenes (Slobin, 1991). English and Spanish employ different rhetorical styles when describing motion scenes: English speakers tend to provide more details than Spanish speakers, including information about the path and the manner of the motion, and have a big lexicon that can express different nuances of the manner of motion. When talking about numerical change, English speakers have in the domain of motion more options to describe numerical change, providing more dynamic descriptions (e.g. numbers can *go up, come up, reach, rise, arise, skyrocket, soar, surge, explode, shoot up*…). This is somewhat more restricted when using the domain of quantity (e.g. numbers can *increase, grow, enlarge?, expand?*). On the other hand, Spanish has a smaller manner of motion lexicon, which in turn makes the speaker tend to leave out motion details, creating more static descriptions and letting the interlocutors infer motion information (e.g. los números pueden *subir, ascender, elevarse, alzarse, dispararse*). By using the domain of quantity, Spanish speakers can leave out those details by not using the motion domain, describing numerical change less dynamically (e.g. los números pueden *aumentar, expandirse, crecer, incrementarse*…). In this case, the typological differences could be influencing this shift in the type of metaphor that is employed when conceptualising numbers, with S-frame languages (English) favouring motion metaphors, and V-frame languages (Spanish) favouring quantity metaphors.

This typological explanation could also account for some of the differences that we observed in the individual expressions. The verbs *skyrocket, spike, plummet*, and *plunge* involve a higher percentage of motion translations (57%–72%). In all these cases, the manner of motion is highly salient, and Spanish has several direct translations that convey a similar salience while maintaining the same or similar

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manner of motion (e.g., *disparar, desplomar*). As a result, translators often employ a similar expression within the motion domain. However, despite also expressing a salient manner of motion, *surge* and *soar* show a lower percentage of motion metaphors (27% and 34% respectively), and instead favour quantity translations. The reason could lie in the absence of direct and equivalent expressions in Spanish. Thus, translators choose to shift to the domain of quantity, which can accommodate the more static descriptions that are favoured by the Spanish rhetorical style. Something similar also occurs with *fall* and *drop*; as they have a less marked type of manner of motion, translators can easily choose not to focus on manner information, and shift to a less marked and more frequent translation in the domain of quantity, such as *disminuir* ('*diminish*').

4.2. Spanish motion translations often keep path information

The analysis of the translation of path information indicates that path information is maintained in 81% of cases that used a motion metaphor in the Spanish translation. These findings align with previous results that suggest that verb-framed languages tend to present path information conflated in the main verb when expressing physical motion events (Slobin, 1996; Slobin et al., 2014; Talmy, 2000a, 2000b). Previous studies have shown that this phenomenon also holds in some domains of metaphorical motion (Caballero, 2007; Ibarretxe-Antuñano & Caballero, 2014; Özçaliskan, 2003; Valenzuela & Alcaraz-Carrión, 2020), and here we confirm that it also holds for numerical metaphorical motion. However, we also observed significant differences in how path information is translated between steep increase and steep decrease expressions. Our model suggested that decreased expressions presented more path information than increased expressions. In steep decrease expressions, path information was not included in only 2 translations (1% of the total steep decrease expressions). However, in steep increase expressions, path information was omitted in 37% of the translations. Thus, it seems that translators deem it more important to specify the path of motion when the translation indicates downward motion than when it indicates upward motion.

One possible explanation is, once again, the typological differences between the languages. Even though the path of motion is not explicit in the translations, it could be implicit in some of the Spanish motion translations. For instance, one of the most common steep increase motion translations that do not include path information is *disparar*. While the literal translation in English is *shoot*, the meaning that *disparar* conveys in this context is *to shoot* ***up***. The path of motion is not explicitly referred to in the translation, but it is implicit that the motion is performed upwards; a quantity is always *shot* upwards in Spanish. The English translation requires the satellite to indicate upwards motion since it is a satellite-framed language. While English can easily chain several path satellites, Spanish tends to conflate path information in the verb, simplifying the path information in the translation (Slobin, 1996; Valenzuela & Alcaraz-Carrión, 2020).

Another possible explanation could be linked to the possible differences in frequency of increased and decreased Spanish expressions. Some recent studies in English suggest that there is a bias towards addition. For instance, words associated with an increase in quantity are more frequent than words associated with a decrease in quantity, and addition-related words are mentioned first when used in binominal

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expressions such as *add and subtract* (Winter et al., 2023). If we assume this is also true for Spanish, the more frequent increase expressions might not need to explicitly include the path of motion because we can infer that they imply an increase in quantity. On the other hand, since decreased expressions are less frequent, it is more crucial to specify the path of motion. Another possible factor that could influence this finding is the lexical frequency and lexical variability of the verbs available in the target language. In this sense, *disparar* is a highly frequent expression used to express a rapid increase in quantity which has no path information. Since Spanish has a more restricted lexicon when conveying manner of motion, most of the translators could have chosen to use this more frequent equivalent.

4.3. Manner information is often lost in Spanish translations

Spanish translations of English manner of motion numerical metaphorical expressions omitted the manner of motion information in 50% of cases. This result closely mirrors Slobin's (1996) finding that 49% of English-to-Spanish translations of (physical) motion events omitted manner of motion information. When Spanish translations used a motion expression, 44% of the translations omitted the manner of motion, and when Spanish translations used a quantity expression, 65% of the translations omitted the manner of quantity change information. The absence of manner did not depend on the direction of motion, but it was characteristic of some specific verbs (*surge, spike, drop and fall*).This omission of the manner of motion present in the English original is likely due to the typological differences between verb-framed and satellite-framed languages that were discussed above (Talmy, 2000a, 2000b).

