

Thoughts in Motion

The Role of Long-Term L1 and Short-Term L2 Experience when Talking and Thinking of Caused Motion

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Abstract

This thesis is about whether language affects thinking. It deals with the linguistic relativity hypothesis, which proposes that the language we speak influences the way we think. This hypothesis is investigated in the domain of caused motion (e.g., ‘The man rolled the tyre into the garage’), by looking at Spanish and Swedish, two languages that show striking differences in how motion events are encoded. The thesis consists of four studies. The first two focus on native speakers of Spanish and Swedish. *Study I* compares how Spanish and Swedish speakers describe the same set of caused motion events, directing the spotlight at how variable the descriptions are in each language. The results confirm earlier findings from semantic typology regarding the dominant ways of expressing the events in each language: Spanish behaves like a verb-framed language and Swedish like a satellite-framed language (Talmy, 2000). Going beyond previous findings, the study demonstrates—using the tools of entropy and Monte Carlo simulations—that there is markedly more variability in Spanish than in Swedish descriptions. *Study II* tests whether differences in how Spanish and Swedish speakers describe caused motion events are reflected in how they think about such events. Using a novel similarity arrangement task, it is found that Spanish and Swedish speakers partly differ in how they represent caused motion events if they can access language during the task. However, the differences disappear when the possibility to use language is momentarily blocked by an interference task. The last two studies focus on Swedish learners of Spanish as a second language (L2). *Study III* explores how Swedish learners (compared to native Spanish speakers) adapt their Spanish motion descriptions to recently encountered input. Using insights from the literature on structural priming, we find that Swedish learners initially expect to encounter in their L2, Spanish, those verb types that are typical in Swedish (manner verbs like ‘roll’) but that, with increasing proficiency, their expectations become increasingly attuned to the typical Spanish pattern of using path verbs (like ‘enter’). These expectations are reflected in the way L2 learners adapt their own production to the Spanish input. *Study IV* asks whether recent linguistic experience in an L2 can affect how L2 learners think about motion events. It is found that encountering motion descriptions in the L2 that emphasize different types of information (path or manner) leads L2 speakers to perceive similarity along different dimensions in a subsequent similarity arrangement task. Taken together, the thesis argues that the study of the relation between language and thought affords more valuable insights when not posed as an either-or question (i.e., does language affect thought or not?). In this spirit, the thesis contributes to the wider aim of investigating the conditions under which language does or does not affect thought and explores what the different outcomes tell us about language, thought, and the intricate mechanisms that relate them.

Keywords: *Linguistic relativity, language and thought, conceptualization, thinking for speaking, semantic typology, lexicalization patterns, events, caused motion, bilingualism, second language acquisition, transfer, adaptation, priming, Spanish, Swedish.*

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Guillermo Montero-Melis
Stockholm, May 2017

The present thesis is based on the following studies:

- I. Montero-Melis, G. (under review). Speakers in motion: The role of speaker variability in motion encoding.
- II. Montero-Melis, G., & Bylund, E. (2016). Getting the ball rolling: The cross-linguistic conceptualization of caused motion. *Language and Cognition*, 1–27. <https://doi.org/10.1017/langcog.2016.22>
- III. Montero-Melis, G. (manuscript). Non-native (and native) adaptation to recent input during motion event lexicalization.
- IV. Montero-Melis, G., Jaeger, T. F., & Bylund, E. (2016). Thinking is modulated by recent linguistic experience: Second language priming affects perceived event similarity. *Language Learning*, 66(3), 636–665. <https://doi.org/10.1111/lang.12172>

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When you are studying any matter, or considering any philosophy, ask yourself only what are the facts and what is the truth that the facts bear out. Never let yourself be diverted either by what you wish to believe or by what you think would have beneficent social effects if it were believed. But look only, and solely, at what are the facts.

—Bertrand Russell, 1959

In 2015, after a lively public debate (Milles, 2011, 2013), the Swedish Academy admitted the pronoun *hen* into *Svenska Akademiens ordlista*, the official list of Swedish words. *Hen* is a gender-neutral pronoun, a word used to refer to a single third person of unspecified gender. The word was a novel addition to a pronoun system that for centuries had merely contained a female (*hon* ‘she’) and a male version (*han* ‘he’), as in English. One of the arguments in favour of adopting the word *hen* was that it would change how we think about people, leading to less gender-stereotypical thinking and making it easier to abstract away from gender when this dimension is irrelevant (cf. Wojahn, 2015). Others maintained that using the word *hen* would have no effect on how we think (Parkvall, 2012). This was a public discussion about whether language affects thought—at times, a heated discussion about linguistic relativity.¹

The present thesis deals with the linguistic relativity hypothesis—the proposal that the language we speak affects the way we think—although not as it relates to the use of the gender-neutral pronoun *hen*. Rather, this thesis explores the hypothesis in the domain of motion in Spanish and Swedish. These two languages show a curious difference in this regard. Were you to show the very same scene to a random Spanish speaker and a random Swedish speaker, the latter would typically describe it as *Mannen rullade däcket in i garaget* ‘The man rolled the tyre into the garage,’ whereas the former would likely express it as *El hombre entró en el garaje con la rueda* ‘The man entered the garage with the tyre.’ While the Swedish description conveys how the man was making the tyre move (he was making it roll), this

¹ Of course, other arguments that matter in this debate are largely independent of whether language affects thought (see Pinker, 1994, 2014).

information would be lost in the Spanish version. The question that arises is this: Does this variation in speaking of an event reflect a difference in how Spanish and Swedish speakers think of that event? Does speaking in one way or the other change the way we think about such situations?

Linguistic relativity can be stripped down to two essential claims. The first is aimed at the level of language; the other targets the level of thought:

1. *Level of language*: There are systematic differences between languages in how they carve up the world.
2. *Level of thought*: Linguistic categories influence how people think, and, therefore, speaking different languages will lead to differences in thinking.

These two claims are too general to be proven right or wrong in the absolute. Any investigation into linguistic relativity needs to make these claims concrete so as to illuminate specific facets of how language relates to thought—the present thesis also proceeds in this fashion.

The first aim of the thesis is to examine the evidence for and against linguistic relativity in the domain of caused motion by comparing native speakers of Spanish and Swedish, regarding both how they describe caused motion events and how they judge similarity between these events. This raises a question about whether the kind of long-term linguistic experience we acquire in our native language affects the mental categories we use for thinking. *Studies I* and *II* were undertaken to answer this question.

The second part of the thesis (*Studies III* and *IV*) broadens the purview of linguistic relativity. Quite generally, linguistic relativity is a hypothesis on how *experience* with language may influence the ways in which we think. Most people on the planet speak more than one language (Grosjean, 2012); thus, our linguistic experience encompasses, not only use of our native language, but also that of additional languages we learn throughout our lives. The past two decades have witnessed a growing interest in questions about how learning a second language (L2) might lead to restructuring the conceptual categories acquired through our native language. By far the dominant focus has been on the effects of long-term L2 learning, asking if years of L2 exposure eventually lead to target-like patterns of expression in the L2 and if this is paralleled by changes in conceptual representation (e.g., Athanasopoulos, 2011a; Pavlenko, 2005). But what happens *immediately* upon hearing a motion description in the L2? What happens in the mind of a Swedish learner of Spanish who hears a Spanish description that is quite unlike the one she would expect to hear in Swedish? These are questions about how short-term experience in an L2 affects how we speak and think in an L2. They are addressed in *Studies III* and *IV*.

Table 1. Overview of the four studies collected in the thesis.

Study	Population	Level	General question
I	Native Spanish and native Swedish speakers	Language	How are caused motion events described in Spanish and Swedish?
II	Native Spanish and native Swedish speakers	Thought	Are cross-linguistic differences in language correlated with cross-linguistic differences in thinking?
III	Swedish learners of L2 Spanish and native Spanish speakers	Language	How does short-term linguistic exposure in the L2 affect L2 speakers' motion descriptions?
IV	Swedish learners of L2 Spanish	Thought	Does recent linguistic exposure in the L2 affect how L2 speakers think about motion events?

Table 1 offers an overview of the four studies that make up this thesis. In the remainder of this introductory chapter, I will present the linguistic relativity hypothesis in general (section 1), then zoom into the domain of motion events (section 2). I will then recapitulate the questions of the thesis (section 3), summarize the individual studies (section 4) and, finally, discuss the contributions of the thesis (section 5).

1. Linguistic relativity

Language and thought sometimes seem intimately related: we may feel we understand our thoughts only once we have been able to verbalize them. At other times language and thought appear detached: we are experiencing a thought, but there is no way of putting words to it; as soon as we say a sentence, we realize that it was not at all what we meant. Or a thought may come to us as an image, without any mediation of language whatsoever. These familiar situations illustrate that language and thought are not the same thing; yet they are related in subtle ways. Linguistic relativity considers the possibility that language is not merely a reflection of our thoughts, but that it actually has a part in shaping them.²

Linguistic relativity has a long lineage, and so a historical context will first be sketched (section 1.1).³ We will then move on to modern formulations of linguistic relativity (1.2), and, finally, we will consider why it is both

² As a friend notes, “it is interesting that even in the reflection metaphor, i.e. that language is a mirror image of thought, the shape of the mirror may influence the reflection, e.g. if it is convex” (F. Marco, personal communication, 25 April 2017).

³ There are many historical treatments of linguistic relativity (see Everett, 2016; Koerner, 1992; Leavitt, 2011; Lee, 1996; Lucy, 1992b; Penn, 1972).

natural and theoretically promising to take into account speakers of more than one language (1.3).

1.1 Historical background

The idea of linguistic relativity, also known as the Whorfian hypothesis or the Sapir-Whorf hypothesis, is largely known to the layman. This neither makes it true nor false, but it does show that linguistic relativity has a long tradition. It is generally Benjamin Lee Whorf (1897–1941) who is credited with the notion that language shapes thinking and that the world appears differently to speakers of different languages *by virtue of their language*. In a memorable passage, Whorf proclaims:

We dissect nature along lines laid down by our native languages. The categories and types we isolate from the world of phenomena we do not find there because they stare every observer in the face; on the contrary, the world is presented in a kaleidoscopic flux of impressions which has to be organized by our minds—and this means largely by the linguistic systems in our minds. We cut nature up, organize it into concepts, and ascribe significances as we do, largely because we are parties to an agreement to organize it in this way—an agreement that holds throughout our speech community and is codified in the patterns of our language. [...] We are thus introduced to a new principle of relativity, which holds that all observers are not led by the same physical evidence to the same picture of the universe, unless their linguistic backgrounds are similar, or can in some way be calibrated. (Whorf, 1956a, pp. 213–214)

Much of the philosophical underpinnings of linguistic relativity, however, can already be found in the work of 19th century German philosophers of language: Herder, Schlegel and Humboldt spelled out the assumption—later rediscovered by Whorf, arguably through Sapir—that language not only reflects, but actually has the power to shape thought (Forster, 2011). The work of Wilhelm von Humboldt (1767–1835) is notable in this respect. His stunning empirical interest in linguistic diversity led him to study more than two hundred genealogically diverse languages in his writings. Humboldt’s research programme of linguistic diversity was motivated by an interest in the study of human *thought* (Forster, 2011). For today’s reader, two aspects of Humboldt’s quest seem both bold and anachronistic. For one thing, Humboldt looks for the national essence of a people in their language, as when he states: “From each language, conclusions can therefore be drawn about the character of a nation” (Humboldt, 1848, p. 205, my translation).⁴

⁴ Original: “Aus jeder Sprache lässt sich daher auf den Nationalcharakter zurückschliessen.”

For another, Humboldt assumes a theory of linguistic evolution from primitive to civilized languages, which he believes to be embodied in structural aspects of languages. For example, after having reported that a certain Brazilian language uses the same word to express the meanings ‘his father,’ ‘he has a father’ and simply ‘father,’ Humboldt draws the following startling conclusion: “The nation which makes use of such a language can therefore in many respects be sensible, skilful and smart, but what cannot emerge from a language built in such a way is a free and pure development of ideas, pleasure for formal thinking” (Humboldt, 1848, p. 279, my translation).⁵ Humboldt’s linear theory of how languages evolve from primitive to civilized is not only problematic for the coarseness and subjectivity of these notions, it is also at odds with modern theories of language change, which hold that language structures are emergent (e.g., Bybee & Dahl, 1989; Bybee & Hopper, 2001) and that languages are complex adaptive systems (Beckner et al. 2009), affected by the continuous interplay between human cognitive abilities and socio-cultural dynamics of inter-speaker communication, rather than being the result of a simple linear process.

In Whorf’s formulation of linguistic relativity a century later, all ideas about the superiority of “civilized” over “primitive” languages were out of the picture. Whorf followed the Boasian tradition in challenging a Eurocentric view of the world and of languages—a tradition that celebrated the richness of these supposedly primitive languages; Bauman and Briggs illustrate it thus: “[Boas] challenged a prime conceit of Euro-American elites in arguing that the grammatical subtleties of many ‘primitive languages’ can make that epitome of linguistic precision and elegance, Latin, ‘seem crude’” (Bauman & Briggs, 2003, p. 257). Whorf’s writings, if anything, are condescending towards European languages (which he groups under the label “Standard Average European”). What Whorf does inherit from Humboldt is both a theoretical conviction that language and thought are intimately inter-related and a methodological principle that leads him to draw conclusions about how people think from observing how they speak.

