RIFL (2013) vol. 7 n. 3: 45-61
DOI 10.4396/20131205

Codability and cost in the naming of motion events

Michele I. Feist
University of Louisiana at Lafayette
feist@louisiana.edu

Abstract With the introduction of Talmy's (1985; 2000) typology for the linguistic encoding of motion events, the domain of motion event cognition has emerged as particularly tractable for the empirical examination of linguistic relativity. The current paper contributes to this literature, focusing on the differential encoding of one aspect of a motion event – manner of motion – and the potential for cognitive differences related to its encoding. When describing motion events, speakers of satellite-framed languages, such as English, have been found to be more likely to encode manner information than are speakers of verb-framed languages, such as Spanish (SLOBIN 2004). Building on this finding, the current study asks whether English speakers also experience lower cognitive costs when accessing manner information than do Spanish speakers. Pushing the connection farther, the study includes a range of manners varying in codability, allowing for a replication of the cross-linguistic correlations between codability and cost as tested within each linguistic population. The findings from both the cross-language comparisons and the within-language comparisons demonstrate a clear connection between codability and cognitive cost, suggesting an influence of language on the thought processes of speakers as they encode the motion events they see.

Keywords: Motion verbs, Manner, Codability, Cognitive cost, Linguistic relativity

0. Introduction

Does a language influence the way its speakers think about the world?[1] This question has been famously posed – and debated – for decades (BROWN & LENNEBERG 1954; GENTNER & GOLDIN-MEADOW 2003; GUMPERZ & LEVINSON 1996; ROSCH HEIDER 1972; SAPIR 1929; WHORF 1956; *inter alia*). Empirical tests of this question have been conducted across a range of semantic domains, including color (BROWN & LENNEBERG 1954; DAVIDOFF, DAVIES, & ROBERSON 1999; LUCY & SHWEDER 1979; ROSCH HEIDER 1972), spatial frames of reference (LEVINSON, KITA, HAUN, & RASCH 2002; LI & GLEITMAN 2002; MAJID, BOWERMAN, KITA, HAUN, & LEVINSON 2004; PEDERSON,

[1] I would like to thank two anonymous reviewers for their comments on this paper. I am also grateful to Paula Cifuentes Férez for her help with running the experiment in Spain, and to Paula Cifuentes Férez and Ana Rojo for their help in creating the videos used in the experiment.

DANZIGER, WILKINS, LEVINSON, KITA, & SENFT 1998) and motion events (GENNARI, SLOMAN, MALT, & FITCH 2002; HOHENSTEIN, NAIGLES, & EISENBERG 2004; NAIGLES, EISENBERG, KAKO, HIGHTER, & MCGRAW 1998; PAPAFRAGOU, MASSEY, & GLEITMAN 2002, 2006), yet the question remains unsettled.

Of particular interest in this debate has been the domain of motion event cognition, stemming from Talmy's (1985; 2000) research into the linguistic encoding of motion events. Having drawn a conceptual separation between the linguistic elements used to describe a motion event and the conceptual/semantic features of the event itself, Talmy opened the way for further inquiries into variation in the mapping between form and meaning across languages. Talmy (1985; 2000) argued that motion events involve a small set of conceptual elements: the moving object (figure); the reference object (ground); the trajectory (path); the way in which the figure moves (manner); and the situation that brought about the motion event (cause); in addition to the fact of motion *per se* (see also BERMAN & SLOBIN 1994; SLOBIN 2004; *inter alia*). He went on to introduce two typologies for the linguistic encoding of motion: first classifying languages according to the conceptual element that gets encoded along with the fact of motion in the main verb (TALMY 1985), and later classifying languages according to the linguistic element that is used to encode path, which Talmy argued to be the core element of a motion event (TALMY 2000). Researchers building on this work have gone on to show that languages do indeed differ in the preferred linguistic packaging of these conceptual elements (e.g., BERMAN & SLOBIN 1994; GENNARI et al. 2002; NAIGLES et al. 1998; PAPAFRAGOU et al. 2002, 2006; SLOBIN 1996a, *inter alia*). As a result, the domain of motion events has emerged as a tractable one in which to pose questions regarding linguistic effects on cognition.

The cross-linguistic difference in lexicalization that has attracted the most attention in this domain has been the distinction between languages that typically lexicalize the path along with the fact of motion together in the main verb (V-languages, such as Spanish) and languages that typically lexicalize the path outside the verb, in a satellite, leaving the verb free to encode a co-event such as manner (S-languages, such as English). This distinction has led to a body of research that built on the further assumption that the conceptual element that is encoded in the main motion verb is particularly codable in that language (cf., BROWN & LENNEBERG 1954), with path hypothesized to be more codable than manner in V-languages, and manner more codable than path in S-languages. If the linguistic variable of codability engenders cognitive effects, it was reasoned, then speakers of S-languages would show heightened attention to manner, while speakers of V-languages would be more attentive to path (e.g., CIFUENTES-FÉREZ & GENTNER 2006; GENNARI et al. 2002; HOHENSTEIN et al. 2004; NAIGLES & TERRAZAS 1998; PAPAFRAGOU, HULBERT, & TRUESWELL 2008; PAPAFRAGOU et al. 2002, 2006). Despite a flurry of research, the results from these studies are mixed, leaving open the question of how codability may be related to cognition in this domain.

