



BRILL



brill.com/irp

A Cross-Linguistic Perspective on the Acquisition of Causal Connectives and Relations*

Sandrine Zufferey

University of Fribourg, Switzerland

Sandrine.Zufferey@unifr.ch

Willem M. Mak

Utrecht University, The Netherlands

w.m.mak@uu.nl

Ted J.M. Sanders

Utrecht University, The Netherlands

T.J.M.Sanders@uu.nl

Abstract

Causality is one of the most frequent coherence relations linking sentences together within texts and discourses, and mastering them is an essential part of acquiring a language. In this paper, we investigate the way French- and Dutch-speaking children acquire these relations depending on the way they are encoded in their mother tongue. From a cross-linguistic perspective, important differences exist in the communication of causal relations. While in some languages like Dutch, objective relations linking causes with consequences and subjective relations linking claims and conclusions are prototypically conveyed by a specific connective, in others like English and spoken French, a single connective is used in both cases. In this paper, we study the impact of these cross-linguistic differences for children's ability to understand causal relations in a text. Our results indicate that French- and Dutch-speaking children have a similar ability to handle objective and subjective causal relations. In addition, subjective relations remain more difficult than objective relations even at the age of eight. We conclude that conceptual development sets the pace for lexical acquisition and discuss the causes for the acute difficulty of subjective relations.

* This work was supported by an Euro-XPRAG grant and an EU Marie-Curie grant (299185) awarded to the first author.

Keywords

discourse connectives – causality – domains of use – acquisition – cross-linguistic comparison

1 Causal Connectives and Their Domains of Use

Sentences are often linked together within texts and discourses by causal relations. Mastering these relations is therefore an essential step in language acquisition. One of the difficulties of causal relations is that they can be used to relate several kinds of propositional content (e.g. Sanders, Spooren and Noordman, 1992; Sweetser, 1990; Van Dijk, 1979). For example, in (1) the connective *because* is used to relate facts taking place in the world independently of the speaker. In (2) the same connective is used to relate the speaker's subjective claim and an argument supporting it. Finally, in (3) it relates a speech act and the reason for performing it.

- (1) Max went home *because* he was tired.
- (2) Max must be tired, *because* he went home.
- (3) Is Max gone? *Because* I don't see him in the room.

In (1) the fact that Max is tired causes the event of his going home in the real world. By contrast, in (2) the fact that Max went home does not cause his state of tiredness but merely the speaker's belief or conclusion that he was tired. The causal relation conveyed by *because* thus holds in the belief world of the speaker rather than in the real physical world. Finally, in (3) the fact that the speaker does not see Max in the room causes the speech act of asking if he is gone. More recently, these domains of use have been conceptualized as a continuum rather than well-separated categories, ranging from relations that are external to the speaker and are therefore objective such as (1) to others involving the speaker's own reasoning (2) or speech act (3) and that are in this respect more subjective (Pander Maat and Degand, 2001; Pit, 2003; Sanders and Stukker, 2012).

A crucial aspect of examples (1) to (3) above is that all domains of use are conveyed by the connective *because*. Another possibility for English speakers is not to mark the causal relation with a connective, and let the hearer reconstruct it by inference (e.g. Spooren, 1997). However, in English, the speaker cannot choose to make the domain of use transparent by using a specific connective. Contrary to English, Dutch possesses two distinct causal connectives depend-

ing of the domain of use (Degand and Pander Maat, 2003; Pit, 2003; Sanders and Spooren, 2009; Stukker and Sanders, 2012). The connective *omdat* is prototypically used to convey objective relations while *want* is prototypically used for subjective relations (epistemic and speech act). Similar distinctions between objective and subjective relations are also made in a number of typologically diverse languages like German (Pasch, 1983; Pit, 2007), Portuguese (Lopes, 2009) and Mandarin Chinese (Xing, 2011). French represents an intermediate case between English and Dutch, with two different connectives used in writing depending of the domain of use: the connective *parce que* is prototypically used to convey objective relations while *car* is used for subjective relations (Lambda Group, 1975; Zufferey and Cartoni, 2012). However, the connective *car* is almost not used anymore in contemporary spoken French with the consequence that *parce que* is used in all domains in this mode (Degand and Fagard, 2012) and that adult speakers' intuitions about the difference of domains between *car* and *parce que* has to some extent become blurred (Zufferey, 2012). In addition, the different relations conveyed by *parce que* are most often not marked by a specific prosody. Simon and Degand (2007: 335) report that in 70% of the cases in their dataset, *parce que* is produced with a neutral prosodic profile, compatible with both objective and subjective relations. In the other cases, when the connective is used to convey an objective relation, the prosodic profile is integrated, in other words there is no pause or intonational frontier between the segments. Conversely, when the connective is used to convey a subjective relation, the connective is either separated from both segments or integrated in the prosodic contour of the first segment and clearly separated from the second segment. In English, Blakemore (1987: 147) also remarked that prosody was not a reliable criterion to separate objective and subjective uses of *because*. Thus there is in most cases a genuine ambiguity between objective and subjective uses of these connectives that has to be resolved by understanding the semantic content of the relation. In speech, and consequently in children's input until they become literate, French therefore presents a similar situation as English.