Both Humboldt and Whorf can be said to be part of a greater anthropological tradition, in which culture, language and thought are seen as interdependent (Leavitt, 2011). This stands in contrast to the discipline of psychology, which instead seeks to unveil the commonalities in human cognition across cultures (and languages). When psychologists in the 1950s took an interest in linguistic relativity, their main criticism of Whorf was that he

⁵ Original: “Die Nation, die sich dieser Sprache bedient, kann darum in vieler Rücksicht verständig, gewandt und lebensklug seyn, aber freie und reine Ideenentwicklung, Gefallen am formalen Denken, kann aus einem solchen Sprachbau nicht hervorgehen.”

made no principled distinction between how people speak and how they think. The notions of language and thought are often conflated in Whorf's work, as they were in Humboldt's. To claim that differences in language bring about differences in thinking, psychologists argued, it is necessary to show empirical evidence beyond language, namely, evidence that shows differences in *thinking* (R. W. Brown & Lenneberg, 1954; Greenberg, 1954). Otherwise the argument becomes circular, as humorously pointed out by Pinker: "Apaches speak differently, so they must think differently. How do we know that they think differently? Just listen to the way they speak!" (Pinker, 1994, p. 61).

The interest in linguistic relativity, however, did not take off among psychologists during the following decades. This can be explained by the "nativist turn," that is, the rise and dominance of ideas about linguistic nativism and the modularity of mind. Linguistic nativism (e.g., Chomsky, 1959, 1965) held that linguistic structure was part of our biological endowment, so that variation between languages was merely superficial, and that a single universal grammar underlay all languages beneath the surface. Linguistic nativism radically shifted the focus away from linguistic diversity (which, recall, is one of the two central claims in linguistic relativity) as an interesting fact per se. The scientific quest then became to find the common denominator between languages, without being beguiled by their apparent differences. Theories of the modularity of mind (e.g., Fodor, 1985) equally delegitimized research into linguistic relativity. These theories hold that the human mind consists of encapsulated, highly specialized modules, which do not directly communicate among one another. Since language was perceived to be a prime candidate for such a module, it followed that language could not in any significant way influence thought (Fodor, 1985).

It should be pointed out that linguistic nativism and modularity are not necessarily in conflict with any version of linguistic relativity. For instance, even if differences between languages were "merely" superficial, they would nonetheless exist, at least at the surface (see Evans & Levinson, 2009, for a criticism of differences being 'merely superficial'). Since even extreme versions of modularity hold that information from the modules needs to be integrated at some level, there would in principle be some room for effects of language on thinking. Nonetheless, anything vaguely reminiscent of linguistic relativism was for many decades an anathema, as evidenced by Fodor's visceral animosity when he writes: "I hate relativism. I hate relativism more than I hate anything else, excepting, maybe, fiberglass powerboats" (Fodor, 1985, p. 5). Nativists also held that thinking takes place in a universal language of thought or "mentalese," which is independent of the actual language we happen to speak around the dinner table (Pinker,

1994). In brief, the nativist position holds that universals of cognition shape all languages. When languages do differ, they do so only superficially, and these differences do not affect how we think (Pinker, 1994).

In sum, it seemed to be equally important for Humboldt or Whorf to prove that speakers of different languages think differently as it was for strong nativists like Fodor or Pinker to prove the contrary. However, both of these strong claims were not supported by equally strong facts. New approaches are more rigorous and evidence-based.

1.2 Contemporary approaches to linguistic relativity: Neo-Whorfianism

In the last decades, the focus has turned to a broadening and a more careful consideration of the empirical evidence—the facts and the more nuanced truth they bear out. The claims today are not nearly as bold as those in some of Whorf’s writings (see quote above). The debate is not about whether speakers of different languages have fundamentally different worldviews or, instead, are constrained by a universal conceptual structure shared by all humans down to every detail. Contemporary research on linguistic relativity (sometimes called Neo-Whorfianism) starts from the premise that trying to approach this issue as an either-or question is neither interesting nor informative (Boroditsky, 2012; Bylund & Athanasopoulos, in press; Casasanto, 2016b; Lupyan, 2012; Regier, Kay, Gilbert, & Ivry, 2010; Wolff & Holmes, 2011). The goal is to investigate which cognitive processes are affected by which linguistic differences under which circumstances. As Alfred Bloom put it:

The claim that the language or languages we learn determine the ways we think is clearly untenable. But it does not necessarily follow that language is merely a code system which neither affects the process by which thinking proceeds nor the nature of the thoughts manipulated in that process. Between these two extremes there is a substantial middle ground which constitutes a promising and important area of experimental research. (Bloom, 1984, p. 275)

The aim of the present thesis is to contribute to the above goal. It is well, then, to consider in more detail the neo-Whorfian approach.

Two seminal publications during the 1990s marked the revival of interest in linguistic relativity. Lucy’s (1992b) *Language diversity and thought* and Gumperz and Levinson’s (1996) edited volume *Rethinking linguistic relativity* reformulated the question of linguistic relativity, making a strong case for both its empirical tractability and its scientific interest for the understanding of human cognition (see also Hunt & Agnoli, 1991; Kay & Kempton, 1984,

for discussions that signalled a returning interest among psychologists). On the linguistic side, cognitive linguistic approaches to language removed the strong emphasis on formal analysis of grammar that was characteristic of the generative school, and instead viewed language structure as intimately related to linguistic meaning (Langacker, 1987; Talmy, 1985; see Lakoff, 1991, for a comparison of generative and cognitive approaches to language; see Cook, 2011, for a discussion of linguistic relativity and cognitive linguistics).

The following ingredients characterize contemporary research on linguistic relativity: rupture with linguistic determinism, more stringent methodological requirements, a more precise operationalization of thought, focus on different conceptual domains, and increasing attention to explaining the mechanisms of language effects on thought. Let us take a look at these ingredients in greater depth.

Contemporary research on linguistic relativity distances itself from linguistic determinism. Linguistic determinism is the proposal that language *determines* the nature and content of thought (cf. Bloom's quote above). An extreme form of linguistic determinism would imply that "thought is the same thing as language" (Pinker, 1994, p. 57). One might doubt that anyone has ever defended such a strong position in general, not even Humboldt (see Penn, 1972) or Whorf (see Lee, 1996). Today this view is never embraced wholesale. Consider, for instance, one of the most controversial studies of linguistic relativity, debated by relativists and universalists alike: Gordon (2004) made the case that numerical cognition is severely constrained among the speakers of Pirahã, because their counting system only differentiates between one, two and many (for debate, see Casasanto & Gordon, 2005; Laurence & Margolis, 2008; for a follow-up, see Frank, Everett, Fedorenko, & Gibson, 2008). Now, even though Gordon actually used the term "linguistic determinism" in his paper, the claim was limited to one specific aspect of language affecting a specific aspect of cognition—it was not a claim about language and thought being the same thing in general. Rejecting linguistic determinism up front is a handy strategy against arguments like Pinker's (1994), which contended that, because it is false that language and thought are the same thing, any (interesting) version of linguistic relativity must be false as well (see Casasanto, 2008, for a thorough discussion of Pinker's argument).

As a second ingredient, **neo-Whorfianism has developed increasingly stringent methodological requirements**, and most studies are experimental. First, since language and thought are assumed to be distinct, empirical studies need to provide independent sources of evidence for the linguistic facts, on the one hand (i.e., verbal or linguistic data stemming from a

linguistic task), and for the thinking, on the other hand (i.e., non-verbal or non-linguistic data stemming from a non-verbal task) (see Greenberg, 1954; Lucy, 1992b). Note that this is not the same as a requirement that the non-verbal task should not allow for any linguistic mediation; studying effects of language under different degrees of linguistic mediation is itself of interest and leads to important insights (see, e.g., Lucy, 2016; Lupyan, 2012, and also the different experiments in *Study II*). Second, linguistic analyses must also abide by the standards of experimental research. It is not enough to just cite a cherry-picked linguistic observation from an informant: Differences in language are to be determined on the basis of representative language samples and statistical analyses.

Language might affect thought, but thought takes many forms. While it is useful to use umbrella terms like ‘thought,’ ‘thinking’ or ‘cognition’ (as I do throughout this thesis), **studies on linguistic relativity need to specify what they mean by thought and make clear how they operationalize it.** A rough cut can be made as follows: Does language affect high-level cognitive processes like reasoning about certain situations or drawing inferences from premises (e.g., Au, 1983; Imai, Schalk, Saalbach, & Okada, 2014)? Or is language hypothesized to affect low-level processes, possibly penetrating into pre-linguistic, perceptual aspects of cognition (e.g., Lupyan & Ward, 2013; Thierry, Athanasopoulos, Wiggett, Dering, & Kuipers, 2009)? The neo-Whorfian reformulation does not argue that only one type of effect of language on thinking is of interest (e.g., only low-level perceptual processes or only high-level reasoning), but the conclusions we might draw from—and the mechanisms that might explain—one or the other type of effects clearly differ. The present thesis, for instance, focuses on perception of similarity, a high-level cognitive operation believed to underlie many other cognitive processes, from categorization to reasoning (Goldstone, 1994b; Hahn, 2014; Medin, Goldstone, & Gentner, 1993; Tenenbaum & Griffiths, 2001). Perception of similarity is an interesting mental operation in that it depends, not only on objective properties of the compared entities, but on how these entities are represented by the observer (Hahn, 2014).

Differences in how languages carve up reality might bring about corresponding differences in how speakers of these languages think about reality—but what aspects of reality? **Contemporary research on linguistic relativity focuses on specific conceptual domains**, such as colour (Gilbert, Regier, Kay, & Ivry, 2006; Roberson, Davidoff, Davies, & Shapiro, 2005; Thierry et al., 2009; Winawer et al., 2007), space (Bohnenmeyer, Donelson, Tucker, & Benedicto, 2015; Levinson, 2003; Levinson, Kita, Haun, & Rasch, 2002; Li & Gleitman, 2002; Pederson et al., 1998), time (Boroditsky, 2001; Boroditsky, Fuhrman, & McCormick, 2011; Bylund & Athanasopoulos, in press; Casasanto et al., 2004; Chen, 2007), gender (Boroditsky,

Schmidt, & Phillips, 2003; Imai et al., 2014; Sera et al., 2002), or motion (see section 2).⁶ Focusing on distinct domains allows researchers to a) broaden the scope of the empirical coverage, and b) draw on relevant theories of cognition that may apply to certain domains but not others. The importance of this latter point—drawing on domain-specific knowledge in investigations of linguistic relativity—can be illustrated in the domain of colour perception, which has probably received the most attention in research on linguistic relativity.

There are numerous studies that show how linguistic differences in basic colour terms affect cognition, but there are also studies that show no such effects. We start with the positive evidence. Languages like Greek or Russian have two basic terms for blue (one for light blue, one for dark blue), whereas English only has one, ‘blue.’ This linguistic difference affects speed of colour recognition, that is, how quickly one can match two shades of the same blue against a blue that is slightly different (Winawer et al., 2007); they can even create a difference in pre-linguistic colour perception that is only detectable by measuring the electrical activity in the brain (Thierry et al., 2009). That is, 200 ms after perceiving a certain shade of blue—before even being conscious of having seen it!—a Greek-speaking brain (recall, Greek has two basic terms for blue, *ble* and *ghalazio*) differs in its neuronal activity from an English-speaking brain (English has just one basic term) (Thierry et al., 2009). If these differences arise from such a subtle linguistic contrast (one vs. two terms for blue), one could suppose that speakers of a language like Dani, which has only two colour terms in total (basically ‘light’ and ‘dark’ colours), should show all kinds of differences with respect to English speakers. Yet, this is not so; in many non-verbal tasks involving colours, speakers of Dani and English do not differ at all (Heider & Olivier, 1972). This would seem to pose a puzzle if all we knew about colours was how they are named in different languages. Fortunately, we can draw on psychophysical research on colour perception, which has established that colour perception is strongly constrained by the physical properties of colours: Some colours—so-called focal colours—are perceptually highly salient and more likely to be named across languages (Berlin & Kay, 1969; Heider & Olivier, 1972; Regier, Kay, & Cook, 2005). This makes it very unlikely that speakers of languages who use different colour terms differ in their perception of focal colours (Heider & Olivier, 1972). Yet, differences can be found along

⁶ A domain-based approach stands in contrast with a structure-centred approach, in which a broad structural property of a language, for example, its number marking system (Lucy, 1992a) or its system of verbal inflections (Whorf, 1956b), is hypothesized to correlate with a number of different cognitive processes. See Lucy (1997, 2016) for discussion of these approaches.

other, perceptually more subtle, distinctions (like different shades of blue). Accounts that take into consideration existing knowledge about the colour domain are able to capture the apparently mixed findings by casting them as examples of Bayesian inference under uncertainty (Bae, Olkkonen, Allred, & Flombaum, 2015; Cibelli, Xu, Austerweil, Griffiths, & Regier, 2016; Regier et al., 2010).⁷ This extended example illustrates the advantages of centring on specific domains when considering language effects on cognition. It also demonstrates why an all-or-nothing approach to linguistic relativity is unable to illuminate the complex relation between language and thought.

Finally, **contemporary research increasingly focuses on specifying the mechanisms by which language affects thought**. Mechanisms can be considered at different levels, and I will not attempt to cover all these levels nor all the proposed mechanisms (for some specific proposals, see Bae et al., 2015; R. W. Brown & Lenneberg, 1954; Casasanto, 2008, 2016a; Cibelli et al., 2016; Kay & Kempton, 1984; Levinson, 2003; Lupyan, 2012; Lupyan & Clark, 2015; Slobin, 1996; Whorf, 1956c; for overviews, see Bylund & Athanasopoulos, 2014b; Lucy, 2016). No overarching theory of how language affects thought has yet gained common currency—this is clearly an area in need of further theoretical development (cf. Lucy, 2016). Relevant for the present thesis are two broad approaches to the relation between language and thinking: long-term effects of linguistic codability (*Study II*) and the formation of ad-hoc categories (*Study IV*).