Of particular note in Talmy's (2000) bipartite typology is the central role accorded to path, suggesting that this conceptual element may be highly codable across languages, even in languages where path is not encoded in the motion verb (IBARRETXE-ANTUÑANO 2009; TALMY 1985). Because conceptual elements may be encoded in lexical items other than the verb, the main verb provides an imperfect marker of the actual codability of individual conceptual elements of a motion event. Thus, a sole focus on the main verb may obscure the codabilities of the conceptual elements of the event. We can arrive at a clearer picture of codability by taking into account information encoded across the utterance rather than focusing on the verb alone (cf., FEIST 2010; SINHA & KUTEVA 1995). Noting this, Slobin (2004) refined Talmy's typology, positing a cline of manner salience rather than a bipartite distinction. In this view, languages differ not only according to the preferred lexicalization pattern, but also in the accessibility of a slot for manner information in the syntactic frame and, hence, languages differ in the codability of manner information.

Along with linguistic differences in the codability of manner, Slobin (2003) argued that manner information is conceptually more accessible to speakers of high manner salient languages than to speakers of low manner salient languages (see also ÖZÇALIŞKAN & SLOBIN 2003). In support of this proposal, Feist, Rojo & Cifuentes (2007) found that contextually manipulating the salience of manner influenced the ease with which speakers of low-manner-salient Spanish could access manner verbs. Furthermore, Feist and her colleagues (2007) argued that some manners of motion may be highly salient to speakers of a low-manner-salient language for cultural reasons, suggesting that the codability of manner information may also vary within a single language (see also POURCEL 2004).

Given Slobin's observations regarding the differential salience of manner across languages, combined with the inclusion of path in a basic motion event (TALMY 2000), the mixed results from research in which salience of path information is contrasted with salience of manner information are unsurprising. Frequently at issue in examinations of linguistic relativity is the question of whether codability predicts greater cognitive availability (as measured by, e.g., memory or discriminability); this issue has played out in the domain of motion events with comparisons between the codability of path and the codability of manner across languages. However, if manner is in fact differentially codable within and across languages, and, further, if there is not a tradeoff between the codability of manner and that of path (IBARRETXE-ANTUÑANO 2009), this suggests that a superior means of testing the relationship between language and cognition is to examine cognitive effects of cross-linguistic differences in the codability of a single kind of information, rather than comparing the codability of multiple kinds of information.

1. Experiment

In their reexamination of the Sapir-Whorf hypothesis from the perspective of cognitive psychology, Hunt and Agnoli (1991) argued that the computational burdens associated with accessing a given concept may differ from language to language, due in part to differences in the codability of the concept in question. In this view, cross-linguistic differences in the cognitive costs associated with accessing differentially codable concepts would be considered to be Whorfian effects, despite the fact that they do not directly bear on extra-linguistic cognition. Taking into account the differential codability of manner across languages (ÖZÇALIŞKAN & SLOBIN 2003; SLOBIN 2004), combined with the differential codability of individual manners within a language (FEIST et al. 2007; POURCEL 2004), the current study examined the costs associated with naming actions involving a variety of manners of motion. In order to examine effects of cross-linguistic differences in the salience of manner, two languages were selected for the study: high-manner-salient English and low-manner-salient Spanish (SLOBIN 1996b). In addition, the individual manners varied in the amount of effort required (POURCEL 2004) and in their cultural significance (FEIST et al. 2007), allowing for a range of codability across the depicted manners of motion. If codability is in fact related to cognitive cost, we should expect to see higher costs associated with the naming of less codable manners of motion in both languages tested. Further, due to the increased salience of manner in English relative to Spanish, we should expect to see stronger correlations between codability and cost in English than in Spanish.

1.1. Method

1.1.1. Participants

91 native English-speaking undergraduates from the University of Louisiana at Lafayette and 48 native Spanish-speaking undergraduates from the University of Murcia (Spain) volunteered or were given partial course credit for their participation in this study.

1.1.2. Materials

Twelve video-taped motion events were used for this study. The clips showed twelve different manners of motion executed along a single path (down a hall toward the camera and into a room) (see Appendix A for the set of manners used along with the most frequent lexical items used in English and in Spanish to describe each clip).