The difference between French and Dutch causal connectives has been empirically assessed. In a paper and pencil task, Mak, Zufferey, Verbrugge and Sanders (submitted) asked a group of French-speaking subjects to choose between *car* and *parce que* to fill in blanks in objective and subjective relations, and a group of Dutch-speaking subjects to choose between *omdat* and *want* to relate similar sentences. Results indicate that French-speaking participants' preference for *car* to convey subjective relations is significantly lower than the preference of Dutch-speaking participants for *want* to relate subjective relations. The difference between French and Dutch has been confirmed by

processing studies using eye-tracking. In Dutch, Canestrelli, Mak and Sanders (2013) found that subjective relations linked with the connective *want* induced a delay in reading times in the region immediately following the connective compared to objective relations conveyed by *omdat*. In English, the processing delay induced by subjective relations conveyed by *because* only appeared later in the sentence, when the semantic content of the segment provided enough information for the reader to know that the relation was subjective (Traxler, Sanford, Aked et al., 1997). In French, Mak et al. (submitted) found a subjectivity effect at the end of the sentence comparable to the effect found in English. This effect was not caused by the connective, as a similar pattern was found for both sentences related with *parce que* and *car*. They also found an early delay caused by the connective *car*, an effect that the authors attributed to the formal register associated with this connective, making it an unexpected lexical choice in the informal context set by the experimental items. These studies thus provide further indications that French connectives do not provide similar processing instructions as Dutch connectives, as they do not appear to guide readers towards a specific domain of use.

In sum, there is an important difference in the linguistic encoding of domains of use for causal connectives depending on the languages. While Dutch speakers have a linguistic cue telling them what the intended domain of use is, English speakers and French speakers need to reconstruct it by inference, as only one connective is used in spoken French and the two connectives used in writing no longer seem to fully discriminate between objective and subjective relations, even though the two connectives are still used with a similar frequency in this mode.

This cross-linguistic difference is also salient for so-called forward causal relations as (4) to (6), in which the cause is presented before the consequence, contrary to backward causal relations where the consequence is presented before the cause, as in examples (1) to (3) above.

- (4) Max was tired *so* he went home.
- (5) Max went home, *so* he must have been tired.
- (6) I don't see Max in the room, *so* is he gone?

In Dutch, forward causal relations are also prototypically conveyed by two different connectives: *daarom* is used for objective relations while *dus* marks subjective relations (Evers-Vermeul and Sanders, 2011). By contrast the connective *alors* is predominantly used in French to convey both objective and subjective causal relations (Degand and Fagard, 2011) even though a specifically subjective connective also exists (*donc*).

In the languages of the world, subjectivity can be encoded in a number of other lexical ways than connectives, for instance by using a lexical paraphrase acting as a subjectivity marker such as “I think that” or “According to John”, or an epistemic modal (e.g. *must*, *should*, etc.). Experimental studies have demonstrated that when such a subjectivity marker is used, the delay induced by subjective relations in the segment following the connective disappeared because the readers already expected the relation to be subjective (Canestrelli et al., 2013; Traxler et al., 1997). However, the difference between these lexical means to communicate subjectivity and the two specific connectives existing in a language like Dutch is that these paraphrases and modal verbs are optional for the communication of a causal relation. In Dutch however, every time a speaker wants to convey a causal relation, he has to make a lexical decision about the objective or subjective nature of the relation in order to be able to choose one of the two connectives. This difference is reminiscent of the communication of evidentiality across languages. Even though evidential information can be conveyed by linguistic means in languages like French or English (e.g. Ifantidou, 2001), this information can also be left underspecified. By contrast, in a language like Turkish or Korean, every use of a verb implies the choice of an evidential suffix (Aksu Koç, 1988; Aikhenvald, 2006; Choi, 1995). The weak version of linguistic determinism predicts that children speaking these languages should have a developmental advantage over their French or English speaking peers in their ability to reason about sources of beliefs (Papafragou et al., 2007). A weaker hypothesis still is that linguistic encoding can speed up the acquisition of linguistic representations, and therefore that children learning a language in which a distinction is lexically encoded will master the structures that involve it sooner than children learning a language where this distinction is linguistically underspecified. In this hypothesis, linguistic encoding could impact on language acquisition without implying an influence on non-verbal representations. If this is the case, it is expected that Dutch-speaking children will have an advantage over French-speaking children in the processing of causal relations. If however cognitive development sets the pace for lexical acquisition, then children from both mother tongues should be able to deal with objective and subjective causal relations at a comparable schedule, independently of the way it is encoded or not in their exposure language. In this paper, our aim is to assess these hypotheses, by comparing the acquisition of objective and subjective causal relations in French- and Dutch-speaking children from age five to eight, on the same comprehension task. The only difference between the two languages in our task is the number of connectives used to convey objective and subjective causal relations: two in Dutch and one in French. We start by reviewing in the next section previous studies that

have addressed the question of the acquisition of causal connectives and their domains of use.