Effects of codability refer to the idea that concepts that are linguistically more codable will also be cognitively more available, even when not speaking (e.g., R. W. Brown & Lenneberg, 1954). We just saw an example of codability: Greek has a basic term for light blue (*ghalazio*), while English does not (one needs to specify “light blue”). In Greek, therefore, the concept ‘light blue’ is linguistically more codable than in English, meaning among other things that it should take Greek speakers less time to retrieve *ghalazio* than it does English speakers to produce “light blue,” that Greek speakers should refer to *ghalazio* more often than English speakers to light blue, and that there should be more agreement between Greek speakers as to what is *ghalazio* than there is among English speakers as to what is “light blue” (cf. R. W. Brown & Lenneberg, 1954). As we will see in section 2, an analogous difference holds between Spanish and Swedish with regard to motion events. Codable concepts become more routinely expressed in language and could thus form part of what Whorf calls “habitual thought” (Whorf, 1956c). The

⁷ Conceptually, these accounts predict that the influence of language on thought will be strongest when there is uncertainty about a perceptual stimulus (cf. Kay & Kempton, 1984). Computationally, these problems are treated as Bayesian belief updating (see also Tseng, Carstensen, Regier, & Xu, 2016).

hypothesis we will test in *Study II* is that differences in codability of motion-related concepts will make these concepts more readily available to other cognitive processes in Swedish than in Spanish speakers. In short, it will be a test of the hypothesis that long-term experience with a language affects thinking.

In *Study IV* we approach the relation between language and thought from a different angle. There we draw on the idea of *ad hoc* categories (Barsalou, 1983; Casasanto & Lupyan, 2015), which proposes that categories are not stable, but inherently flexible. Rather than being static entries in a lexicon, concepts should be seen as “fleeting, idiosyncratic neurocognitive representations that people actually use for thinking and communicating” (Casasanto & Lupyan, 2015, p. 543). The question addressed in *Study IV* is whether recent linguistic experience in an L2 can influence those representations.

1.3 Semantic and conceptual restructuring in L2 speakers

The principle of linguistic relativity is often understood to imply that native speakers of different languages will think differently. However, the broader claim is that our experience with language shapes the way we think. This justifies an interest in speakers who have linguistic experience in more than one language (Bylund & Athanasopoulos, 2014b; Cook & Bassetti, 2011; Han & Cadierno, 2010; Pavlenko, 2005, 2011), who, after all, are the majority of people on earth (Aronin & Singleton, 2012; Grosjean, 2012).⁸ There are two broad questions. First, do L2 speakers come to *linguistically* carve up the world as native speakers of the target language do; that is, to what extent do L2 speakers acquire the semantic distinctions characteristic of the L2? This question lies at the level of language. Second, to what extent do L2 speakers come to *think* differently about the world as a consequence of learning a new language? This question lies at the level of thought. This thesis speaks to both of these questions.

The bulk of research has focused on the first question, or semantic restructuring: Do L2 speakers acquire native-like ways of structuring meaning in language? Languages can differ in many ways in their naming patterns (Malt & Majid, 2013). This means that speakers of an L2 need not only learn new labels to express the same conceptual categories they express in their native language—they need to pay attention to new aspects of reality

⁸ I restrict the discussion to speakers of two languages for ease of exposition and because this is a common simplification made in the literature (i.e., multilingual individuals are mostly treated as bilinguals). Embracing the complexity of multilingual cognition remains a task for future research, which lies beyond the scope of this thesis (see, e.g., Bylund & Athanasopoulos, 2014a).

or to new distinctions in the world that are irrelevant when speaking their native language. Some of these distinctions are more grammatical in nature, such as the distinctions encoded in verb morphology. For example, a Swedish or German speaker does not need to distinguish in the form of the verb between actions that they describe as ongoing and those described as concluded; that is, Swedish and German have no grammaticalized perfective aspectual distinction (e.g., Dahl, 1985). Such a distinction, however, *needs* to be encoded in Spanish verb morphology every time a verb is used to refer to a past action: If you wish to say you went to the store, the form of the verb will either zoom in on the action (*iba a la tienda* ‘I was going to the store’) or zoom out and present the event as concluded (*fui a la tienda* ‘I went to the store’). This filmic contrast between zooming in or out on the action is not an optional device to introduce a special rhetoric effect—it is an obligatory (albeit implicit) decision a speaker of that language needs to make every time they talk. This linguistic distinction seems to have more general consequences for how events are conceptualized and described in different languages, and it is hard for L2 speakers to acquire it (Bylund & Jarvis, 2011; M. Carroll, Weimar, Flecken, Lambert, & von Stutterheim, 2012).

But differences in how languages carve up the world are not restricted to abstract categories like time. For instance, languages may differ in the distinctions they make among very concrete objects like a jar and a bottle or other kitchen accessories (Malt, Sloman, & Gennari, 2003; Malt, Sloman, Gennari, Shi, & Wang, 1999). For a Russian speaker, a glass and a paper mug will be treated alike linguistically (both are *stakan*), whereas, the same speaker will draw a linguistic line between a typical, shorter coffee cup (*chashka*) and a plastic cup (*stakan*), even though both are “cups” in English (Pavlenko & Malt, 2011). Even after many years of immersion in the L2 environment, it remains a challenge for L2 speakers to make the same distinctions as native speakers of the target language when naming concrete objects (Malt & Sloman, 2003), even though initial learning can be surprisingly fast (Malt, Jobe, Li, Pavlenko, & Ameel, 2016). One general consequence of speaking several languages seems to be that the semantic categories made when speaking each language converge, so that they fall in between what would be typical of monolingual speakers of each language (Ameel, Malt, Storms, & Van Assche, 2009; A. Brown & Gullberg, 2013).

Semantic restructuring pertains to how people acquire new ways of speaking (or fail to do so). They do not necessarily imply changes in the underlying non-linguistic categories people maintain. As we saw in the preceding section, it is problematic to draw conclusions about how people think from how they speak. The second broad question is whether L2 speakers’ more general conceptual categories change with L2 learning. Although this question has received much less attention in the literature on second

language acquisition (SLA) than the previous one, presumably because of its added methodological difficulty, the interest in it is growing (Athanasopoulos, Bylund, & Casasanto, 2016; Bylund & Athanasopoulos, 2014b).⁹ An increasing number of studies now indicate that conceptual restructuring may take place. One set of demonstrations comes from the acquisition of languages that differ in whether they make a count/mass distinction among objects or not. For example, in English the plural of a count noun like ‘car’ is ‘cars,’ but a mass noun like ‘sand’ has no corresponding plural form. Such mass nouns typically denote substances (sand, water). This distinction is not made, however, in languages like Yucatec (Lucy, 1992a) or Japanese (Imai & Gentner, 1997). In these languages, all nouns are treated alike. It has been suggested that this may impact how speakers of those languages represent inanimate objects: while speakers of English have been reported to show a preference towards grouping objects by their shape (e.g., a pyramid made of cork is similar to a pyramid of plastic, because both are pyramids), Japanese or Yucatec speakers reportedly show a comparatively greater bias towards grouping objects by the material or substance they are made of (e.g., a cork pyramid is similar to a piece of cork, because both are made out of cork) (Cook, Bassetti, Kasai, Sasaki, & Takahashi, 2006; Lucy, 1992a). It was found that Japanese speakers who acquire English come to change their categorization preferences, from being more like those of monolingual speakers of Japanese to more closely resembling those of monolingual speakers of English (Cook et al., 2006); in this and similar cases, the change seems to be largely a function of L2 proficiency (see Athanasopoulos, 2011a, for an overview; in the colour domain, see, e.g., Athanasopoulos, Damjanovic, Krajciová, & Sasaki, 2011; Athanasopoulos, Dering, Wiggert, Kuipers, & Thierry, 2010; for effects of grammatical gender, see, e.g., Kurinski & Sera, 2011; for spatial cognition, see, e.g., Park & Ziegler, 2014).

In sum, speakers of more than one language are of particular interest in the context of linguistic relativity because they allow us to ask whether additional linguistic experience (after childhood) can lead to restructuring the semantic and conceptual categories acquired in early years, thus shedding light on the flexibility of these categories. *Studies III* and *IV* make a contribution to this literature.

⁹ A misleading aspect of the literature dealing with L2 speakers is that the term “linguistic relativity” is sometimes used when the evidence presented is purely verbal (see Athanasopoulos, 2011b; Athanasopoulos & Bylund, 2013; Bylund & Athanasopoulos, 2014b, for discussion).

2. Motion events in language and cognition

This thesis investigates linguistic relativity in the motion domain. Why motion? Motion, like colour, combines universal and language-specific facets. On the one hand, low-level aspects of motion perception are rooted in a universal cognitive architecture shared by the species as a whole (Snowden & Freeman, 2004): a moving dot among a thousand still dots instantly stands out to our visual system no matter what language we speak (and no matter if we are a human or a rabbit). On the other hand, and as we will see shortly, the way humans *talk* about events of motion largely depends on their native language (Talmy, 2000). Motion is also a pervasive component of our daily lives: We get out of bed, step into the shower, cycle to work; children run across the fields and climb up trees; cars drive along the alleyway or into the garage. All humans need to talk about motion (which is not the case about, say, snow). Finally, the kind of linguistic differences found between languages are peculiar in that they do not seem to be in any obvious way connected to larger aspects of culture (see, e.g., Malt, Gennari, & Imai, 2010); this makes it easier to conclude—if differences in thinking are found between speakers of different languages—that these differences are caused by language, rather than language being the reflection of more general variation in culture. All of this makes motion a suitable candidate for the study of linguistic relativity.

In this section, we will see how motion events are talked about in different languages (2.1), how these differences may affect the way native speakers of different languages think of these events (2.2), and how it can be a challenge to learn an L2 in which motion is talked about differently (2.3). Since we are now touching more directly on the topics covered by the individual studies, this overview will only convey the main lines; the reader will be directed to the individual studies for details.

2.1 Motion events in language: Talmy's typology and manner salience

A motion event refers to any situation in which an entity moves with respect to some landmark. One of the most influential approaches to the linguistic analysis of motion events—and the one we adopt in this thesis—is Talmy's framework of cognitive semantics. In particular, we draw on his treatment of lexicalization patterns and the typological distinction between satellite-framed and verb-framed languages (e.g., Talmy, 1985, 1991, 2000, 2007).

Talmy's approach consisted in isolating, on the one hand, conceptual components of a motion event and, on the other hand, the linguistic means by which these components are expressed in different languages. For

instance, if we say *The man runs up the stairs*, the situation being described can be broken down into the following conceptual components: An entity or *figure* that is moving (the man); a landmark or *ground* that serves as the referent with respect to which the figure is moving (the stairs); the *path* followed by the figure with respect to the ground (upwards); and also a certain *manner* of moving (running). While Talmy’s framework assumes that these components are universal in cognition, he shows systematic cross-linguistic differences in how and whether the different components are linguistically expressed. Consider possible descriptions of the same event in English (1), Swedish (2) and Spanish (3):

- (1) English:
 The man runs up the stairs.
 FIGURE MANNER PATH GROUND
- (2) Swedish:
Mannen springer uppför trapporna.
 The man runs up the stairs
 FIGURE MANNER PATH GROUND
 ‘The man runs up the stairs.’
- (3) Spanish:
El hombre sube las escaleras (corriendo).
 The man moves-up the stairs (running)
 FIGURE PATH GROUND (MANNER)
 ‘The man ascends the stairs (running).’

The English and Swedish examples are very similar regarding the mapping of conceptual components (*what* is expressed) onto linguistic structure (*how* it is linguistically expressed). Crucially, both English and Swedish express manner of motion in the main verb (*runs* and *springer*, respectively, so called ‘manner verbs’), and they express path of motion outside of the verb: in the particle *up* in English and in the preposition *uppför* in Swedish. Talmy refers to this pattern of linguistically encoding motion events as satellite-framing, and he refers to languages such as English and Swedish—which typically follow this pattern in motion descriptions—as satellite-framing languages.¹⁰ The Spanish sentence (3)

¹⁰ The term “satellite” was coined by Talmy to denote “the grammatical category of any constituent other than a noun-phrase or prepositional-phrase complement that is in a sister relation to the verb root” (Talmy, 2000, p. 102). However, this original definition has been shown to be too narrow (see, e.g., Beavers, Levin, & Tham, 2010; Croft, Barðdal, Hollmann, Sotirova, & Taoka, 2010). A satellite is therefore often considered to refer to any linguistic constituent outside of the main verb root (Beavers et al., 2010; Croft et al., 2010; Verkerk,

represents a different pattern of mapping information onto linguistic structure. Its crucial characteristic is that the main verb in (3), *subir* encodes information about path (i.e., motion upwards as in ‘ascend’) rather than manner. Verbs like *subir* are called ‘path verbs,’ and this lexicalization pattern—path encoded in the main verb—is called verb framing. Languages like Spanish that have a preference for this pattern are thus verb-framed languages.¹¹

Study I in the present thesis makes a contribution to the typological literature on motion event descriptions. This literature has elaborated Talmy’s typology and probed its limits. On the one hand, a large amount of empirical data has by now confirmed that many languages can indeed be characterized by their broad tendencies as satellite-framed or verb-framed languages (Berman & Slobin, 1994; Strömquist & Verhoeven, 2004). On the other hand, the limitations of using a binary typology to describe entire languages are increasingly realized (e.g., Beavers, Levin, & Tham, 2010; Berthele, Whelpton, Næss, & Duijff, 2015; Bohner et al., 2007, 2007; Croft, Barðdal, Hollmann, Sotirova, & Taoka, 2010; Goschler & Stefanowitsch, 2013; Kopecka, 2006; Verkerk, 2014). For example, languages that belong to the same type overall because of their general tendencies can still vary in many ways; that is, there are differences between languages of the same type. A related limitation of a binary typology is tackled in *Study I*, namely the fact that one and the same language might allow for several lexicalization patterns. In other words, there is variability, not only *between*, but also *within* languages. While this has been long recognized (see background section of *Study I*), previous studies have not attempted to quantify variability—providing such a quantification is the specific aim of *Study I*.