1.1.3. Procedure

The experiment took place in laboratory space at the University of Louisiana at Lafayette (English speakers) and in a computer room at the University of Murcia (Spanish speakers). The twelve video clips were shown individually in random order on a computer screen. After each clip, participants were asked to describe what the actor did, using a single word to describe the action. A custom-written computer program recorded keystrokes and response latency for each response.

1.1.4. Measures of codability

Three measures of codability were used in this study: mean length of description in phonemes (BROWN & LENNEBERG 1954; ROSCH HEIDER 1972; ZIPF 1935), the percentage of people who produced a single word description as requested (also an index of length of name), and interpersonal agreement on the label for the action (BROWN & LENNEBERG 1954; LUCY & SHWEDER 1979), as measured with Simpson's Diversity index (MAJID, GULLBERG, VAN STADEN, & BOWERMAN 2007; SIMPSON 1949). Because more codable concepts tend to receive shorter names (BROWN & LENNEBERG 1954; ROSCH HEIDER 1972), degree of codability can be indexed by the lengths of the names produced, with shorter names indicating higher codability. Relatedly, considering length of name in terms of number of words produced, codability may also be indexed by the proportion of participants who produced a single word description, with a higher proportion indicating higher codability. In addition, because speakers are more likely to agree on the labels for more codable concepts than for less codable ones (BROWN & LENNEBERG 1954), higher agreement amongst speakers on the lexical item produced for a clip indicates higher codability of the motion depicted. Thus, if the three measures are indexing codability as predicted, the hallmarks of high codability will be high interparticipant agreement, a high proportion of one-word responses, and short names. As such, we should see a significant positive correlation between agreement and the proportion of one-word responses, and significant negative correlations between both these factors and name length.

1.1.5. Measures of cognitive cost

Three measures of cognitive cost were used in this study: mean response latency (CALFEE 1975) and two measures of the rate at which participants changed their responses.
Although response latency has been treated in earlier research as a measure of codability (BROWN & LENNEBERG 1954; ROSCH HEIDER 1972), longer response latencies may also indicate greater difficulty accessing or retrieving the desired lexical item (TRAXLER 2012). For this reason, response latency is considered in the current study as a measure of cognitive cost, with longer latencies indicating higher cost.
Similarly, the more difficulty a speaker has in accessing a lexical item, the more likely they may be to realize during their response that they prefer a different lexical item to the one they began to produce. Hence, the rate at which participants changed their responses to a clip was used as an index of cognitive cost, with higher rates of change indicative of higher cost. The rate of changed responses was measured in two ways. First, I asked whether or not participants backspaced while responding to each of the clips, as backspacing allows participants to erase an initial response and replace it with a new one. However, the need to backspace can result from either a desire to change a response or a desire to correct a typographical error. Thus, a second, more stringent, measure of rate of change of response was developed. For each response, I coded whether the word presented as the final response differs from the word initially produced, or, in the case of a single letter produced and then erased with a backspace, whether the word presented as the final response begins with a different letter than that initially typed. For example, in response to the clip depicting a person walking with crutches, one participant typed "wak" followed by a backspace followed by "lking", then backspaced seven times before typing the final response of "moving"; this sequence was coded as a changed response. In contrast, in response to the same clip, another participant typed "wasl" followed by two backspaces, followed by "lking" to produce a final response of "walking". While this response was included under the first measure, rate of backspacing, under the second, more stringent measure, this was not coded as a changed response.
Because higher scores on all three measures are hypothesized to be indicative of higher cognitive cost, we should see significant positive correlations between the three measures if they are indeed indexing different aspects of the same phenomenon.

1.2. Results

1.2.1. Codability

As predicted, in English I observed a significant positive correlation between agreement and the rate of one-word responses (r = .72, p < .01) and a significant negative correlation between agreement and name length (r = -.72, p < .01).

Similarly, in Spanish I observed a significant positive correlation between agreement and the rate of one-word responses (r = .68, p < .02), and significant negative correlations between agreement and name length (r = -.69, p < .02) and between the rate of one-word responses and name length (r = -.75, p < .01). This pattern of results suggests that the three measures of codability are all indexing the same phenomenon. The results for English are summarized in Table 1; the results for Spanish, in Table 2 (see below). I turn now to the question of whether the manners of motion depicted in the clips are more codable in English than in Spanish, in line with previous typological observations.

1.2.1.1. Length of description in phonemes

The length of description varied amongst the video clips in the responses elicited in both languages. In English, the mean length of description ranged from 4.79 phonemes (for the clip depicting jogging) to 7.38 phonemes (for the clip depicting walking backwards). In Spanish the mean length of description ranged from 5.15 phonemes (for the clip depicting jogging) to 10.38 phonemes (for the clip depicting walking backwards). In keeping with Talmy's (1985, 2000) and Slobin's (2004) observations, manner was found to be more codable by this measure in English (M = 5.75) than in Spanish (M = 7.60), $t(11)$ = 4.86, p < .0005 (one-tailed). The mean lengths of description in each language for all twelve video clips are presented in Appendix B.