2 The Acquisition of Causal Relations in French and Dutch: A View from the Literature

Several studies have investigated the order of acquisition between objective and subjective relations (Kyratzis, Guo and Ervin-Tripp, 1990; Spooeren and Sanders, 2008; Zufferey, 2010; Evers-Vermeul and Sanders, 2011). In Dutch, Spooeren and Sanders (2008) designed two elicitation tasks to analyse the production of causal relations in children from two age groups: 6–7 year-olds and 11–12 year-olds. All sequences of causally related sentences were analysed, independently of the presence of connectives. Results indicate that the younger age group produced more objective relations than the older age group. The use of subjective relations (speech act and epistemic) however didn't differ between the two groups. In both cases, speech act relations were predominant with respect to epistemic relations. These experiments also highlighted the role of context for the production of domains of use. In one of the tasks, children were asked to describe a picture, with the effect of strongly biasing them towards the production of objective relations. Another task, involving argumentation, biased children towards the subjective relations. Given that the younger age group from this study already produced relations in all domains, Evers-Vermeul and Sanders (2011) have conducted two additional elicitation tasks in Dutch with three-, four- and five-year-old children, again designed to bias the production of causal relations towards one specific domain of use. Results indicate that children as young as three are already able to produce all kinds of relations when the task they have to perform encourages them to do so. However, both three- and four-year-olds produced significantly less epistemic relations than five-year-olds.

As three-year-old Dutch-speaking children are already able to produce all kinds of relations, Evers-Vermeul and Sanders (2011) have also studied 12 younger children's productions in a series of longitudinal Dutch corpora available through the CHILDES database. The recordings included the period of 2;0 to 3;6 on average. In this experiment, causal relations were studied only when they were marked by four specific connectives: *omdat*, *want*, *dus* and *daarom*. The connectives *omdat* and *want* indicate backward causal relations, that is relations with the consequence presented first in the sentence and the cause following the connective (as in examples 1 to 3), while *dus* and *daarom* are forward causal connectives, with segments presented in reversed order (as in

examples 4 to 6). The conclusions from this analysis are that children are able to produce connectives in all three domains by the age of three, and that epistemic relations are systematically acquired later than the other two domains.

Evers-Vermeul and Sanders also report that for backward connectives, children incorrectly start by using only the connective *want* to express relations in all three domains. However, they also note that: “the two children who do have a domain preference in their use of *omdat* reflect the prototypical content use that adults exhibit” (2011: 1658). Moreover, for the other pair of connectives made of *dus* and *daarom*, children have a differentiated usage, based on relation type. While *dus* is predominantly used for subjective relations, *daarom* is used for objective ones, as it is the case in adult speech. These early production studies therefore leave open the question of when children fully perceive the difference of domains between *omdat* and *want*. In another set of experiments, Zufferey and Mak (2014) have found that eight-year-old Dutch-speaking children are sensitive to the specificities of *want* and *omdat* to express objective and subjective causal relations. More specifically, children preferentially choose to use *want* to convey subjective relations and *omdat* to convey objective relations. Therefore children’s sensitivity to the difference of domains between *want* and *omdat* seems to be developing between the age of three and eight.

In another longitudinal corpus study in French, Zufferey (2010) analysed productions of the causal connective *parce que* by four children. Three of the children were recorded on average between the age 2;3 and 3;4. The fourth child was recorded between the age of 2;8 and 4;3. These results indicate that French-speaking children are also able to produce all kinds of relations by the age of three, and that the onset of production for epistemic relations is delayed with respect to the other two domains, which are acquired simultaneously. Zufferey (2010: 140) also notes that epistemic productions are very rare at three and that the child recorded until the age of 4;3 had a marked increase in epistemic uses of *parce que* during the second half of her fourth year.

All the studies quoted above have investigated the emergence of children’s spontaneous production of connectives in naturalistic data. This represents only one aspect of the acquisition process and does not provide indications about the way children understand and manipulate these connectives in more specific contexts, nor does it provide information about how the acquisition continues to develop after the early emergence of these connectives in children’s speech. Indeed, other studies have revealed that the appropriate use of connectives (Peterson, 1986) and also their understanding (Cain and Nash, 2011; Irwin and Pulver, 1984) are still developing for several years after they first appear.