For linguistic relativity, the crucial fact regarding the expression of motion is the difference between languages in the codability of manner, sometimes also called ‘manner salience’ (e.g., Slobin, 2003, 2004, 2006). Differences in manner codability are a consequence of Talmy’s typology: If a speaker of a verb-framed language like Spanish (who typically expresses path in the main verb, e.g., *subir* ‘ascend’) wishes to include information about the manner of motion, this is usually done by adding a grammatical adjunct, such as the gerund phrase *corriendo* (‘running’) in example (3) above. Adjuncts are grammatically optional, and, thus, speakers of verb-framed languages may omit this information and simply say *El hombre sube*

2014). In this thesis I adopt the latter, broader definition. Importantly, this choice is irrelevant to the larger aims and conclusions of the present work.

¹¹ Talmy (e.g., 1985, 2000) also considers a third type of languages, like Atsugewi, in which the main verb characteristically encodes information about the figure, such as its geometrical form (e.g., if it is spherical), or its consistence or appearance (e.g., if it is a slimy, lumpy object). These have received far less attention in the literature and will not concern us here.

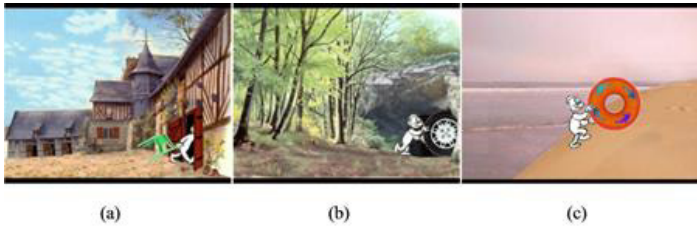


Figure 1. Three caused motion events. These are snapshots of three events used in the current thesis. The events were originally designed by Hendriks and colleagues (e.g., Hendriks et al., 2008).

las escaleras ‘The man ascends the stairs,’ without mentioning manner at all. So, whereas speakers of satellite-framed languages tend to *always* describe manner (because it is expressed in the verb, and verbs are obligatory), speakers of verb-framed languages more often omit this information or express it with less detail (A. Brown & Chen, 2013; Cappelle, 2012; Cardini, 2008; Malt et al., 2014; Slobin, 2003, 2004, 2006; Slobin, Ibarretxe-Antuñano, Kopecka, & Majid, 2014). The potential impact of this linguistic difference for how different speakers think about motion is discussed in the next section (2.2) and constitutes the main topic of *Study II*.

The present thesis expands previous research on motion events by exploring the domain of caused motion. Caused motion events are situations in which an agent acts upon another entity to make it move along a certain trajectory, as in *He dragged the chair into the barn* (Talmy, 2000). The kind of caused motion events considered in this thesis is illustrated in Figure 1. Caused motion events add an extra layer of complexity with respect to voluntary (or spontaneous) motion events, in which an entity moves by its own force (as in the example above: *The man runs up the stairs*). Most previous studies adopting Talmy’s framework, including most of the studies cited above, have focused on voluntary motion; only a handful has explored caused motion (e.g., Choi & Bowerman, 1991; Engemann, Harr, & Hickmann, 2012; Furman, Küntay, & Özyürek, 2014; Hendriks, Hickmann, & Demagny, 2008; Park, 2015). No study on caused motion has specifically looked at Spanish and Swedish. How caused motion is encoded in Spanish and Swedish is covered in *Studies I* and *II*.

2.2 Motion events in cognition

In satellite-framed languages, manner information is more *codable* than in verb-framed languages: Speakers of the former express manner more often and in greater detail than speakers of the latter (Slobin, 2003, 2004). Could it

be that this affects the way speakers of different languages *think* about motion? A number of studies have tested different variants of this hypothesis.

One prominent formulation of how language might affect thinking is Slobin's 'thinking for speaking' hypothesis (Slobin, 1996, 2003). According to this formulation, language affects a special type of thinking, namely the kind of thinking we engage in while we are speaking or about to speak. Several studies have found evidence of thinking for speaking in the motion domain. Papafragou and colleagues, for instance, showed that the way in which visual attention to a motion scene unfolds over time depends on the speaker's native language, but only if speakers are about to describe the scene (Papafragou, Hulbert, & Trueswell, 2008). In one of the experimental conditions, speakers of English (satellite-framed) and Greek (verb-framed) watched motion scenes, for example, a scene in which a man is skating towards a snowman, and described them. The gaze of English speakers (measured with eye-tracking) focused on the skates very early, which is crucial to describing the information encoded in English verbs: manner of motion (*skating*). In contrast, the gaze of Greek speakers swiftly moved to the snowman, which is relevant to the path information expressed in Greek verbs (translated: '*approaching* the snowman'). These differences disappeared when participants were not asked to describe the scenes, but simply to watch them for a later memory task (Papafragou et al., 2008). Other evidence for thinking-for-speaking effects is found in studies showing that the way people gesture *while* speaking depends on their native language (A. Brown & Chen, 2013; McNeill & Duncan, 2000; Özçalışkan, Lucero, & Goldin-Meadow, 2016). This suggests that, at the time of speaking, speakers of different languages rely on partly different conceptual representations of the events. Similar to Papafragou and colleagues, some of these studies find that cross-linguistic differences in gesturing disappear when speakers are *not* describing motion events (Özçalışkan et al., 2016).

Thinking-for-speaking effects are uncontroversial, but the findings are mixed when it comes to whether language affects people's mental representations of motion events *even when they are not speaking* (nor preparing to speak). There are many factors that seem to affect the findings. One of them is to what extent language is evoked prior to the non-verbal task (Finkbeiner, Nicol, Greth, & Nakamura, 2002; Gennari, Sloman, Malt, & Fitch, 2002; Papafragou & Selimis, 2010). For example, Gennari and colleagues found that Spanish speakers were more likely than English speakers to group events by path similarity (rather than manner similarity), but only if they had previously described the events (Gennari et al., 2002).

Another factor that may explain different outcomes is the choice of languages to be tested. Does any pair of languages qualify for testing

Whorfian effects as long as they belong to different types (i.e., verb-framed or satellite-framed)? As hinted at above, there is substantial variability also between languages of the same type. This variability could affect the results, as languages might behave more or less like prototypical satellite-framed or verb-framed languages, forming a spectrum between extremes (e.g., Ibarretxe-Antuñano, 2009; Slobin, 2004). Under the assumption that language affects thinking, *where* a language falls on this spectrum should influence the outcome on non-verbal tasks.

Until recently, the idea that variability between languages could affect performance on non-verbal tasks was merely an *a priori* argument, since most studies compared just one pair of languages at a time, making it difficult to tease out the effect of language choice from the effects of other factors that might also differ between studies. A recent paper by Montero-Melis and colleagues, however, compared 19 genealogically diverse verb-framed and satellite-framed languages in the same experimental paradigm (Montero-Melis et al., 2017).¹² Applying statistical analyses that corrected for random variability between languages of the same type, we did not find an overall effect of language type (satellite- vs. verb-framed) on speakers' mental representations of motion events. Importantly, there was considerable variability between languages. For instance, had we only sampled one language of each type (as most studies do), we could have found either a significant effect of language, a null effect, or even an effect in the opposite direction than expected (Montero-Melis et al., 2017). One conclusion to draw from this is that a careful and well-motivated choice of languages is important, and that one should not generalize from the results from one language pair to all possible language pairs. In the current thesis, the choice of Spanish and Swedish was motivated by the assumption that they would be close to prototypical examples of their respective types (see Donoso, 2013).

The nature of the task also seems to play a role in the mixed findings. Indeed, the choice of task in many studies could reflect a potentially non-trivial point of confusion, in the following sense. As laid out in the previous section, the crucial cross-linguistic difference in the motion domain relates to the codability of manner of motion. Yet, many studies employ a two-alternative forced-choice paradigm as the non-verbal task (e.g., Finkbeiner et al., 2002; Gennari et al., 2002; Montero-Melis et al., 2017; Papafragou, Massey, & Gleitman, 2002; Papafragou & Selimis, 2010). In two-alternative forced-choice similarity tasks, each trial has the following structure: Participants first see a target event (e.g., a man running up the stairs). They then see two alternatives: a same-path variant (a man walking up the stairs) and a same-manner variant (a man running down a hallway). The participants' task is to

¹² This study is not part of the current thesis.

choose which of the two variants is more similar to the target event. Such a task—by opposing a path and a manner alternate—confounds path preference and manner preference. It implicitly seems to assume, not only that speakers of satellite-framed languages should show a manner bias compared to speakers of verb-framed languages, but also that speakers of verb-framed languages should show a path bias compared to speakers of satellite-framed languages. If these dimensions are not in opposition in the speaker’s mind, it would be preferable to design non-verbal tasks that allow for measuring bias towards manner without creating an overt dichotomy with path. Interestingly, one of the studies that employed a paradigm where path and manner were not overtly opposed found extensive evidence for a language effect (Kersten et al., 2010). This issue is further discussed in *Study II*. For *Studies II* and *IV*, we developed a non-verbal task that allowed us to gauge manner bias independently of path bias.

2.3 Talking and thinking about motion in an L2

What happens when a speaker of one type of language (satellite- or verb-framed) learns an L2 of a different type? We discussed above two broad questions about L2 speakers’ semantic and conceptual restructuring (section 1.3). In the motion domain, these questions become: First, do learners acquire the way of speaking about motion that is characteristic of their L2? Second, do learners change their way of conceptually representing motion events as a consequence of learning the L2?

A large number of studies address the first question on whether L2 learners acquire target lexicalization patterns in the motion domain (e.g., A. Brown & Gullberg, 2013; Bylund, 2009; Cadierno, 2010; Cadierno & Ruiz, 2006; Daller, Treffers-Daller, & Furman, 2011; Hendriks & Hickmann, 2011; Hohenstein, Eisenberg, & Naigles, 2006; Konishi, Wilson, Golinkoff, Maguire, & Hirsh-Pasek, 2016; Larrañaga, Treffers-Daller, Tidball, & Ortega, 2012; Özçalışkan, 2016; Song, Pulverman, Pepe, Golinkoff, & Hirsh-Pasek, 2016). The bulk of these studies involve data from elicited production tasks, in which L2 learners’ descriptions of (mostly voluntary) motion events are compared to descriptions of functionally monolingual speakers of both the L1 and L2. Despite the similarity in the general paradigm, there are substantial methodological differences among studies. Studies differ with respect to the languages involved (with English being both the most frequent L1 and L2 across studies), the modality of production (written vs. oral), the type of stimuli (static pictures vs. dynamic animations), the studied populations of bilinguals (e.g., simultaneous vs. late bilinguals), whether they focus on the learners’ L1, L2 or both, and also with respect to what precisely is treated as the dependent variable or variables. Although these differences

make the specific findings difficult to compare, some general themes emerge.

A general point of agreement is that it is challenging for L2 learners to fully attune to the particular ways in which information is selected and syntactically distributed across a sentence in the target language (e.g., Alferink & Gullberg, 2014; Bylund, 2011; Cadierno, 2010; Carroll & von Stutterheim, 2003; Daller et al., 2011; Hohenstein et al., 2006; Indefrey, Şahin, & Gullberg, 2016; Song et al., 2016). Many studies document situations in which L2 speakers transfer structures from their L1 (Hendriks et al., 2008; Larrañaga et al., 2012). For example, L1 English learners of L2 Spanish use manner-verb constructions in Spanish that do not express the intended meaning, such as saying *Corre en el banco* (lit. ‘He runs in the bank’) to describe a situation in which a man runs *into* a bank (Larrañaga et al., 2012). To describe this situation in Spanish, it would be more common to use a path verb with or without specification of manner through an adjunct, as in *Entra en el banco (corriendo)* ‘He enters the bank (running)’ (see Aske, 1989).¹³

L1-based preferences are not always transferred, however. For example, learners of L2 English are capable of acquiring the basic target-like pattern of encoding manner in the main verb and path outside of the verb, even when their L1s have a different preference (Hohenstein et al., 2006; Ji & Hohenstein, 2014; Park, 2015). Also, L1 influence does not always manifest itself as overt transfer of the L1 pattern in production. In some cases, L2 speakers in fact seem to avoid the pattern typical of their L1 altogether, instead overgeneralizing the L2 pattern and differing from native speakers of the L2 in the opposite direction than would be expected by L1 transfer. For example, in a recent study, L1 English learners of L2 French at intermediate-advanced proficiency who described voluntary motion produced more path verbs than French natives did (Hendriks & Hickmann, 2011).

Study III contributes to the literature on the acquisition of L2 lexicalization patterns, but it does tackle an issue that, to my knowledge, had not been treated before. Instead of barely looking at how L2 speakers describe motion

¹³ Recently, I personally experienced the difficulty of fully automatizing knowledge of Swedish motion verb semantics, even after eight years of living in Sweden. Swedish lacks a general-purpose motion verb, as represented by the English verb *go*. The Swedish cognate *gå* does not underspecify manner of motion like *go*, but in fact means ‘go (somewhere) *by foot*, walk (somewhere).’ I know this; yet, I recently had the following awkward conversation with a native Swedish speaker (NS):

NS: *Vi ska gå till Söder.* (‘We are walking [*gå*] to Söder [a place in Stockholm].’)

Me: *Ska ni ta bilen?* (‘Will you go by car?’)

NS: *Men jag sa ju precis att vi ska gå!* (‘I just said we’ll walk [*gå*]!’)