1.2.1.2. Percent single word descriptions

Despite the instruction to provide a description of the action in the video clip using a single word, in some cases participants responded using multiple words. As the number of words in a description is also an index of codability (BROWN & LENNEBERG 1954), it was reasoned that the percentage of participants responding with a single word as requested would provide an additional measure of codability. In keeping with Talmy's (1985, 2000) and Slobin's (2004) observations, and consistent with the results for length of description in phonemes, manner was found to be more codable by this measure in English (M = 96.34) than in Spanish (M = 82.64), $t(11)$ = 4.36, p < .001 (one-tailed). The percentages of participants in each language responding with a single word to each of the twelve video clips are presented in Appendix C.

1.2.1.3. Interparticipant agreement

An additional index of codability is the rate of interparticipant agreement on descriptions, with more highly codable concepts being more likely to be described with the same lexical items than less codable concepts (cf., BROWN & LENNEBERG 1954). Interparticipant agreement can be measured via diversity scores such as Simpson's D (MAJID et al. 2007; SIMPSON 1949), which in the current study measures the probability that two individuals sampled at random will use the same verb to describe the clip[2]. The value of Simpson's D was calculated for

[2] Simpson's D is calculated with the following formula: $D = \sum \frac{n(n-1)}{N(N-1)}$, where n is the total number of occurrences of a particular lexical item, and N is the total number of responses. D can vary

each clip in each language, yielding separate measures of interparticipant agreement amongst speakers of English and amongst speakers of Spanish for each clip. In English, the scores for Simpson's D ranged from .08 (for the clips depicting a half-twirl while walking and walking in high heels) to .98 (for the clip depicting crawling). In Spanish the scores ranged from .04 (for the clip depicting walking in high heels) to .88 (for the clip depicting crawling). In keeping with Talmy's (1985, 2000) and Slobin's (2004) observations and with the data on length of description, manner was found to be more codable in English (M = .43) than in Spanish (M = .29) by this measure, $t(11) = 1.91$, $p < .05$ (one-tailed). The values for Simpson's D for each of the video clips in each language are presented in Appendix D.

1.2.2. Cognitive cost

As predicted, in English I observed significant positive correlations between response latency and the rate at which participants backspaced (r = .79, p < .005), between response latency and the rate at which participants changed their responses (r = .77, p < .005), and between the rates of backspacing and of changed responses (r = .78, p < .005) (see Table 1 below). Similarly, in Spanish I observed significant positive correlations between response latency and the rate at which participants backspaced (r = .65, p < .05) and between the rates of backspacing and of changed responses (r = .68, p < .05) (see Table 2 below). This pattern of results suggests that the three measures of cost are all indexing the same phenomenon. The results for English are summarized in Table 1; the results for Spanish, in Table 2. I turn now to the question of whether the manners of motion depicted in the clips are associated with lower cost in English than in Spanish, as would be predicted if higher codability engenders lower cognitive cost.

1.2.2.1. Response latency

Consistent with the prediction that higher salience of manner information would lead to lower cognitive cost when accessing manner information (SLOBIN 2003), I found that response latencies in English (M = 4.86 seconds) were shorter than in Spanish (M = 9.01 seconds), $F(1,137) = 59.32$, $p < .0001$.

1.2.2.2. Rate of changed response

In keeping with the findings for response latencies, which suggested lower cognitive cost overall for English speakers than for Spanish speakers, I found that English speakers backspaced during a lower proportion of their responses (M = .20) than did Spanish speakers (M = .26), $F(1,138) = 5.34$, $p < .05$. Consistent with this result, I also found that English speakers changed their responses less frequently (M = .04) than did Spanish speakers (M = .07), $F(1,137) = 5.07$, $p < .05$.

1.2.3. Relating codability and cost

One way to probe the relation between codability and cost is to ask whether cross-linguistic differences in codability are paralleled by cross-linguistic differences in

between 0 and 1, with higher values of D indicating greater interpersonal agreement and hence greater codability.

cognitive cost (see Discussion), as suggested by the differences in cognitive cost observed between speakers of English and speakers of Spanish. In addition, however, if codability is in fact related to cognitive cost, we should expect to see higher costs associated with the naming of less codable manners of motion in both languages tested. Thus, the current section looks directly at correlations between codability and cost, asking whether higher codability may lead to lower cognitive cost within each language group.

While higher scores on all three measures of cognitive cost indicate higher cost, the relation between codability and its measures is less straightforward, as detailed above. To recap, a high proportion of participants responding with a single word and high interparticipant agreement both index high codability. However, when looking at length of name it is *shorter* names (rather than longer ones) that index high codability. Hence, if high codability leads to low cognitive cost we should see significant negative correlations between agreement and the three measures of cost and between the proportion of participants responding with a single word and the three measures of cost, but we should see significant positive correlations between name length and the three measures of cognitive cost.