Van Veen (2011) addressed the question of children's comprehension of objective and subjective (epistemic) domains of use using the visual world paradigm of eye-tracking. In this experiment, children were presented with two pictures on a computer screen, and heard a stimulus sentence that contained either an implicit objective or an implicit subjective relation with one of them. For example, children saw a picture of a pig standing in some mud plus an additional distraction picture featuring the same pig in another situation and heard the sentence: "The pig will get dirty". In this case, there is an objective relation (taking place in the real physical world) between the fact of standing in the mud and that of getting dirty. Therefore, if children are sensitive to objective causal relations, it is expected that they should look more at the pig standing in the mud than at the distracting picture that is not causally related to the stimulus sentence. Preferential looking time was measured for two groups of children: 2;0 and 3;4 year-olds, as well as an adult control group. This study revealed that while both groups of children performed equally well with objective relations, the 3;4 group performed better than the 2;0 group with subjective relations. More specifically, while children from both age groups did manage to relate the correct pictures to the verbal stimuli even in the subjective condition, three-year-old children were faster and more accurate than two-year-olds. This was not the case for objective relations, for which both groups got comparable results. Crucially, the performance of three-year-olds was not yet comparable to that of adults in both conditions, indicating that some further developments in the processing of causal relations must be taking place at a later age.

To summarize, the production studies reported above indicate that French- and Dutch-speaking children are able to produce subjective relations linked by a causal connective by the age of three. However, results from the Dutch-speaking children indicate that most of them have not firmly acquired the specificities of connectives and their relation to domains of use at that age, at least for backward relations. In the study of Zufferey and Mak (2014), eight-year-old children were however found to be sensitive to this distinction in a pen and pencil task in which they were asked to choose between the two connectives in objective and subjective relations, even though they did not yet reach adult-like performances. This means that between the age of three and eight, Dutch-speaking children gradually develop sensitivity to the meaning of the causal connectives *omdat* and *want*. In our experiment, we assess whether this growing sensitivity helps them to perform better than French-speaking children when they have to deal with causal relations in a text.

From a cross-linguistic perspective, studies from the literature do not allow for a systematic comparison of the acquisition process of connectives, as results from Dutch- and French-speaking children come from corpora gathered in

different contexts and the uniformity of the data cannot be guaranteed cross-linguistically. In order to provide a reliable cross-linguistic comparison, children from different mother tongues must be assessed on the same task. Our study provides such a comparison by testing children with a protocol diverging only on the number of connectives used to express domains of use: two in Dutch and one in French.

3 A Cross-Linguistic Comprehension Experiment

3.1 *Participants*

In French and in Dutch, four groups of children from the age of five to eight participated to the study, as reported in Table 1.

For the French-speaking groups, children were recruited and tested in a primary school in Geneva, in the French-speaking part of Switzerland. For the Dutch-speaking groups, children were recruited and tested in 's-Hertogenbosch in the South of the Netherlands. In both countries, all children were native speakers of the language tested and none of them suffered from a form of language or cognitive impairment. All the children were able to complete the task. The average duration was 15 minutes.

3.2 *Material*

We created a storybook containing two short stories, using pictures from Arnold Loebel's book *Mouse Tales* (1972) with an adapted text. Each story contained a total of five objective and five subjective relations, alternated with filler sentences. In total, the two stories contained 10 items per condition (objective, subjective and control). Every page of the story contained one objective relation, one subjective relation and two filler sentences. For example, one page of the stories read like this (translated from the experimental material):

The mouse felt very tired, because she went to bed straight away. She laid down in her little bed and closed her eyes. Everything became dark outside, because it was the night. The mouse quietly fell asleep while the water continued to flood the streets of the city.

For this page, (7) is the objective relation and (8) is the subjective relation.

- (7) Everything became dark outside, because it was the night.
- (8) The mouse felt very tired, because she went to bed straight away.

TABLE 1 Summary of French- and Dutch-speaking participants for each age group

	French-speakers				Dutch-speakers			
	No	Mean	Range	SD	No	Mean	Range	SD
5 year-olds	19	5;2	4;9–5;6	0;3	17	5;5	5;1–5;11	0;3
6 year-olds	19	6;0	5;9–6;6	0;3	16	6;4	6;0–6;11	0;4
7 year-olds	19	7;2	6;9–7;7	0;3	24	7;6	7;0–7;11	0;3
8 year-olds	19	8;7	7;11–9;1	0;5	20	8;6	8;1–8;11	0;3

Children's comprehension of these relations was tested by asking *why*-questions targeting the causes of objective (9) and subjective (10) relations. Children were also asked ten control questions (11), designed to assess their attention level and to check the comprehension of vocabulary items.

- (9) Why did everything become dark outside?
 (10) Why did the mouse go to bed straight away?
 (11) What do you see outside the mouse's window?