As this anecdote illustrates, Swedish is a prototypical satellite-framed language that makes systematic use of manner verbs, more so than even English (see *Studies I–III*).

events compared to native speakers, we ask how L2 learners' descriptions are affected by processing recent input in their L2. Putting the focus on the effects of recent experience allows us to get at an issue that is not easily addressed by simple production studies, namely what lexicalization patterns L2 speakers *expect* to encounter in their L2. In *Study III*, we are able to figure out their expectations, because there are theories of how speakers change their linguistic behaviour depending on whether they expect to encounter a certain linguistic structure or not (e.g., Jaeger & Snider, 2013; see *Study III* for details).

Less work has addressed whether acquiring an L2 with different lexicalization preferences than one's L1 affects how L2 speakers *think* about motion. On the one hand, the literature based on Talmy's and Slobin's path/manner distinction has concentrated on thinking for speaking (see section 2.2), mostly restricting the object of study to purely linguistic data (see Bylund & Athanasopoulos, 2015, which introduces a special issue on the topic). On the other hand, a number of studies that have explored non-linguistic motion cognition in L2 speakers have done so from a different theoretical perspective, namely taking interest in cognitive attention to endpoints in motion events, which bears a relation to whether a language has grammaticalized aspect or not (e.g., Athanasopoulos, Bylund, et al., 2015; Bylund & Athanasopoulos, 2014a; see von Stutterheim & Nüse, 2003, for an initial formulation of the aspect hypothesis). The little work that speaks to conceptual restructuring in L2 speakers from a Talmyan perspective is, as of now, inconclusive. A recent dissertation, for instance, examined how L1 Korean learners of L2 English described and non-verbally categorized both voluntary (called "spontaneous" by the author) and caused motion events (Park, 2015). Park found evidence that L2 speakers acquire some, but not all, of the linguistic aspects that go into describing such events in a native-like fashion. When it came to non-verbal categorization, however, no sign of conceptual restructuring was found (Park, 2015). Further literature on this topic is reviewed in *Study IV*.¹⁴

What sets apart *Study IV* from previous studies on bilingual cognition is that it focuses on the effects of recent experience in an L2 for how L2 speakers come to think about (or, more specifically, perceive the similarity of) motion events. The study is thus able to speak to the issue of how flexible conceptual representations are, and whether they may be affected by recent linguistic exposure, even when the exposure is in the L2. Such a prediction would follow from accounts that emphasize the malleable, *ad hoc* nature of concepts (Barsalou, 1983; Casasanto & Lupyan, 2015).

¹⁴ Park's dissertation is not reviewed in *Study IV* because I did not know about it at the time I wrote the paper.

3. Questions

The overall goal of the thesis is to gain a more qualified understanding of the interplay between language and thought in the domain of caused motion. *Studies I* and *II* concentrate on long-term linguistic experience in the native language: *Study I* compares caused motion descriptions by native Spanish and Swedish speakers, and *Study II* investigates native Spanish and Swedish speakers' perceptions of event similarity. *Studies III* and *IV* evaluate the role of short-term linguistic exposure in the L2 for lexicalization choices in descriptions (*Study III*) and for perceptions of event similarity (*Study IV*). For convenience, an extended overview of the studies is provided again in Table 2.

Table 2. Questions addressed in the four studies collected in the thesis.

Study	Population	Level	Questions
I	Native Spanish and native Swedish speakers (N = 84)	Language	How are caused motion events described in Spanish and Swedish? Are there differences in variability in motion descriptions within each language, so that one language is more variable than the other?
II	Native Spanish and native Swedish speakers (N = 135)	Thought	Are differences in manner codability correlated with greater attention to manner in the perception of event similarity? How is event perception influenced by linguistic mediation during the task?
III	Swedish learners of L2 Spanish and native Spanish speakers (N = 119)	Language	How do learners and native speakers adapt their lexicalization choices in production to short-term linguistic exposure (path-verb vs. manner-verb priming)?
IV	Swedish learners of L2 Spanish (N = 60)	Thought	Does recent linguistic exposure in the L2 (path-verb vs. manner-verb priming) affect how L2 speakers perceive similarity between motion events?

4. The studies

4.1 Study I: “Speakers in motion: The role of speaker variability in motion encoding”

Background

Talmy (1985, 2000) introduced an influential typological distinction between satellite-framed languages, which encode the path of motion (up, down, into, etc.) outside of the verb, and verb-framed languages, which encode path in verbs. Talmy’s framework laid the foundation for detailed empirical research on how motion is spoken about in many different languages (see Filipović & Ibarretxe-Antuñano, 2015, for a review). With the growing body of empirical evidence, however, has also come the insight that a simple binary typology does not capture how motion is spoken about in any specific language (e.g., Beavers et al., 2010; Croft et al., 2010). This study focuses on one way in which languages defy a binary typology: A single language can allow for both types of framing patterns; for example, in English one can say *He ROLLS the tyre into the garage* (satellite-framed pattern) or *He ENTERS the garage with a tyre* (verb-framed pattern). The novelty in this study lies in approaching this question quantitatively. That is, the question asked here is not whether it is *possible* to use different patterns in a language, but rather *how much variability* there is in the ways that different speakers of the same language describe motion events.

The article has two aims. First, it expands the existing empirical evidence on the cross-linguistic encoding of motion events to the subdomain of caused motion, which has received far less attention than voluntary motion. Previous research has characterized Spanish as a verb-framed language (e.g., Sebastián & Slobin, 1994; Talmy, 2000) and Swedish as a satellite-framed language (e.g., Ragnarsdóttir & Strömquist, 2004; Zlatev & David, 2003). It was thus expected that these would be the dominant patterns for these languages also in caused motion. The second and main aim is to quantitatively assess the amount of within-language variability around the dominant pattern in each language.

Method

Forty-two native Spanish and 42 native Swedish speakers of comparable backgrounds (university students living in their respective home countries) took part in the study. All participants described 32 caused motion events that varied regarding path (e.g., upwards, inwards) and manner (e.g., rolling or dragging objects) (see examples in Figure 1, p. 18).

Two dependent variables were investigated: a) *Framing strategy* refers to whether a description encoded path in the main verb (verb framing) or outside of the main verb (satellite framing); b) *manner encoding* refers to whether manner was expressed at all in a description or not. Within-language variability was assessed by breaking down each of the two dependent variables by speakers and events. For example, breaking down Spanish framing strategies by speaker meant to compute, for each Spanish speaker, what proportion of their descriptions are verb framed or satellite framed. This tells us to what extent different Spanish speakers vary in their tendency to use verb-framed or satellite-framed patterns. Breaking down Spanish framing strategies by events tells us instead how much Spanish descriptions vary due to variation in certain characteristics of the event (e.g., is the choice of framing strategy affected by whether the agent pushes or pulls an object?). To quantify variability, the information-theoretical notion of entropy was used.¹⁵ Monte Carlo simulations were used to determine whether variability by speakers or by events was greater than expected by chance.¹⁶

Results

Spanish descriptions were substantially more variable than Swedish descriptions, regarding both framing strategies and manner encoding. This was already the case at the language level, that is, when averaging over speakers and events: Swedish descriptions followed a satellite-framed pattern 97% of the time, and they also included manner 97% of the time. In contrast, 59% of the Spanish descriptions followed a verb-framed pattern, and 35% followed a satellite-framed pattern (6% followed neither because they did not encode path); with regard to manner encoding, 63% of the Spanish descriptions mentioned manner and the rest did not.

Most interestingly, this variability in Spanish arose from a striking variability between speakers: A few Spanish speakers always used verb framing, others hardly ever used it, and all the gradients in between were also attested. The same was true for manner encoding: Some Spanish speakers always included manner information, others never did, and the rest formed a

¹⁵ Entropy quantifies the degree of randomness in a random process: it is zero when a process is completely predictable and becomes larger as the process becomes more unpredictable (for details, see Cover & Thomas, 2005).

¹⁶ These simulations consisted of two steps: First, I defined what exactly was meant by “variability expected by chance,” which amounts to spelling out a null hypothesis in probabilistic terms. Then I simulated a large number of experiments under this null hypothesis. If the outcome in the actual experiment departed from those in the simulations, it could be concluded that variability was not due to mere chance (Mooney, 1997).

continuum between those extremes.¹⁷ Compared to variability between speakers, variability between events was relatively minor. That is, in order to know how an event would be described in Spanish, *who* was describing the event mattered much more than *which* event was being described. Compared to Swedish, Spanish was significantly more variable both when analysed by speakers and by events.

Monte Carlo simulations showed that in both languages there was more speaker variability than expected by chance. In other words, in both languages differences between speakers significantly contributed to the overall variability in that language. Variability by event, on the other hand, was only higher than expected by chance in Spanish, but not in Swedish. That is, in Swedish, the little overall variation in framing strategies and manner encoding was not linked to the specific characteristics of the events, but in Spanish it was. For example, Spanish descriptions were more likely to include manner information if the agent was pushing an object than if he was dragging it.

Discussion

With regard to the first aim of the study, it was found that the broad characterization of Spanish as a verb-framed language and Swedish as a satellite-framed language also applies in the domain of caused motion. Indeed, verb framing was the predominant strategy in Spanish, while satellite framing prevailed in Swedish. Similarly, and still in line with typological predictions (e.g., Slobin, 2003, 2004), Swedish speakers expressed manner more often than Spanish speakers.

More novel were the results relating to the study's second aim: to quantify within-language variability. It was found that Spanish motion descriptions were strikingly more variable than Swedish descriptions. This means classifying Swedish as a satellite-framed language is more accurate than classifying Spanish as a verb-framed language, at least for the events considered here. In addition, most of this variability arose from differences between speakers rather than from the specific characteristics of the events.

To my knowledge, no previous study had attempted to quantify variability in motion encoding in a systematic fashion, breaking the linguistic patterns down by speakers and by events. Without such quantification, it is not possible to compare within-language variability across languages. In light of the current results, the approach seems promising from a cross-linguistic perspective; the approach is also general enough that it can be applied to other domains beyond motion. The upshot for the cross-linguistic study of motion events is that research should not only try to establish the dominant

¹⁷ The Spanish speakers who always used satellite framing were not the same who always encoded manner; the two variables were only weakly correlated by speakers ($r = .28$).

lexicalization patterns in different languages, but also the variability surrounding those patterns. The question remains: why is within-language variability of interest?

One central question for the relation between language and thought is how tight the mapping is between the outside world and the way in which it is linguistically conceptualized (Malt et al., 2010). The current findings suggest we might find asymmetries between languages; in other words, the tightness of this mapping might differ between languages. The Swedish data suggest Swedish has a highly entrenched syntactic construction to describe caused motion events. This construction, which is similar to the English caused motion construction (cf. Goldberg, 1995), assigns one slot to manner information (the verb) and one slot to path information (the satellite). In Spanish, in contrast, there is no equally entrenched construction to describe caused motion events; hence, Spanish speakers vary much more in their descriptions. This asymmetry is not apparent if we simply consider Swedish a satellite-framed and Spanish a verb-framed language. Only quantifying variability affords this insight.

4.2 Study II: “Getting the ball rolling: The cross-linguistic conceptualization of caused motion”

Background

Are differences in the way speakers of different languages *talk* about motion reflected in how these speakers *think* about motion? Speakers of satellite-framed languages like English or Swedish convey more information than speakers of verb-framed languages like Spanish about manner of motion (e.g., run, skip, roll, bounce). This difference can be attributed to manner being more codable in satellite-framed than verb-framed languages (Slobin, 2003, 2004). Does this greater linguistic emphasis on manner correlate with greater attention to manner outside of language, that is, in the way people think about motion? A number of previous studies have examined this question, suggesting that relativistic effects mostly emerge when experimental conditions make linguistic categories salient during the task (Finkbeiner et al., 2002; Gennari et al., 2002; Kersten et al., 2010; Papafragou et al., 2002; Papafragou & Selimis, 2010). All of these studies, however, deal with voluntary motion in which an entity moves by its own force (e.g., the man walked into the barn).

This paper extends the scope of previous research by exploring how Spanish and Swedish speakers judge event similarity in the domain of caused motion (e.g., *He rolled the tyre into the barn*). Caused motion events

are conceptually more complex than voluntary motion events because they involve more components that can be linguistically expressed. For example, the verb can express information about the manner in which the agent causes a certain movement, henceforth *manner of cause* (e.g., *he PUSHES/PULLS a chair*), or it can convey information about the way in which the object itself moves, henceforth *manner of object* (e.g., *he ROLLS the tyre*) (cf. Hendriks et al., 2008).

We constructed a novel non-verbal similarity arrangement task, which allowed participants to use several dimensions in their similarity judgements, rather than forcing them to make a binary choice between path and manner alternates (see section 2.2). Such a design captures the possibility that speakers of Spanish and Swedish differ in the importance they assign to manner (which is where the crucial cross-linguistic difference resides), but that they deem path an equally important component of caused motion. Additionally, we manipulated in three experiments the degree to which the non-verbal task would be linguistically mediated.

Method

A total of 68 Spanish and 67 Swedish native speakers from the same populations as in *Study I* participated in *Study II*. Each participant took part in only one of Experiments 1–3.

The stimuli consisted of 32 short animations (i.e., the events) in which the same agent moved objects in different manners along different paths (see Figure 1, p. 18). The structure of the stimuli was as follows. First, there were four different *paths* in which the agent and object could move: up, down, across or into some landmark; second, the *manner of cause* was manipulated: in half of the events, the agent pushed an object, while in the other half he pulled or dragged an object behind him; third, the *manner of object* was manipulated: half of the events involved rolling objects (e.g., a tyre) and the other half sliding objects (e.g., a chair). For example, in the event shown in Figure 1a, the path is *into*, the manner of cause is *pulling* and the manner of object is *sliding*. Finally, the direction of movement went from left to right in half of the events and from right to left in the other half. This yielded 32 target events (4 paths × 2 manners of cause × 2 manners of object × 2 directions).

A linguistic norming study established that Swedish event descriptions were significantly more likely than Spanish descriptions to express both manner of cause and manner of object.¹⁸ Both languages were equally likely to express the path of motion.