Consistent with these predictions, in English I observed significant negative correlations between agreement and each of the measures of cognitive cost (agreement and response latency: $r = -.66$, $p < .05$; agreement and rate of backspacing: $r = -.80$, $p < .005$; agreement and rate of changed response: $r = -.75$, $p < .01$). Similarly, I observed significant negative correlations between the proportion of participants providing a single word response and each of the measures of cognitive cost (rate of single word responses and response latency: $r = -.92$, $p < .001$; rate of single word responses and rate of backspacing: $r = -.79$, $p < .005$; rate of single word responses and rate of changed responses: $r = -.74$, $p < .01$). Finally, I observed significant positive correlations between length of name and rate of backspacing ($r = .66$, $p < .05$) and between length of name and rate of changed responses ($r = .81$, $p < .005$). In all, for the English language data, eight of the nine tested correlations between codability and cost were significant at the .05 alpha level and in the predicted direction if high codability leads to low cognitive cost, suggesting a strong relation between codability and cost in this domain for speakers of English. These results are summarized in Table 1.

In Spanish I observed significant negative correlations between the proportion of participants providing a single word response and each of the measures of cognitive cost (rate of single word responses and response latency: $r = -.89$, $p < .0001$; rate of single word responses and rate of backspacing: $r = -.74$, $p < .01$; rate of single word responses and rate of changed responses: $r = -.72$, $p < .01$). In addition, I observed a significant positive correlation between length of name and response latency ($r = .80$, $p < .005$). Finally, I observed marginal negative correlations between agreement and two of the measures of cognitive cost (agreement and response latency: $r = -.55$, $p = .062$; agreement and rate of changed response: $r = -.53$, $p = .077$). In all, for the Spanish language data, four of the nine tested correlations between codability and cost were significant at the .05 alpha level and in the predicted direction if high codability leads to low cognitive cost, while another two were marginal and in the predicted direction. This pattern of findings suggests that there is a relation between codability and cost in this domain for speakers of Spanish, albeit a weaker one than that observed for speakers of English. These results are summarized in Table 2.

Table 1: Correlations amongst the measures of codability and the measures of cost in the English data

	Agreement	Single word	Name length	Response latency	Backspace
Agreement	-------				
Single word	r = .72**	-------			
Name length	r = -.72**	r = -.50	-------		
Response latency	r = -.66*	r = -.92***	r = .48	-------	
Backspace	r = -.80**	r = -.79**	r = .66*	r = .79**	-------
Changed response	r = -.75**	r = -.74**	r = .81**	r = .77**	r = .78**

*Note *p<.05, **p<.01, ***p<.001

Table 2: Correlations amongst the measures of codability and the measures of cost in the Spanish data

	Agreement	Single word	Name length	Response latency	Backspace
Agreement	-------				
Single word	r = .68*	-------			
Name length	r = -.69*	r = -.75**	-------		
Response latency	r = -.55	r = -.89***	r = .80**	-------	
Backspace	r = -.45	r = -.74**	r = .32	r = .65*	-------
Changed response	r = -.53	r = -.72**	r = .41	r = .49	r = .68*

*Note *p<.05, **p<.01, ***p<.001

2. Discussion

Does a language influence the way its speakers think about the world? One way that we can evaluate this question empirically is to ask whether there are differences in cognitive cost when accessing a concept that are related to differences in the linguistic codability of the concept (HUNT & AGNOLI 1991). The relation between codability and cost can be probed in two ways, focusing either on an examination of cross-lingusitic differences in codability or on an examination of differences in codability within a single language. In both cases, the relation is fleshed out with a subsequent examination of any concomitant differences in cognitive cost. Taking the semantic domain of motion events as a testing ground, the current paper probes the relation between codability and cost for a single semantic dimension – manner of motion – investigated both within and between languages.

Since the introduction of Talmy's (1985; 2000) typological observations regarding the lexicalization of motion events, cross-linguistic differences in the lexical encoding of the conceptual elements of a motion event have been the focus of much research attention (BERMAN & SLOBIN 1994; STRÖMQVIST & VERHOEVEN 2004; *inter alia*). One important finding that has emerged from these studies is that languages differ in the salience and codability of manner of motion (SLOBIN 2004), with high-manner-salient languages evidencing relatively large manner verb vocabularies, the members of which are both frequently used and early to be acquired (SLOBIN 1996b; 2003). In addition to being variable cross-linguistically, the codability of individual manners of motion demonstrates variation within languages, with culturally significant manners (FEIST et al. 2007), as well as effortful manners and those that involve an instrument (e.g., *skating*) (POURCEL 2004) evidencing higher codability than do other manners of motion. Based on these observations, manner of motion emerges as a particularly illuminating domain in which to examine the relation between codability of a concept and cognitive cost associated with accessing the concept.