In order to ensure a reliable comparison between objective and subjective causal relations, it is essential that both types of relations are equally plausible. We therefore asked a group of 68 adults (Mean age = 20; Range 17–34) to rate the plausibility of all causal relations from our experimental material. The plausibility judgment task consisted of a list of all causal relations from the two stories. Subjects were asked to rate their plausibility on a scale from 1 (very implausible) to 5 (very plausible). For example, the relations (9) and (10) were presented in the following manner:

- (12) Is the fact that it is the night a plausible reason for everything to become dark outside?
 (13) Is the fact of feeling very tired a plausible reason for going to bed?

In order to determine to what extent knowing the context of the story influenced these judgments, participants evaluated the causal relations for one story out of context and for the other story after reading it. The two stories were evaluated both in context and out of context by half of the participants. Results indicate that the plausibility of objective and subjective relations does not differ. When subjects evaluated the causal relations after reading the stories, objective relations got a mean plausibility score of 3.6 and subjective relations

of 3.55. When subjects rated the sentences without reading the stories, objective relations got a mean plausibility score of 3.25 and subjective relations of 3.2. Even though the plausibility scores slightly decrease when the relations are evaluated out of context, the results obtained indicate that these relations are still plausible even without knowing the context in which they occurred. We submit therefore that children should be able to understand individual causal relations from our texts even if they do not understand the whole story.

3.3 *Procedure*

Children were tested individually in a quiet room. Before the experiment started, children from the seven and eight years groups were told that they were going to hear stories and had to listen carefully, because they would be asked questions after every page in order to check their comprehension. This procedure was slightly adapted for the younger age groups of five and six. Because the target questions involved elements of the text that the experimenter had just read, it was pragmatically implausible that the experimenter should need to ask comprehension questions. This proved not to be a problem for the older age groups who were used to teachers asking questions in order to assess their comprehension, but it was disturbing for the younger children of five and six. For these groups, in order to get a more plausible situation, children were introduced to a puppet and told that she did not understand stories. She would ask questions during the stories and the children's task was to help her by providing answers to her questions. An additional advantage of this setting was that younger children were more relaxed when interacting with the puppet than with the experimenter.

For all age groups, questions were asked immediately after the relations were presented in order to reduce memory load, a long-identified confounding factor when testing the comprehension of clauses related with causal connectives (Peterson and McCabe, 1985). The order of the two stories was systematically alternated between the children. In the texts, the order in which objective and subjective relations appears was balanced. For every story, two different lists of questions were created, and the order of presentation between objective, subjective and control questions was systemically varied. The same lists were used cross-linguistically. All children were rewarded for their participation with stickers.

3.4 *Scoring*

All answers were recorded and transcribed for analysis. In both languages, only answers including the causal element presented in the text were coded as correct. Children's reformulations of causes using their own words (e.g. the mouse

is sleepy vs. the mouse is tired) were also coded as correct. All other answers were coded as incorrect. Incorrect answers included either invented causes that were not mentioned in the text (presumably based on world knowledge) or elements retrieved from the text but that were not included in the causal relation. Ambiguous cases were resolved through discussion and coders from both languages saw a selection of answers from the other language groups to assess reliability.

3.5 Results

We analysed the probability of providing a correct answer by performing Linear Mixed Effects Regression analyses (LMER) in R on the data (Baayen, 2008). We first created a base model including story and participant as random factors. We then added the effect of relation (objective versus subjective). This improved the model significantly ($\chi^2(1) = 242.17, p < .001$). Adding language, and the interaction of language and relation did not improve the model further (language: $\chi^2(1) = .81, p = .37$; interaction: $\chi^2(1) = 1.21, p = .27$). Adding the effect of age in months did improve the model ($\chi^2(1) = 159.96, p < .001$), but adding the interaction of age and relation did not improve the model further ($\chi^2(1) = 0.14, p = .71$).

The final model, including the main effects of relation and age thus showed significant main effects of relation ($\beta = -1.29, SE = 0.085, z = -15.09, p < .001$) and age ($\beta = -0.04, SE = 0.003, z = 14.52, p < .001$). Thus the score of the objective relations was higher than the score of the subjective relations, and the score in both conditions improved with age. Crucially however, language did not influence the score, and the difference in score between objective and subjective relations did not diminish with age. Figure 1 illustrates these effects.