¹⁸ *Study II* was run and written before *Study I*, so the results of the norming study were a necessary check.

For the non-verbal task, we implemented a computerized free arrangement similarity task adapted from Goldstone (1994a). It comprised two phases: an encoding phase and a test phase. During the encoding phase, participants observed all 32 events in order to get familiarized with them. The test phase was the actual similarity arrangement task, during which participants arranged the events on the screen according to how similar they judged the events to be. They saw the events one by one in random order and had to place similar events near each other and different events far away from each other.

Experiments 1 through 3 progressively reduced the likelihood that participants would use language to solve the similarity arrangement task. In Experiment 1 (linguistic encoding), participants described the events during the encoding phase, then carried out the similarity arrangement task. In Experiment 2 (free encoding), participants simply watched the events silently during the encoding phase, then moved on to the similarity task. Experiment 3 (linguistic interference) was similar to Experiment 2, except that now participants carried out a verbal interference task throughout the encoding and test phases: they had to repeat aloud random strings of numbers that changed on every trial; this manipulation was assumed to block their ability to use language (see Trueswell & Papafragou, 2010).

The goal of the analysis was to determine from the arrangements whether Swedish speakers relied more than Spanish speakers on the manner of motion. We extracted a continuous similarity measure for each pair of events. Using mixed-model regression analyses, we could then test if two events sharing, say, the manner of object (e.g., in both events the object rolled, see Figures 1b and c) were rated as significantly more similar than two that did not share the manner of object (e.g., Figures 1a and b). Crucially we were interested in whether Spanish and Swedish speakers relied on motion components to a different extent.

Results

When participants had to describe the events before the non-linguistic arrangement task (Experiment 1: linguistic encoding), Spanish and Swedish speakers partly relied on different components when judging event similarity. Concretely, for Swedish speakers the manner in which the object moved (manner of object) mattered: Swedish speakers judged events to be more similar if objects moved in the same way (all rolling or all sliding) than if they did not (e.g., one rolling and one sliding). For Spanish speakers, in contrast, manner of object was irrelevant. There were no other differences between groups. In particular, speakers of both languages equally cared in their similarity arrangements about whether the agent pushed or pulled an

object (manner of cause). As expected, there was no difference in how much Spanish and Swedish speakers relied on the path of events to determine event similarity.

When participants were not asked to describe the events before the non-linguistic task, but simply to watch them quietly so as to get acquainted with them (Experiment 2: free encoding), the results were qualitatively identical to those in Experiment 1: Again, the manner of object (rolling vs. sliding objects) mattered more to Swedish speakers than to Spanish speakers. As in Experiment 1, there were no differences with regard to manner of cause or path.

Were the cross-linguistic differences found in Experiments 1 and 2 due to participants covertly using language to solve the arrangement task? To answer this question, Experiment 3 (linguistic interference) added a verbal interference task to Experiment 2. In this final experiment, all cross-linguistic differences disappeared.

Finally, we ran a compound analysis of all three experiments to see how the degree of linguistic mediation affected similarity arrangements. The analysis showed that describing the events before carrying out the similarity arrangement task (Experiment 1) made participants of both languages more sensitive to the path in the event (up, down, into, etc.). In contrast, participants cared more about whether the movement was from left to right or from right to left if they had *not* described the events than if they had described them. There were no interactions of experiment and language group, suggesting that the effects above held for both language groups.

Discussion

Does the way people perceive similarity between events reflect the linguistic biases of their native language? We found the answer to be a partial yes. A “partial” yes, because cross-linguistic differences in the conceptual categories participants used in their similarity judgements emerged when it was *possible* to use language as a means to solve the task, perhaps to keep the structure of the events in memory (Experiments 1 and 2)—but the differences disappeared when the use of language was blocked (Experiment 3). This suggests that language-specific labels can modulate how speakers think about events as long as they can utilize language to solve a non-linguistic task, consistent with previous work on voluntary motion (Gennari et al., 2002; Kersten et al., 2010; Papafragou & Selimis, 2010).

A second reason to treat the results as only partially supporting an effect of language on thinking is that just one of the two differences we found in how Spanish and Swedish speakers *described* caused motion events was reflected in how they *thought* about the events. Recall that Swedish speakers in the norming study expressed more often than Spanish speakers whether

the agent pushed or pulled an object (manner of cause); yet both groups used this dimension to an equal extent in the non-linguistic task. This result defies any simple account of linguistic relativity that treats differences in language as a sufficient condition for bringing about differences in thinking.

What is a possible explanation for the lack of effect for manner of cause? It is known from domains like colour that some aspects of reality are more salient than others (e.g., focal colours are perceptually more salient than non-focal colours); as a consequence, performance on non-verbal tasks may reflect the perceptual salience of the stimulus above and beyond language (e.g., Heider & Olivier, 1972). Perhaps a similar argument can be applied to motion and to manner in particular: Some types of manner could be seen as more general or salient and thus more likely to be encoded in any language (Malt et al., 2014; Slobin et al., 2014). The contrast between pushing and pulling objects may belong to this class of salient manners, which are thus less likely to elicit Whorfian effects (see Malt et al., 2010). Future research will have to establish whether certain manner distinctions are more likely to lead to language effects than others.

A final conclusion of this study concerns, not the comparison between languages, but the effect of linguistic mediation in and of itself (addressed in the final compound analysis of Experiments 1 through 3). The findings serve to illustrate the following point: It is misleading—as some defendants of the universalist position seem to imply—to oppose supposedly “core” conceptual categories, which are basic and unaffected by language, with other categories that are the product of “linguistic intrusions” (Gleitman & Papafragou, 2012). The findings regarding path are particularly telling in this respect. We found no differences between language groups in how likely speakers were to express path nor in how much they relied on this component in their similarity arrangements. Is this enough to conclude that path is a universal, “core” conceptual component, unaffected by language? The compound analysis suggests otherwise. We saw that describing the events increased the importance of path in the non-linguistic task, in both languages. This suggests that path is not a universal category, of constant importance in motion representation irrespective of language and task. Rather, this finding suggests we represent motion events flexibly: motion representation is affected by recent experience and the specific task at hand (Casasanto & Lupyan, 2015). We return to this idea in *Study IV*.

4.3 Study III: “Non-native (and native) adaptation to recent input during motion event lexicalization”

Background

Linguistic encoding—how a speaker structures a spoken message—is affected by long-term experience with a language and also by recently encountered linguistic input. The latter is reflected, for example, in that recently encountered words are likely to be repeated, and the same is true for recently encountered syntactic structures (lexical and structural priming, respectively). Here we ask how the long-term linguistic experience of L2 learners interacts with recent L2 experience in shaping the way in which learners describe motion events in their L2. We focus on inverse preference effects, that is, stronger adaptation to unexpected than to expected recent input (e.g., Chang, Dell, & Bock, 2006; Jaeger & Snider, 2013; Reitter, Keller, & Moore, 2011). We investigate how L1 Swedish learners of L2 Spanish and native Spanish speakers lexicalize motion events in Spanish—specifically, whether they use path verbs like *subir* ‘ascend’ or manner verbs like *empujar* ‘push’ in their descriptions—as a function of whether they encounter path verbs or manner verbs in recent input.

Swedish has a very strong preference for manner verbs; in contrast, Spanish has an overall preference for path verbs, even though manner verbs are also used. If L1 Swedish learners of L2 Spanish carry over their L1-based expectations, then they should expect manner verbs and be surprised by path verbs in the Spanish input. For a native Spanish speaker, the opposite should hold: they should expect to encounter path verbs more than manner verbs. By the inverse preference effect, Swedish learners of Spanish should adapt more strongly to path verbs and native Spanish speakers should show stronger adaptation to manner verbs.

Our first question is whether we can replicate with respect to motion lexicalization the inverse preference effect found for native speakers in other domains (Q1). We then ask whether Swedish learners of L2 Spanish adapt to recent input as a function of their L1 and L2 experience or their L2 experience only (Q2). We base our reasoning on the inverse preference effect: If the former is the case (expectations based on both L1 and L2), they should adapt more to path verbs than native Spanish speakers, but if the latter is the case, then their patterns of adaptation should be qualitatively similar to those of natives. Finally, we ask whether L2 learners become increasingly native-like in how they adapt to recent input as a function of L2 proficiency (Q3).

Method

Sixty Swedish learners of L2 Spanish (learners) and 59 native Spanish speakers (native speakers) were randomly assigned to one of three exposure conditions: path-primed, manner-primed or baseline (i.e., no priming). All learners had started acquiring Spanish after early childhood and lived in Sweden at the time of the experiment; their Spanish proficiency was at least that of “independent users” (B1 on the CEFR scale). Their exact proficiency was assessed by means of a written cloze test.

For the priming conditions, the trial procedure was as follows. First, participants had to read out loud a Spanish sentence that contained either a path verb (path-priming) or a manner verb (manner-priming); except for the verb, the other lexical items in the sentence and the syntactic structure were held constant across conditions. Then, participants saw a target event (see Figure 1 on p. 18) and had to describe it. The action in the event could always be described by the verb in the preceding exposure sentence (e.g., *entrar* ‘enter’ or *arrastrar* ‘drag’ for Figure 1a). This trial procedure was repeated for the same 32 target events used in *Studies I* and *II*, presented in random order. Participants in the baseline condition did the same task, except they did not read any Spanish sentences before describing the events.

Adaptation was defined as the cumulative increase in the use of the primed lexicalization (path or manner verb), measured against the baseline condition. Generalized additive models (Wood, 2006) were used for the analysis in order to capture possibly non-linear adaptation patterns over the course of the experiment.

Results

Native speakers showed the expected inverse preference effect. They adapted more strongly to manner verbs (unexpected in Spanish) than to path verbs (expected in Spanish) (Q1). The learners adapted to both path and manner verbs, thus suggesting that their expectations were based on both their L1 and L2 experience (Q2). Finally, with increasing proficiency, learners’ patterns of adaptation changed, becoming more like those of Spanish native speakers: learners increasingly adapted less to path verbs and more to manner verbs (Q3).

Discussion

This study addressed how recent experience shapes production patterns in L2 speakers, an overall understudied aspect of all the processes that go into the acquisition of an L2 (e.g., Jackson & Ruf, 2017; Kaan & Chun, 2017). No previous study on the acquisition of patterns of motion lexicalization had investigated the role of recent experience. Here we used a well-established

effect from the psycholinguistic literature on priming and adaptation—the inverse preference effect—to infer the expectations of L2 speakers regarding lexicalization patterns in the L2. We found that, in comparison to native speakers, the Swedish learners adapted more strongly to path verbs; this we take as evidence that they partly transfer their L1-based expectations to encounter manner verbs to their L2 Spanish. Crucially, as they became more proficient in Spanish, their patterns of adaptation changed, becoming more similar to how native speakers adapted to the input. This suggests that their expectations about L2 lexicalization preferences become increasingly attuned to the actual preferences of the target language, so that learners come to rely less and less on the biases introduced by their L1 experience.

This study applies to L2 processing and production models developed in the L1 psycholinguistic literature, which is based on evidence from native (monolingual) speakers. It thus contributes to the debate on whether emerging theories of L1 learning and adaptation can explain L2 learning and adaptation as well (Kaan, 2014; Pajak, Fine, Kleinschmidt, & Jaeger, 2016; Phillips & Ehrenhofer, 2015). One idea that is generating much interest and debate is the question of to what extent L2 speakers maintain online expectations about the input they will encounter, that is, whether L2 users predict the input (Foucart, Martin, Moreno, & Costa, 2014; Grüter, Lew-Williams, & Fernald, 2012; Hopp, 2013; Leal, Slabakova, & Farmer, 2016; Martin et al., 2013). Here we took the question into a slightly different direction by asking what part of L2 learners' previous linguistic experience determines their expectations in the L2, and how these expectations in turn affect their adaptation in spoken production. The proposed explanation is that speakers—including L2 learners—modify their behaviour as a function of an error signal, that is, the mismatch between their expectations and the actual input. Better understanding the nature of the perceived error signal, how it leads to immediate adaptation, and whether this results in long-term learning are likely to become important questions for future research on L2 acquisition.

4.4 Study IV: “Thinking is modulated by recent linguistic experience: Second language priming affects perceived event similarity”

Background

Study III explored the effect of recent L2 input on how L2 learners talk about motion. *Study IV* extends the exploration to whether recent linguistic experience in the L2 can also modify how learners *think* about motion

events. Accounts of language effects on thought that emphasize “habitual thinking” suggest that long-term experience with the native language shapes the mental categories speakers form when facing different cognitive tasks (Levinson, 2003; Lucy, 1992a; Whorf, 1956a). In accordance with such a view, Slobin suggested that L1-based patterns of conceptualizing events should be “exceptionally resistant to restructuring in adult second-language acquisition” (Slobin, 1996, p. 89). Previous studies on bilingual cognition, however, indicate that conceptual categories are not quite so resistant. First, bilinguals’ mental categories restructure in the direction of the L2 (Athanasopoulos, Damjanovic, Burnand, & Bylund, 2015; Athanasopoulos et al., 2010; Cook et al., 2006). Second, bilinguals’ conceptual categories are not fixed, but may change as a function of the language in which bilinguals operate, becoming more like those of monolingual speakers of either language when a task is carried out in the corresponding language (Athanasopoulos, Bylund, et al., 2015; Kersten et al., 2010; Lai, Garrido Rodriguez, & Narasimhan, 2014; Miles, Tan, Noble, Lumsden, & Macrae, 2011). This literature suggests flexibility of mental representations.