This loss of manner information has important repercussions for the meaning that is conveyed in the translated text. As previously discussed, several studies have described the importance of accurately translating physical path and manner of motion information from the source to the target language, particularly in legal reports, for which the inclusion or omission of this motion information can be vital (Filipovic 2008, Rojo & Cifuentes Férez, 2017). The loss of physical manner information during the translation process caused by typological differences between languages can have important repercussions on how motion events are interpreted and the inferences built on them. We hypothesise that the same may be true for numerical metaphorical motion events. We believe that the meaning conveyed in the target language can drastically change if the manner of motion of a numerical metaphorical motion expression is omitted during the translation process. For instance, the *spike* is defined as 'a sharp increase in the magnitude of something' (Oxford Languages Dictionary). However, as shown in example 6, a frequently-chosen Spanish translation is *elevar* (e.g., *to rise*), which makes no mention of the sharpness of the increase. As we saw in example 12, the English source text *'the fever has spiked'* corresponds to the Spanish translation 'the fever has risen'. There is a critical difference between temperature *spiking* and temperature *rising*; while the former would likely require urgent medical assistance, the latter would probably only require some extra caution. As another example, *skyrocketing prices* are sometimes translated as *aumento de los precios* (e.g., *increase in the prices*), which does not convey the magnitude and speed of the increase that is included in the English original. Thus, omitting the manner of motion information

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in translation can drastically change the meaning conveyed. This is of particular importance in documents that are used in policy making, such as the UN and the EUROPARL official translations that we have used in this study. The loss of the manner of motion in numerical change translations could lead, for instance, to underestimates of the effects of an illness (as in the previous example of *spiking fever*), or to misrepresentations of the impact of economic measures (as in the previous example of *skyrocketing prices*).

Even though here we provide evidence that manner of motion is often lost when translating numerical metaphorical expressions from English to Spanish, it is still necessary to experimentally test to what extent and in what circumstances this loss of information matters. While it seems that the presence or absence of manner of motion matters for literal motion translations (Filipović, 2008; Rojo & Cifuentes-Férez, 2017), the effect for metaphorical motion translations is unclear. A future study could, for instance, expose participants to Spanish translations of an English text that describes a numerical change that keeps motion information or omits it, and test whether there are any differences in the quantities that participants estimate from those texts.

5. Limitations and future directions

This research has several limitations inherent to working with corpus data. First, there is no record of the translators who have been involved in the translation of the texts used in the parallel corpora. Many of the translations that we have analysed could have been produced by the same translator, and the choices they made might have been caused by individual differences or stylistic choices rather than typological differences.

Another limitation of this study has to do with the generalizability of the results. First, most of the parallel corpora used in this study were drawn from the EU parliament or UN proceedings, and these corpora might not reflect the same linguistic tendencies that would be observed in other specialised corpora. Some of the differences we have observed might be genre-specific, for example, the way numerical change is linguistically encoded when, for instance, talking about change in economic tendencies might differ from how numerical change is linguistically encoded when talking about cases of illness. Thus, future research should aim to conduct similar studies on texts that expand the range of genres. Second, here we have compared English, the prototypical satellite-framed language, to Spanish, the prototypical verb-framed language, but it is not clear to what extent these results can be generalised to other satellite-framed or verb-framed languages. Extending this type of comparison of numerical metaphorical expressions to other languages and cultures would also help clarify to what extent there is variability in the metaphorical expression of numerical information. Some languages that could prove fruitful for examination are Greek and Indonesian, which have been argued to have different metaphorical structures from English for conveying temporal information (Bylund & Athanasopoulos, 2017; Casasanto, 2008). From a typological perspective, conducting this kind of comparison with other verb-framed and satellite-framed languages could prove useful for establishing whether the findings obtained in this study are due to typological differences or other differences between English and Spanish.

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6. Conclusions

We conducted an informational gain or loss analysis of English-to-Spanish translations of the manner of motion metaphorical expressions of numerical information. We hypothesised that the typological differences between these languages would result in the following differences: (1) Spanish would favour quantity expressions rather than motion metaphors to describe the numerical change in a substantial number of cases, (2) path information would generally be maintained, and (3) the manner of motion information would sometimes be lost in the translation process. The findings obtained in this study partially confirmed these predictions, while posing new questions. First, English-to-Spanish motion translations omitted manner of motion information in almost half of the translations, which could drastically alter the messages indicated in the source language. Second, the path of motion was nearly always included in the translations that expressed a downward direction; however, about a third of the cases that expressed an upward direction did not include path information. This can be explained by the way in which Spanish implicitly includes path information in certain verb forms, simplifying the path information in the translation. Lastly, Spanish translations shifted from the motion domain present in the source text to a quantity domain in almost half of the translations, favouring less dynamic descriptions, as has been previously attested for the domain of time. Overall, the typological differences across languages that have been reported for the linguistic encoding of literal motion were also observed in the domain of numerical, metaphorical motion. These findings open up new questions concerning the role of typology in the choice of metaphorical mappings, as well as the impact of typology on the translation of numerical expressions and its impact on the inferences made by the readers of the translations.

Supplementary material. The supplementary material for this article can be found at http://doi.org/10.1017/langcog.2025.9.

Data availability statement. Data is publicly available in the following link: https://osf.io/vk3ey/?view_only=13888a2c09894928a27edb752c4eb1e7.

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