4 Discussion

In an off-line comprehension experiment, we assessed French- and Dutch-speaking children's ability to understand objective and subjective causal relations from a text. We tested the possibility that the linguistic cue provided by two specific connectives used in Dutch to convey objective and subjective relations could provide Dutch-speaking children a developmental advantage over their French-speaking peers in the ability to extract information from sentences containing a causal relation. Our results clearly indicate that this difference in linguistic encoding between French and Dutch did not have a significant effect on children's performances. This result is in line with many other studies that have investigated weak cases of linguistic determinism, for

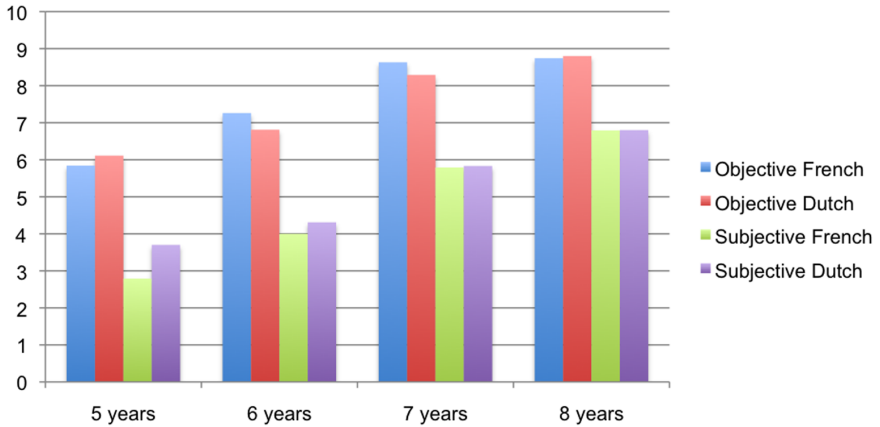


FIGURE 1 No of correct answers (max = 10) per language and per type of causal relation (objective vs. subjective)

example on the acquisition of theory of mind between languages where a specific word exists for false beliefs or conversely when no specific word exists to express beliefs, and failed to evidence any developmental differences between children learning these languages and English-speaking children (e.g. Shatz, Diesendruck, Martinez-Beck and Akar, 2003).

We also observed that children systematically obtained lower scores for subjective relations compared to objective relations, in both languages and across all age groups. Moreover, the difference of scores between objective and subjective relations was not smaller for the older age groups. This result raises the question of why subjective relations are more difficult to understand than objective relations, even for eight-year old children. Zufferey (2010) argued that the specificity of subjective (epistemic) relations is that they require theory of mind abilities. Indeed, in order to understand epistemic causal relations, the hearer must be able to project into another speaker's belief world, and understand that this mental space may be different from the real perceptual world (when the speaker holds a false belief) or from his own belief world. A similar argument has been made for epistemic modals by Papafragou (2001a; 2001b) who observed correlations between the acquisition of epistemic modals and the age of success at the false-belief task, traditionally used to measure theory of mind abilities. Zufferey (2010) also observed that the first occurrences of the epistemic uses of *parce que* are concomitant with children's first uses of mental state verbs like *believe* and *think* (*croire* and *penser* in French). It is therefore likely that subjective uses of connectives are correlated with the acquisition of mindreading skills.

Even though theory of mind abilities may be a necessary condition for mastering subjective causal relations, they are not necessarily a sufficient one. Indeed, at the age of eight, the older children from our study have already long acquired theory of mind abilities, but they still do not perform at ceiling with subjective relations. Spooren and Sanders (2008: 2009) argue that another cause for the difficulty of subjective relations is that “they require abstract reasoning, usually exploiting relations that exist between real world events”. It is plausible that this kind of abstract reasoning, described by Zufferey (2010) as an implicature, adds an additional layer of difficulty to subjective relations compared to objective ones, as various forms of implicatures have long been found to be costly to process even for adults (e.g. Breheny, Katsos and Williams, 2006; Gibbs and Moise, 1997; Gibbs, 2004; Noveck and Posada, 2003— but see also Breheny, Ferguson and Katsos, 2013). Specific experiments comparing different types of subjective causal relations are however still needed in order to disentangle further the causes for the complexity of subjective relations.

Another factor that could explain children’s performance in our experiment is related to the type of experimental method used to assess comprehension. More specifically, some recent empirical studies of connectives have shown that children’s performance in off-line experiments provided a more conservative estimation of their proficiency compared to on-line measures. For example, Cain and Nash (2011) have tested eight and ten year-old children’s ability to understand and use temporal, causal, and adversative connectives. In a sentence completion task and an acceptability judgment tasks, they found that children do not perform in an adult like manner for all relations, even at the age of ten. Using an on-line measure (self-paced reading) they found that even eight year old children read complex sentences faster when the two-clauses were linked by an appropriate connective than when they were linked by a neutral connective like *and*. Similarly, Zufferey, Mak, Degand and Sanders (2013) found that advanced second language learners of English performed significantly less well than native speakers in a grammaticality judgment task evaluating misuses of discourse connectives. However, the same learners demonstrated a similar slowdown in reading as native speakers for the same cases of misuses in an eye-tracking experiment. Taken together, these results tend to indicate that on-line measures provide a more sensitive evaluation of the developmental process of connectives in a first and a second language than off-line tasks. In the present study, our aim was to compare children across two different languages. As the task used was the same for the two populations of children, this difficulty has not biased our cross-linguistic comparison. Future work should however seek to assess children’s ability to understand connectives using on-

line methods in order to determine when children's ability to process objective and subjective connectives in an adult-like manner first emerges.