Here we extended this line of research to ask whether the mental representations we construe when assessing similarity between events are partly determined in an *ad hoc* fashion (Casasanto & Lupyan, 2015). No previous study had explored whether L2 learners shift their categorization preferences as a function of recent L2 experience. We took advantage of the fact that Spanish allows for different lexicalization patterns (i.e., use of path verbs or manner verbs) to test whether exposing Swedish learners of L2 Spanish to L2 sentences that highlight either path or manner changes the way L2 learners think about caused motion events. We combined the priming paradigm in *Study III* with the free arrangement similarity task used in *Study II*. If the conceptual categories used to represent motion events can be constructed *ad hoc*, we should observe that recent linguistic input in the L2 can influence these representations.

Method

Sixty Swedish learners of L2 Spanish took part in the experiment. These were the same L2 participants who participated in *Study III*. Participants were randomly assigned to one of three encoding conditions: path-priming, manner-priming or control. The experiment consisted of two phases, an encoding phase and a test phase. The encoding phase corresponded to the task reported in *Study III*: Path-primed and manner-primed participants were exposed to Spanish sentences with path verbs or manner verbs (respectively) and had to describe caused motion events, whereas participants in the control (or baseline) condition described the events without additional L2 exposure.

The test phase consisted of a similarity arrangement task in three blocks almost identical to that of *Study II* (see corresponding Method section).¹⁹ The analyses focused on how much participants relied on path vs. manner information in their similarity arrangements as a function of their encoding condition.²⁰

Results

Manner-primed participants relied more on the manner of motion in their similarity arrangements than path-primed participants. This effect held throughout the three blocks. There was a statistical trend towards path-primed participants relying more on path than manner-primed participants (recall that in our experimental paradigm reliance on path and reliance on manner are conceptually and statistically independent).

Participants in the control condition—who were not primed but still had to describe the events in their L2 Spanish—performed qualitatively like the path-primed group; they also differed from manner-primed participants in the same way as path-primed participants did.

Discussion

This study for the first time employed a priming paradigm with L2 learners to test whether recent L2 exposure affected how learners performed on a subsequent non-verbal task. The fact that the result was positive suggests that linguistically induced conceptual categories are flexible, rather than merely dependent on their habitual linguistic encoding. That is, conceptual categories induced by long-term experience with (our native) language can at least temporarily be overridden by recent linguistic exposure in an L2. This result offers a miniature scenario for conceptual restructuring in bilinguals: Possibly the same kind of cognitive restructuring shown to occur as a consequence of long-term L2 exposure in previous studies (e.g., Athanopoulos et al., 2010; Cook et al., 2006) was observed here as a consequence

¹⁹ The sole difference is that here all 32 target events were included in each block (whereas only 22 events were used per block in *Study II*). This change made it possible to include block as a factor in the regression analyses, instead of having to average across blocks (as in *Study II*).

²⁰ Compared to *Study II*, where we had two manner variables (manner of cause, manner of object), in *Study IV* manner was treated in the analysis as a single variable. We collapsed manner of cause (pushing/pulling) and manner of object (rolling/sliding) into a single manner variable with four levels. This follows the design of our priming manipulation (see Table 2 in Montero-Melis, Jaeger, & Bylund, 2016, p. 646) and makes it easier to compare effects of path-priming and manner-priming. However it makes it hard to compare the results of *Studies II* and *IV*.

of relatively little linguistic exposure. Future work should investigate how long-lived these short-term effects are.

More broadly, the findings suggest that the conceptual categories highlighted by habitual language are not necessarily the most available ones. Rather, and dovetailing with other proposals about the dynamic nature of conceptual representations (Barsalou, 1983; Casasanto & Lupyan, 2015), people seem to anchor their judgements in recent experience when carrying out a task under uncertainty (Tversky & Kahneman, 1974; Kahneman, 2011). Here, the uncertainty came from the different criteria participants could use to judge event similarity; recent exposure made the primed dimensions more available.

An interesting aspect of the results is that performance on the similarity arrangement task by the unprimed control group was indistinguishable from that of path-primed participants. In light of the results of the baseline group in *Study III*, this result makes sense. Indeed, as shown there, non-primed speakers were using more path verbs than manner verbs, so the mere fact of carrying out the task in Spanish was perhaps already biasing their linguistic attention towards path.²¹ This linguistic attention to path could then have been transferred to the non-verbal task. Such a result replicates studies with bilinguals that show that carrying out a task in the L2 activates conceptual categories that are linguistically salient in the L2 (Athanasopoulos, Damjanovic, et al., 2015; Athanasopoulos et al., 2011; Lai et al., 2014).

5. General conclusions

The overall aim of this thesis has been to explore the linguistic relativity hypothesis—the proposal that the language we speak affects the way we think—in the domain of caused motion. The ultimate goal was not to prove this idea right or wrong in the absolute, but to try to gain a more nuanced understanding of the interplay between language and thought. The first part of the thesis focused on long-term linguistic experience: we assessed how speakers of Spanish and Swedish habitually describe caused motion events and whether habitual language influences how these speakers think about events. In the second part, the focus shifted instead to the role of short-term linguistic experience in an L2: this allowed us to look at linguistic adaptation and to probe the flexibility of our mental representation of events. In this final section, I will summarize what I see as the original contributions of the

²¹ This result is reported in *Study III*, but not in the summary presented in this introductory chapter. Note that, at the time *Study IV* was written, the linguistic data reported in *Study III* had not yet been analysed, so no comparison between studies is made in *Study IV*.

individual studies and of the thesis as a whole; I will also point to directions for future research based on these contributions.

Study I proposes two quantitative tools (entropy and Monte Carlo simulations) to assess *how much* variability there is in the way motion is described in a language, thus contributing to the literature on typological differences in motion encoding (see Filipović & Ibarretxe-Antuñano, 2015). The findings show that languages can markedly differ in amount of variability: Spanish motion descriptions were structurally and semantically much more variable than Swedish descriptions. The relevance of within-language variability for the linguistic relativity hypothesis has long been recognized, both as a challenge to extreme formulations of linguistic relativity (e.g., Kay, 1996) and as an opportunity to test the hypothesis within a language rather than cross-linguistically (e.g., R. W. Brown & Lenneberg, 1954; Casasanto, 2008; see also *Study III*). However, variability had hitherto simply been taken for granted: *we know* there is variability within every language.²² Challenging this somewhat axiomatic assumption and actually quantifying within-language variability in the motion domain (so that it can be compared *across* languages) leads to an important insight: The distinction between satellite-framed and verb-framed languages might not be symmetric, in the sense that each of these two “types” might not be equally distinct a type. For instance, the little variability in Swedish caused motion descriptions suggests there is an entrenched construction that Swedish speakers more or less automatically associate with this kind of situation (see also Toivonen, 2002); no equally entrenched construction seems to exist in Spanish. To what extent there really is such a construction (in the sense of Goldberg, 1995; see Ambridge, Noble, & Lieven, 2014, for how to test it) and whether this observation extends to other satellite-framed and verb-framed languages is a hypothesis that remains to be tested.

Study II extends previous investigations of linguistic relativity in the motion domain. First, it probes the effects of Talmy’s (1985, 2000) typological distinction in the caused motion domain, while previous studies had targeted voluntary motion. Here the findings show that voluntary and caused motion can be fruitfully studied within Talmy’s framework, and that the results with regard to linguistic relativity compare well across studies. Second, this study implements a non-verbal task that teases apart differences in cognitive bias towards path from differences in bias towards manner. This is theoretically sounder than treating path and manner as an opposition,

²² For example, Paul Kay remarks: “[...] the kinds of differences *between* languages which are routinely taken as evidence in favor of the Whorfian view commonly occur *within* languages” (1996, p. 97).

because the relevant cross-linguistic difference in codability concerns only manner, not path.

Study III explores how native Spanish speakers and Swedish learners of L2 Spanish adapt their lexicalization choices—specifically, their use of path verbs or manner verbs—to recent Spanish input. Using a paradigm inspired by studies of structural priming, the study shows that L2 learners’ expectations about how motion events will be described in their L2 reflect a mixture of their L1 and L2 experiences, but also that expectations become more native-like with increasing L2 proficiency. This study bridges two literatures that hitherto had been unconnected, namely research on the acquisition of L2 lexicalization patterns (see Cadierno, 2008) and research on structural priming and linguistic adaptation (e.g., Jaeger & Snider, 2013; Pickering & Ferreira, 2008). Future work on the acquisition of L2 lexicalization preferences could extend this design to test whether L2 speakers genuinely develop abstract path verb and manner verb categories in their L2 (see Konishi et al., 2016). More generally, future work on L2 acquisition could further develop the notion of error-signal (Chang et al., 2006; Jaeger & Snider, 2013) as it applies to L2 processing (see Kaan, 2014 for a similar call).

Study IV finds that recent linguistic experience in an L2 affects how L2 learners think about motion events. This might be seen as a first miniature demonstration of conceptual restructuring in an L2, by which contact with an L2 leads to change in a person’s conceptual representations (e.g., Athanapoulos, 2011a). While here we showed that recent L2 exposure affects the conceptual categories used in an immediately following non-verbal task, future work will have to explore how long-lived these effects are and how exactly recent linguistic experience gets integrated with previous long-term experience.

Two contributions cut across the thesis as a whole:

First, path and manner do not form a natural opposition and should not be treated as such. Much earlier work on linguistic relativity in the motion domain has been carried out under the assumption that, if the linguistic relativity hypothesis was right, then speakers of verb-framed languages should be biased towards path, while speakers of satellite-framed languages should be biased towards manner (see section 2.2). However, a more appropriate description of the relevant cross-linguistic difference is that satellite-framed and verb-framed languages differ with respect to the codability of manner, which is greater in the former than in the latter type of languages. In the linguistic domain, this point had been raised by Berthele (2013), who showed that expressing manner is quite independent from expressing path. In the non-linguistic domain, Loucks and Pederson (2011)

drew attention to this conceptual confusion, while the study by Kersten et al. (2010) provided empirical evidence that differences in manner bias are independent of differences in path bias. The present thesis provides additional linguistic and non-linguistic evidence for the logical independence of path and manner from a novel language pair (Spanish and Swedish) and in a novel subdomain of motion (caused motion): *Study I* (and the norming study in *Study II*) found that Spanish and Swedish only differ in their likelihood to encode manner, not path; *Study II* correspondingly found that non-verbal differences only arise with respect to manner, not path; *Study IV* found an asymmetry in the effect of priming: path- vs. manner-priming significantly affected how much participants relied on manner in the non-verbal task, but for path the effect did not reach significance. This converging evidence strongly suggests that future studies aiming to test effects of linguistic relativity in motion should focus on manner, not path.²³ Specifically, future work should try to gain a better theoretical understanding of what the notion of *manner of motion* really encompasses (see Slobin et al., 2014). If Malt and colleagues are right in suggesting that effects of language on thought are more likely for aspects of the world that do not intrinsically stand out so strongly (Malt et al., 2010; see also Cibelli et al., 2016), then we should find effects of linguistic relativity mainly in subtle manner distinctions.

Second, the studies in this thesis support a view of conceptual representation that is flexibly modulated by task demands (*Study II*) and recent linguistic experience (*Study IV*). Such a view is neither reconcilable with accounts that suggest our native language strongly constrains conceptual representation, nor with those that suggest conceptual representation is strongly constrained by universal conceptual categories; yet, discussions surrounding linguistic relativity are still often framed as though these were the two only possible alternatives (e.g., Gleitman & Papafragou, 2012; see Regier et al., 2010, for discussion). As laid out in the introduction, there is a growing consensus in the field that none of these extreme views can be right. The present thesis offers yet another example of why this dichotomy is counterproductive. We found an effect of manner codability in *Study II*, but only for one of the two relevant linguistic contrasts. Is this evidence either for or against linguistic relativity? We also found, in *Study IV*, that, whatever the Whorfian effects of speakers' long-term linguistic experience, this effect

²³ This statement is aimed at studies taking Talmy's (2000) typology as their point of departure. This is not to say that languages do not differ with respect to how they encode subtle aspects of path—they certainly do (e.g., A. Brown & Gullberg, 2011; Ibarretxe-Antuñano, 2009), and it is largely an open question whether these differences are reflected at some non-linguistic conceptual level (see Flecken, Carroll, Weimar, & von Stutterheim, 2015, for evidence of thinking-for-speaking effects).

is overridden by short-term linguistic exposure in the L2. Again, is this evidence for or against linguistic relativity? We need refined theories of the interaction of language and thought—theories that allow for both influence of habitual linguistic categories under some circumstances, but also for their absence under others—we need theories that can account for effects of recent experience and at the same time can predict how that new experience will become integrated with long-term experience. At Marr’s (1982) computational level, probabilistic formulations of language effects as a result of inference under uncertainty suggest a promising path, able to capture some of the mixed evidence, by specifying when language effects are more likely to arise (in the colour domain, see, e.g., Bae et al., 2015; Cibelli et al., 2016; in the domain of spatial relations, see Tseng, Carstensen, Regier, & Xu, 2016). A major challenge will be to link these accounts to Marr’s physical level and to the neuroscientific literature, where the issue of cognitive penetrability is intensively discussed (Firestone & Scholl, 2016)

I hope the previous discussion shows the substantial theoretical interest of contemporary research into linguistic relativity, and, more broadly, into the relation between language and thought. What about its practical relevance: Are effects of linguistic relativity of any practical significance? I should like to answer with a thought experiment. Think back to the example that opened this introductory chapter: the Swedish gender-neutral pronoun *hen*. Suppose for a moment research found a “small” effect of using a gender-neutral pronoun—say, small like the effect found in *Study II* in the domain of motion. Suppose this effect meant that people were a bit more likely to think about gender in a non-dichotomized way, or that they had an easier time (and possibly were a bit faster) in abstracting away from gender when such information is irrelevant. Would this small effect not be of practical relevance? Would it not be a good reason to accept and use a word like *hen*? In any case, taking less idealistic positions and, instead, as Bertrand Russell suggests, looking at the facts of the matter is surely the way forward.