In order to probe this relation, a set of twelve video-taped motion events was created, each with a different manner of motion, with the intention that the manners would fall along a continuum from highly codable to minimally so. These video clips were then presented to speakers of two languages that differ in the overall codability of manner of motion, English and Spanish (SLOBIN 1996b), for a motion description task. Confirming previous typological observations regarding the two languages, it was found that manner of motion was indeed more codable in English than in Spanish, across three measures of codability. In addition, the video clips were found to evidence a range of codability within each language, thus enabling within-language tests of the correlation between codability and cost that paralleled the correlation tested between languages.

We turn first to the cross-linguistic comparison, asking whether the codability difference between English and Spanish is paralleled by a difference in cognitive cost. Consistent with the prediction that higher codability of manner information would lead to lower cognitive cost when accessing manner information, I observed differences between English and Spanish across three measures of cognitive cost, whereby English speakers evidenced lower cognitive costs associated with accessing and using manner verbs than did Spanish speakers. This result suggests that the language one speaks may indeed affect the way in which one views the world, as indexed by the difficulty associated with accessing information about observed events.

Turning now to the within-language comparisons, we ask whether speakers experience lower cognitive cost associated with the access and use of highly codable manners of motion as compared to less codable manners of motion, regardless of their native language. Once again, a correlation between codability and cost emerges, whereby more codable manners of motion were associated with lower cognitive cost for speakers of both languages. The replication of the codability and cost correlations within each language group points to a strong role for codability in the observed cross-linguistic differences in cost.

The domain of motion event cognition and its association with the cross-linguistic variation in the lexicalization of motion events have been the focus of a great deal of attention in the literature on linguistic relativity (CIFUENTES-FÉREZ & GENTNER 2006; GENNARI et al. 2002; HOHENSTEIN et al. 2004; NAIGLES & TERRAZAS 1998; PAPAFRAGOU et al. 2008; PAPAFRAGOU et al. 2002, 2006; *inter alia*), with much of this research focused on comparing attention to manner with attention to path across speakers of typologically different languages. This body of research has resulted in a mixed set of findings, and leaves open the question of whether there are Whorfian effects in this domain. One possible reason for the lack of a clear answer is that, in focusing on two conceptual elements, prior studies may have in actuality been asking two Whorfian questions rather than one. Because the two conceptual elements each display their own pattern of cross-linguistic variation (IBARRETXE-ANTUÑANO 2009; SLOBIN 1996a, 2004), the answers will not necessarily converge, leading to inconsistencies in the pattern of findings.

Unlike these studies, the current study asked whether Whorfian effects might be found when comparing linguistic and cognitive variables associated with a single conceptual element of motion events, manner of motion, which has been shown to vary in codability both within and between languages. Comparisons between the codability patterns and the cost patterns associated with this single conceptual element revealed clear Whorfian effects, whereby codability correlated with cost within each language group and across the two languages, suggesting that the particulars of a language do indeed influence the way its speakers think. Furthermore, the combination of the current study's finding of a language effect on cognitive processing and previous mixed findings suggests that the influences that language may have on thought are subtle and complex. Navigation of these complexities may require a series of focused studies akin to the present study, in which effects of individual patterns of linguistic behavior are examined in isolation. In this way, a clear picture of the ways in which language may influence thought may be built up, step by step.

References

BERMAN, Ruth A. & SLOBIN, Dan I. (1994), *Relating events in narrative: A crosslinguistic developmental study,* Hillsdale, NJ, Lawrence Erlbaum.

BROWN, Roger W. & LENNEBERG, Eric H. (1954), «A study in language and cognition», in *Journal of Abnormal and Social Psychology,* n. 49, pp. 454-462.

CALFEE, Robert C. (1975), *Human experimental psychology*, New York, Holt, Rinehart and Wilson.

CIFUENTES-FÉREZ, Paula & GENTNER, Dedre (2006), «Naming motion events in Spanish and English», in *Cognitive Linguistics,* n. 17, pp. 443-462.

DAVIDOFF, Jules, DAVIES, Ian & ROBERSON, Debi (1999), «Colour categories in a stone-age tribe», in *Nature,* n. 398, pp. 203-204.

FEIST, Michele I. (2010), «Motion through syntactic frames», in *Cognition,* n. 115, pp. 192-196.

FEIST, Michele I, ROJO, Ana & CIFUENTES, Paula (2007), «Salience and acceptability in Spanish manner verbs: A preliminary view», in *International Journal of English Studies*, n. 7, pp. 137-148.

GENNARI, Silvia P., SLOMAN, Steven A., MALT, Barbara C. & FITCH, W. Tecumseh (2002), «Motion events in language and cognition», in *Cognition,* n. 83, pp. 49-79.

GENTNER, Dedre & GOLDIN-MEADOW, Susan (eds) (2003), *Language in mind: Advances in the study of language and cognition*, Cambridge, MA, MIT Press.