5 Conclusion

Our aim in this paper was to investigate the potential role of linguistic encoding for the acquisition of causal connectives and relations across languages. Results from our comprehension experiment indicate that the lack of lexical difference to convey objective and subjective causal relations in contemporary spoken French does not imply a disadvantage for French-speaking children's ability to understand these relations in a text, compared to Dutch-speaking children who possess such a lexical cue in their language. Future research should seek to disentangle further the causes for the acute difficulty of subjective relations and to assess their acquisition using on-line measures of language processing.

References

- Aksu-Koç, Ayhan. 1988. *The Acquisition of Aspect and Modality: The Case of Past Reference in Turkish*. Cambridge: Cambridge University Press.
- Aikhenvald, Alexandra. 2006. *Evidentiality*. Oxford: Oxford University Press.
- Astington, Janet and J. Baird. 2005. *Why Language Matters for Theory of Mind*. Oxford: Oxford University Press.
- Baayen, R.H. 2008. *Analysing Linguistic Data. A Practical Introduction to Statistics Using R*. Cambridge: Cambridge University Press.
- Blakemore, Diane. 1987. *Semantic Constraints on Relevance*. Oxford: Blackwell.
- Bowerman, Melissa and Stephen Levinson (eds.). 2001. *Language Acquisition and Conceptual Development*. Cambridge: Cambridge University Press.
- Breheny, Richard, Heather Ferguson and Napoleon Katsos. 2013. Investigating the time-course of accessing conversational implicatures during incremental sentence interpretation. *Language and Cognitive Processes* 28: 443–467.
- Breheny, Richard, Napoleon Katsos and John Williams. 2006. Are scalar implicatures generated by default? *Cognition* 100: 434–463.
- Cain, Kate and Hannah Nash. 2011. The influence of connectives on young readers' processing and comprehension of text. *Journal of Educational Psychology* 103: 429–441.
- Callaghan, Tara, Philippe Rochat, Angeline Lillard et al. 2005. Synchrony in the onset of mental-state reasoning: evidence from five cultures. *Psychological Science* 16: 378–384.

- Canestrelli, Anneloes, Willem Mak and Ted Sanders. 2013. Causal connectives in discourse processing. How differences in subjectivity are reflected in eye-movements. *Language and Cognitive Processes* 28: 1394–1413.
- Choi, Soonja. 1995. The development of epistemic sentence-ending modal forms and functions in Korean children. In J. Bybee and S. Fleischman (eds), *Modality in Grammar and Discourse*, 165–204. Amsterdam: John Benjamins.
- Degand, Liesbeth and Benjamin Fagard. 2011. Alors between Discourse and Grammar. The role of syntactic position. *Functions of Language* 18: 29–56.
- Degand, Liesbeth and Benjamin Fagard. 2012. Competing connectives in the causal domain: French *car* and *parce que*. *Journal of Pragmatics* 44: 154–168.
- de Villiers, Jill and Jenny Pyers. 2002. Complements to cognition: a longitudinal study of the relationship between complex syntax and false-belief-understanding. *Cognitive Development* 17: 1037–1060.
- Evers-Vermeul, Jacqueline and Ted Sanders. 2011. Discovering domains. On the acquisition of causal connectives. *Journal of Pragmatics* 43: 1645–1662.
- Gentner, Dedre and Susan Goldin-Meadow (eds.) 2003. *Language in Mind: Advances in the Study of Language and Thought*. Cambridge, MA: MIT Press.
- Gibbs, Raymond. 2004. Psycholinguistics and linguistics-pragmatics. In I. Noveck and D. Sperber (eds.), *Experimental Pragmatics*, 50–71. Basingstoke: Palgrave Macmillan.
- Gibbs, Raymond and Jessica Moise. 1997. Pragmatics in understanding what is said. *Cognition* 62: 51–74.
- Gleitman, Lila and Anna Papafragou. 2005. Language and thought. In R. Morrison and K. Holyoak (eds.), *Cambridge Handbook of Thinking and Reasoning*, 633–661. Cambridge: Cambridge University Press.
- Huttenlocher, Janellen, Patricia Smiley and Rosalind Ratner. 1983. Emergence of action categories in the child: evidence from verb meanings. *Psychological Review* 90: 72–93.
- Ifantidou, Elly. 2001. *Evidentials and Relevance*. Amsterdam: John Benjamins.
- Irwin, Judith and Cynthia Pulver. 1984. Effects of explicitness, clause order, and reversibility on children's comprehension of causal relationships. *Journal of Educational Psychology* 76: 399–407.
- Kyrtzsis, Amy, Jiansheng Guo and Susan Ervin-Tripp. 1990. Pragmatic conventions influencing children's use of causal constructions in natural discourse. *Proceedings of the Sixteenth Annual Meeting of the Berkeley Linguistics Society*: 205–214.
- Lambda-L Group. 1975. Car, parce que, puisque. *Revue Romane* 10: 248–280.
- Lopes, A.C.M. 2009. Justification: a coherence relation. *Pragmatics* 19: 241–252.
- Mak, Willem, Sandrine Zufferey, Sara Verbrugge and Ted Sanders. submitted. How usage affects the processing of subjective causality across languages.
- Noveck, Ira and Andres Posada. 2003. Characterising the time course of an implicature. *Brain and Language* 85: 203–210.