Sammanfattning på svenska

Denna avhandling undersöker sambandet mellan språk och tanke – den handlar om språklig relativism. Förespråkare av språklig relativism hävdar att det språk man talar påverkar ens sätt att tänka och följaktligen att talare av olika språk i viss mån tänker olika (Boroditsky, 2012; Whorf, 1956a). Mer konkret undersöker avhandlingen hur talare av spanska och svenska beskriver och tänker om rörelseskeenden, det vill säga situationer där någon eller något förflyttar sig i en viss riktning. Att prata om rörelse är universellt och förekommer i alla mänskliga språk. Däremot skiljer sig språk avsevärt från varandra gällande *hur* rörelse beskrivs. I denna avhandling koncentrerar jag mig på kausal rörelse: situationer där någon får ett föremål att förflytta sig. Det finns markanta skillnader mellan spanska och svenska i hur sådana skeenden beskrivs. Samma scen som på svenska skulle beskrivas som *Han rullade in däck i garaget* skulle i stället på spanska vanligtvis beskrivas som *Entró en el garaje con una rueda* ('han kom in i garaget med ett däck'). Det spanska verbet *entrar* betyder ungefär 'komma in', men det säger ingenting om sättet på vilket man kommer in. En spankstalande skulle således inte behöva beskriva *hur* personen i fråga fick in däck i garaget (puttade han däck? drog eller bar han det?). Detta beror på att spanska och svenska har olika sätt att lexikalisera rörelsekomponenter; dessa språk skiljer sig åt i hur de uttrycker rörelsens konceptuella beståndsdelar (Talmy, 2000). Den väsentliga skillnaden är att så kallade satellitspråk, som svenska eller engelska, uttrycker *rörelsesätt* (eng. *Manner of motion*) i verbet (man säger t.ex. *Han RULLADE/PUTTADE/DROG däck in i garaget*) och *bana* (eng. *Path*) i en satellit till verbet (t.ex. *Han rullade däck IN I / UT UR garaget*). Verbbaserade språk som spanska eller franska uttrycker istället *bana* i verbet (t.ex., *ENTRÓ en / SALIÓ d(e) el garaje con una rueda*, där just verbet uttrycker om någon kom in eller ut). Till följd av detta utelämnas ofta information om rörelsesätt i verbbaserade språk som spanska, som i exemplet ovan. Det går förvisso att på spanska uttrycka rörelsesätt, t.ex. genom att lägga till ett verb i gerundium (*Entró en el garaje EMPUJANDO una rueda* 'han kom in i garaget skjutandes ett däck'), men detta är inte grammatiskt nödvändigt och därför utelämnas ofta rörelsesättsuttryck på spanska.

Avhandlingen är baserad på fyra experimentella studier som kan delas in i två dimensioner. Enligt den första dimensionen delas studierna in beroende på huruvida de i första hand handlar om språk eller tanke. Två studier behandlar hur rörelseskeenden *beskrivs*; de använder sig av språklig data (*Studie I* och *III*). De två andra behandlar hur man *tänker* kring dessa skeenden; dessa studier använder sig av icke-språklig data som ger inblick i hur man uppfattar likhet mellan dessa skeenden (*Studie II* och *IV*). Den andra

dimensionen som studierna kan delas in efter är typ av språklig erfarenhet: *Studie I* och *II* jämför hur infödda, huvudsakligen enspråkiga talare av spanska och svenska talar om och uppfattar likhet mellan skeendena. *Studie III* och *IV* fokuserar på svenska andraspråkstalare av spanska; frågorna här relaterar till hur dessa påverkas i sitt sätt att antingen beskriva rörelseskeenden på spanska (*Studie III*) eller tänka kring rörelseskeenden (*Studie IV*) beroende på vilka spanska meningar de nyligen exponerats för.

Studie I undersöker i närmare detalj den variation som finns inom ett och samma språk vad gäller beskrivning av kausala rörelseskeenden. Indelningen ovan i satellit- respektive verbbaserade språk är en förenkling. Sedan länge har man observerat att det inom ett och samma språk kan finnas olika mönster för att beskriva skeenden (Beavers et al., 2010; Croft et al., 2010). Dessa iakttagelser har dock mestadels varit kvalitativa: man har inte på ett systematiskt sätt försökt mäta hur stor den inomspråkliga variationen är. Föreliggande studie går ett steg vidare genom att kvantifiera variationen i olika mönster på spanska och svenska. Detta åstadkoms genom att låta 42 infödda talare av varje språk beskriva samma uppsättning skeenden. Med hjälp av det informationsteoretiska måttet entropi samt statistiska simuleringar (Monte Carlo) visas hur variationen på spanska är avsevärt större än på svenska. Även om de dominanta mönstren i varje språk följer beskrivningen ovan (svenska uttrycker bana i satelliter medan spanska uttrycker bana mest i verb), förekommer det mycket större variation i det spanska mönstret än i det svenska. Den större spanska variationen gäller både syntaktiska mönster (t.ex. vilken typ av information som uttrycks i verbet eller utanför verbet) och den information som över huvud taget uttrycks (t.ex. om rörelsesätt nämns eller inte). Vidare visas att denna stora variation på spanska inte främst beror på variation mellan olika scener utan på variation mellan individer. Med andra ord, det är inte fallet att man på spanska systematiskt använder olika typer av beskrivning beroende på rörelseskeenden. Snarare är det så att sättet på vilket ett skeende beskrivs beror mest på *vem* som beskriver det – olika talare har olika sätt att beskriva.

Studie II söker att gå bortom språkliga skillnader mellan infödda talare av spanska och svenska, och undersöker om dessa talare även tänker olika kring samma rörelseskeenden. Det som menas med ”tänka” i denna studie är hur dessa talare uppfattar likhet mellan olika skeenden. Betrakta följande tre rörelseskeenden: I det första drar någon en stol in i en lada (1); i det andra rullar samma person ett däck in i en grotta (2); i det tredje rullar återigen samma person en badring uppför en kulle (3) (se Figur 1 på s. 18). Scenerna 1 och 2 har bana gemensamt då rörelsen i båda fall sker *in* någonstans, men scenerna 2 och 3 har rörelsesätt gemensamt, då föremålet i båda fallen *rullas*. Frågan som ställs här är om svensktalande, som ju är mer benägna att

beskriva rörelsesätt än spansktalande, även skulle uppfatta rörelsesätt som en viktigare aspekt av rörelse än spansktalande när de bedömer likhet mellan scener. Vi skapade en uppgift som lät oss mäta just detta, som vi hädanefter refererar till som den (ickespråkliga) *likhetsbedömningsuppgiften*. Deltagarna (sammanlagt 68 infödda spansktalande och 67 infödda svensktalande) gjorde denna uppgift under en av tre olika betingelser. I den språkliga betingelsen beskrev först deltagarna alla skeenden (på sitt språk) och utförde sedan likhetsbedömningsuppgiften. Här fann vi att talare av svenska var mer benägna än talare av spanska att bedöma likhet i termer av sättet på vilket föremålen rörde på sig (alltså om de rullade eller gled på marken). I den andra, fria betingelsen beskrev inte deltagarna skeenden, utan de fick endast se på dem i tystnad innan de utförde likhetsbedömningsuppgiften. Resultatet här var likt det första: återigen var föremålets rörelsesätt viktigt för svensktalande, men inte för spansktalande. I den tredje och sista betingelsen blockerade vi deltagarnas förmåga att använda språk för att lösa uppgiften, genom att låta dem upprepa olika slumpgenererade sifferserier (t.ex. 89, 54, 11) under hela experimentet, både medan de tittade på alla scener och under likhetsbedömningsuppgiften. I denna betingelse försvann alla skillnader mellan hur spansk- och svensktalande bedömde skeendernas likhet. Den slutsats vi kan dra från denna studie är att språkliga skillnader *kan* speglas i tänkandet, men endast när språket är *tillgängligt* för att tänka kring en viss situation.

Studie III utreder huruvida svenska andraspråkstalare av spanska överför sina svenska förväntningar när de möter spanska rörelsebeskrivningar eller om de anammat det spanska mönstret för att beskriva dessa skeenden. För att undersöka detta studerades hur deltagarnas sätt att beskriva rörelseskeenden påverkas av att exponeras för olika typer av beskrivningar på spanska. Deltagarna i denna studie var 59 infödda talare av spanska och 60 svenska andraspråkstalare av spanska. Kom ihåg att *Studie I* visade att det finns avsevärd variation i spanska rörelsebeskrivningar. Vi använde oss av denna variation på följande sätt. Alla deltagare fick beskriva rörelseskeenden på spanska (deras första- eller andraspråk beroende på grupp). En tredjedel av deltagarna beskrev skeendena utan någon manipulering, medan resten fick läsa upp en spansk mening innan de beskrev varje rörelseskeende. Hälften av dessa läste meningar där huvud verbet uttryckte bana (t.ex. *entran* 'komma in'), som ju är det typiska mönstret i spanska; den andra hälften läste meningar som i alla avseenden var lika den första hälften med undantaget att huvud verbet i stället uttryckte rörelsesätt (t.ex. *empujan* 'skjuta'), som är typiskt för svenska. Nu kunde vi använda oss av en känd effekt inom priming-litteraturen, den så kallade "inverse preference effect", som går ut på att man primas starkare av (man imiterar i större utsträckning) de språkliga strukturer man *inte* förväntar sig, än av de språkliga strukturer man

förväntar sig. Enligt denna effekt borde vi finna att infödda talare av spanska primas starkare av meningar med sättsverb än med banverb, alltså att de anammar de förra verben i större utsträckning än de senare *jämfört med hur dessa verb används när talarna inte primas*. Exakt så blev resultatet. Gällande andraspråkstalare så kan man använda en liknande logik: om svenska andraspråkstalare överför sina svenska förväntningar så borde de förvänta sig sättsverb och primas mindre av dessa verb än av banverb. Resultaten på grupp-nivå tydde på att inlärnarnas förväntningar påverkades både av deras förstaspråk svenska och av deras andraspråk spanska. Det mest slående resultatet var att primingeffekterna förändrades beroende på andraspråkstalarnas behärskningsnivå i spanska. Talare med låg behärskningsnivå påverkades av de spanska meningarna såsom man skulle förvänta sig om de överförde det svenska mönstret (preferens för sättsverb). Men vid högre behärskningsnivåer betedde de sig näst intill som infödda talare av spanska (preferens för banverb). Den allmänna slutsats denna studie drar är att andraspråkstalare börjar sin inläring av andraspråket med förväntningar likt sitt förstaspråk men att de med ökande behärskningsnivå anpassar sina förväntningar efter de karakteristiska mönstren i andraspråket. I studien reflekterades dessa förväntningar i hur både infödda talare och andraspråkstalare anpassade sina beskrivningar till spanska meningar som de precis hade läst.

Studie IV tar avstamp i forskning om tvåspråkig kognition, vilken ställer frågan om koncept kan omstruktureras till följd av att man lär sig ett nytt språk (se t.ex. Athanasopoulos, 2011a). Den litteraturen har mest fokuserat på huruvida kognitiva kategorier förändras efter några års kontakt med ett språk som delar upp verkligheten på ett annat sätt än inlärares förstaspråk (t.ex. Athanasopoulos, 2009; Athanasopoulos et al., 2011). I föreliggande studie ställer vi frågan om man kan hitta effekter av andraspråkets påverkan på kognitiva kategorier mycket tidigare än så, bara efter några minuter. För att testa detta lät vi svenska andraspråkstalare av spanska utföra en likhetsbedömningsuppgift (såsom i *Studie II*). Andraspråksdeltagarna var desamma som i *Studie III*. Efter att de primats med antingen banverb eller sättsverb (se *Studie III*) fick de utföra likhetsbedömningsuppgiften. Vi fann att de olika grupperna lade mer vikt vid de komponenter som var framträdande i de spanskspråkiga meningar de just hade läst. Det betyder att dessa meningar på andraspråket spanska utövade starkare inflytande på kategorisering än deltagarnas livslånga exponering för svenska uttryck. Vi drar slutsatsen att språkliga kategorier som vi lär oss i vårt förstaspråk inte dominerar vårt tänkande. I stället verkar kategorier kunna skapas *ad hoc* för att utföra en viss uppgift (Casasanto & Lupyan, 2015); uttryck man nyligen exponerats för, även i ett andraspråk, kan då påverka vilka mentala kategorier vi formar.

Sammanfattningsvis bidrar denna avhandling till en berikad förståelse för det komplexa sambandet mellan språk och tanke genom att särskilt studera rörelsedomänen. Frågan om huruvida det språk vi talar påverkar hur vi tänker kan inte besvaras med ett simpelt ”ja” eller ”nej”. Det är varken fallet att språket inte alls påverkar vårt tänkande (t.ex. Papafragou et al., 2002; Pinker, 1994), eller att språket fullständigt och ofrånkomligen dominerar vår världssyn (stundtals i Whorf, 1956a). Avhandlingen visar att de kategorier som frekvent uttrycks i vårt språk kan påverka hur vi tänker kring vissa situationer. Den visar också att ny språklig erfarenhet i vårt andraspråk kan överskugga tidigare språklig erfarenhet i vårt förstaspråk och påverka vilka aspekter av verkligheten vi lägger märke till, åtminstone på kort sikt.

Author contributions on co-authored manuscripts

Study II:

Montero-Melis conceptualized the research, designed the experiment, coordinated data collection, analysed the data, and wrote the bulk of the manuscript. Bylund discussed the design and wrote bits of the manuscript.

Study IV:

Montero-Melis and Bylund conceptualized the research. Montero-Melis designed the experiment, coordinated data collection, analysed the data, and wrote the manuscript. Jaeger contributed to the study design, guided data analysis, and edited the manuscript. Bylund edited the manuscript.

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