GUMPERZ, J. J. & LEVINSON, Stephen C. (eds) (1996), *Rethinking linguistic relativity*, Cambridge, Cambridge University Press.

HOHENSTEIN, Jill M., NAIGLES, Letitia R. & EISENBERG, Ann R. (2004), *Keeping verb acquisition in motion: A comparison of English and Spanish*, in HALL, D. & WAXMAN, S. (eds), *Weaving a lexicon*, Cambridge, MA, MIT Press, pp. 569-602.

HUNT, Earl & AGNOLI, Franca (1991), «The Whorfian hypothesis: A cognitive psychology perspective», in *Psychological Review,* n. 98, pp. 377-389.

IBARRETXE-ANTUÑANO, Iraide (2009), *Path salience in motion events*, in GUO, J., LIEVEN, E., BUDWIG, N., ERVIN-TRIPP, S., NAKAMURA, K. & ÖZÇALIŞKAN, Ş. (eds), *Crosslinguistic approaches to the psychology of language: Research in the tradition of Dan Isaac Slobin*, New York, Taylor and Francis, pp. 403-414.

LEVINSON, Stephen C., KITA, Sotaro, HAUN, Daniel B. M. & RASCH, Björn H. (2002), «Returning the tables: Language affects spatial reasoning», in *Cognition,* n. 84, pp. 155-188.

LI, Peggy & GLEITMAN, Lila (2002), «Turning the tables: Language and spatial reasoning» in *Cognition,* n. 83, pp. 265-294.

LUCY, John A. & SHWEDER, Richard A. (1979), «Whorf and his critics: Linguistic and nonlinguistic influences on color memory», in *American Anthropologist,* n. 81, pp. 579-615.

MAJID, Asifa, BOWERMAN, Melissa, KITA, Sotaro, HAUN, Daniel B. M. & LEVINSON, Stephen C. (2004), «Can language restructure cognition? The case for space», in *Trends in Cognitive Science,* n. 8, pp. 108-114.

MAJID, Asifa, GULLBERG, Marianne, VAN STADEN, Miriam & BOWERMAN, Melissa (2007), «How similar are semantic categories in closely related languages? A comparison of cutting and breaking in four Germanic languages», in *Cognitive Linguistics,* n. 18, pp. 179-194.

NAIGLES, Letitia R., EISENBERG, Ann R., KAKO, Edward T., HIGHTER, Melissa & MCGRAW, Nancy (1998), «Speaking of motion: Verb use in English and Spanish», in *Language and Cognitive Processes,* n. 13, pp. 521-549.

NAIGLES, Letitia R. & TERRAZAS, Paula (1998), «Motion-verb generalizations in English and Spanish: Influences of language and syntax», in *Psychological Science,* n. 9, pp. 363-369.

ÖZÇALIŞKAN, Şeyda & SLOBIN, Dan I. (2003), *Codability effects on the expression of manner of motion in Turkish and English*, in ÖZSOY, A.S., AKAR, D., NAKIPOĞLU-DEMIRALP, M., ERGUVANLI-TAYLAN, E. & AKSU-KOÇ, A. (eds), *Studies in Turkish linguistics*, Istanbul, Boğaziçi University Press, 259-270.

PAPAFRAGOU, Anna, HULBERT, Justin & TRUESWELL, John (2008), «Does language guide event perception? Evidence from eye movements» in *Cognition,* n. 108, pp. 155-184.

PAPAFRAGOU, Anna, MASSEY, Christine & GLEITMAN, Lila (2002), «Shake, rattle, 'n' roll: The representation of motion in language and cognition», in *Cognition,* n. 84, pp. 189-219.

PAPAFRAGOU, Anna, MASSEY, Christine & GLEITMAN, Lila (2006), «When English proposes what Greek presupposes: The cross-linguistic encoding of motion events», in *Cognition*, n. 98, pp. B75-B87.

PEDERSON, Eric, DANZIGER, Eve, WILKINS, David, LEVINSON, Stephen C., KITA, Sotaro & SENFT, Gunter (1998), «Semantic typology and spatial conceptualization», in *Language,* n. 74, pp. 557-589.

POURCEL, Stephanie (2004), *Motion in language and cognition*, in SOARES DA SILVA, A., TORRES, A. & GONÇALVES, M. (eds), *Linguagem, cultura e cognição: Estudos de lingüistica cognitiva*, Coimbra, Portugal, Almedina, pp. 75-91.

ROSCH HEIDER, Eleanor (1972), «Universals in color naming and memory», in *Journal of Experimental Psychology*, n. 93, pp. 10-20.

SAPIR, Edward (1929), «The status of linguistics as a science», in *Language,* n. 5, pp. 207-214.

SIMPSON, E. H. (1949), «Measurement of diversity», in *Nature,* n. 163, p. 688.