- Pander Maat, Henk and Liesbeth Degand. 2001. Scaling causal relations and connectives in terms of speaker involvement. *Cognitive Linguistics* 12: 211–245.
- Papafragou, Anna and Julien Musolino. 2003. Scalar implicatures: experiments at the semantics-pragmatics interface. *Cognition* 86: 253–282.
- Papafragou, Anna, Peggy Li, Youngon Choi and Chung-hye Han. 2007. Evidentiality in language and cognition. *Cognition* 103: 253–299.
- Pasch, Renate. 1983. Die Kausalkonjunktionen 'da', 'denn', und 'weil': drei Konjunktionen—drei lexikalische Klassen. *Deutsch als Fremdsprache* 20: 332–337.
- Peterson, Candida. 1986. Semantic and pragmatic uses of *but*. *Journal of Child Language* 13: 583–590.
- Peterson, Candida and Alicia McCabe. 1985. Understanding 'because': How important is the task? *Journal of Psycholinguistic Research* 14: 199–218.
- Pinker, Steven. 1989. *Learnability and Cognition. The Acquisition of Argument Structure*. Cambridge, MA: MIT Press.
- Pit, Mirna. 2003. *How to Express Yourself with a Causal Connective: Subjectivity and Causal Connectives in Dutch, German and French*. Amsterdam: Rodopi.
- Pit, Mirna. 2007. Cross-linguistic analyses of backward causal connectives in Dutch, German and French. *Languages in Contrast* 7: 53–82.
- Sanders, Ted and Wilbert Spooren. 2009. Causal categories in discourse—converging evidence from language use. In T. Sanders and E. Sweetser (eds.), *Causal Categories in Discourse and Cognition*, 205–246. Berlin: Mouton de Gruyter.
- Shatz, Marylin, Gill Diesendruck, Ivelisse Martinez-Beck and Didar Akar. 2003. The influence of language and socioeconomic status on children's understanding of false belief. *Developmental Psychology* 39: 717–729.
- Simon, Anne-Catherine and Liesbeth Degand. 2007. Connecteurs de causalité, implication du locuteur et profils prosodiques: le cas de *car* et de *parce que*. *Journal of French Language Studies* 17: 323–341.
- Spooren, Wilbert. 1997. The processing of underspecified coherence relations. *Discourse Processes* 24: 149–168.
- Spooren, Wilbert and Ted Sanders. 2008. The acquisition order of coherence relations: on cognitive complexity in discourse. *Journal of Pragmatics* 40: 2003–2026.
- Sweetser, Eve. 1990. *From Etymology to Pragmatics*. Cambridge: Cambridge University Press.
- Traxler, Matthew, Anthony Sanford, Joy Aked and Linda Moxey. 1997. Processing causal and diagnostic statements in discourse. *Journal of Experimental Psychology: Learning, Memory and Cognition* 23: 88–101.
- Van Veen, Rosie. 2011. *The Acquisition of Causal Connectives*. Ph.D. dissertation, University of Utrecht.
- Whorf, Benjamin Lee. 1956. In J. Carroll (ed.), *Language Thought and Reality: Selected Writings of Benjamin Lee Whorf*. Cambridge, MA: MIT Press.

- Xing, F. 2001. “汉汉汉句研究”. ‘A study of Chinese complex sentences’. Beijing: Commercial Publishing House.
- Zufferey, Sandrine. 2010. *Lexical Pragmatics and Theory of Mind: The Acquisition of Connectives*. Amsterdam: John Benjamins.
- Zufferey, Sandrine. 2012. ‘Car, parce que, puisque’ revisited: three empirical studies on French connectives. *Journal of Pragmatics* 44: 138–153.
- Zufferey, Sandrine and Bruno Cartoni. 2012. English and French causal connectives in contrast. *Languages in Contrast* 12: 232–250.
- Zufferey Sandrine, Willem Mak, Liesbeth Degand and Ted Sanders. 2013. Advanced learners’ sensitivity to misuses of connectives during on-line processing: the role of L1 transfer. Paper presented at the 23rd Conference of the European Second Language Association, Amsterdam, the Netherlands.
- Zufferey, Sandrine and Willem Mak. 2014. The acquisition of objective and subjective causality. Paper presented at the 13th International Congress for the Study of Child Language (IASCL), Amsterdam, the Netherlands.