SINHA, Chris & KUTEVA, Tania (1995), «Distributed spatial semantics», in *Nordic Journal of Linguistics,* n. 18, pp. 176-199.

SLOBIN, Dan I. (1996a), *From 'thought and language' to 'thinking for speaking'*, in GUMPERZ, J. J. & LEVINSON, S.C. (eds), *Rethinking linguistic relativity*, Cambridge, UK, Cambridge University Press, pp. 70-96.

SLOBIN, Dan I. (1996b), *Two ways to travel: Verbs of motion in English and Spanish*, in SHIBATANI, M. & THOMPSON, S.A. (eds), *Grammatical constructions: Their form and meaning*, Oxford, UK, Clarendon Press, pp. 195-220.

SLOBIN, Dan I. (2003), *Language and thought online: Cognitive consequences of linguistic relativity*, in GENTNER, Dedre & GOLDIN-MEADOW, Susan (eds), *Language in mind: Advances in the study of language and cognition*, Cambridge, MA, MIT Press, pp. 157-192.

SLOBIN, Dan I. (2004), *The many ways to search for a frog: Linguistic typology and the expression of motion events*, in STRÖMQVIST, S. & VERHOEVEN, L. (eds), *Relating events in narrative: Typological and contextual perspectives*, Mahwah, NJ, Lawrence Erlbaum Associates, pp. 219-257.

STRÖMQVIST, S. & VERHOEVEN, L. (2004), *Relating events in narrative: Typological and contextual perspectives*, Mahwah, NJ, Lawrence Erlbaum Associates.

TALMY, Leonard (1985), *Lexicalization patterns: semantic structure in lexical forms*, in SHOPEN, T (ed.), *Language typology and syntactic description*, Cambridge UK, Cambridge University Press, 57-149.

TALMY, Leonard (2000), *Toward a cognitive semantics,* Cambridge, MA, MIT Press.

TRAXLER, Matthew J. (2012), *Introduction to psycholinguistics: Understanding language science*, West Sussex, Wiley-Blackwell.

WHORF, Benjamin Lee (1956), *Language, thought, and reality: Selected writings of Benjamin Lee Whorf*, Cambridge, MA, MIT Press.

ZIPF, G. K. (1935), *The psycho-biology of language,* Boston, Houghton Mifflin.

RIFL (2013) vol. 7 n. 3: 45-61
DOI 10.4396/20131205

Appendix A: Most frequent lexical items used in the description for each video clip in each language

Manner	English	Spanish
Crawling	*Crawling*	*Gatear*
Jogging	*Running*	*Correr*
Walking	*Walking*	*Andar*
Hopping	*Hopping*	*Cojear*
Skipping	*Skipping*	*Saltar*
Twirling	*Spinning*	*Girar*
With crutches	*Limping*	*Cojear*
In high heels	*Stomping*	*(Dar) pasitos*
Dancing	*Tapping/tap dancing*	*Bailar*
Sliding feet	*Dragging (his) feet*	*Andar*
Moonwalking	*Backwards*	*Andar*
Half-twirl while walking	*Twisting*	*Andar*

Appendix B: Mean length of description in phonemes for each video clip

Manner	English length	Spanish length
Crawling	5.74	6.10
Jogging	4.79	5.15
Walking	4.93	6.42
Hopping	4.93	7.81
Skipping	5.69	7.13
Twirling	5.55	6.94
With crutches	6.04	8.56
In high heels	6.14	8.40
Dancing	5.69	6.77
Sliding feet	5.81	8.46
Moonwalking	7.38	10.38
Half-twirl while walking	6.27	9.08

RIFL (2013) vol. 7 n. 3: 45-61
DOI 10.4396/20131205

Appendix C: Percent of participants providing a single word description for each video clip

Manner	English	Spanish
Crawling	100	97.92
Jogging	100	100
Walking	98.90	100
Hopping	98.90	77.08
Skipping	100	89.58
Twirling	98.90	85.42
With crutches	96.70	77.08
In high heels	93.41	70.83
Dancing	94.51	93.75
Sliding feet	94.51	72.92
Moonwalking	86.81	62.50
Half-twirl while walking	93.41	64.58

RIFL (2013) vol. 7 n. 3: 45-61
DOI 10.4396/20131205

Appendix D: Simpson's D for each clip in English and in Spanish

Manner	English diversity index	Spanish diversity index
Crawling	0.97802198	0.87766
Walking	0.83125763	0.562943
Skipping	0.81318681	0.353723
Hopping	0.81123321	0.343972
Jogging	0.48376068	0.268617
Twirling	0.32820513	0.237589
Dancing	0.24639805	0.216312
Sliding feet	0.18339438	0.177305
Moonwalking	0.15531136	0.144504
With crutches	0.14261294	0.140957
Half-twirl while walking	0.08156288	0.133865
In high heels	0.08107448	0.04344