THE ROLE OF COMPLEXITY AND INPUT PATTERNS ON CHILDREN'S ACQUISITION OF ADVERBIAL CONNECTIVE FUNCTION

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Heather C. P. Lemen

School of Health Sciences

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Abstract

Although children are competent at producing the adverbial connectives *because* and *if* from a young age (e.g. Diessel, 2004; Hood & Bloom, 1979), their ability to understand them in the speech of others is unreliable until much later in childhood (e.g. Emerson & Gekoski, 1980). However, corpus studies have also shown that there are pragmatic patterns in children's production of these connectives (De Ruiter, Lemen, Brandt, Theakston, & Lieven, in press), which are often overlooked in comprehension research. In particular, although Sweetser (1990) argued that these connectives can express three different pragmatic functions (Content, Epistemic, Speech-Act), previous research on children's understanding of these connectives has generally been limited to the Content type (e.g. De Ruiter, Theakston, Brandt, & Lieven, 2018; Emerson & Gekoski, 1980). While this aligns with accounts of cognitive complexity, which predict the Content type should be the easiest to acquire (e.g. Sanders, 2005; Zufferey, 2010), this seems to underestimate the influence of input patterns, which from a usage-based perspective (e.g. Tomasello, 2001), should impact language acquisition. For example, based on input frequency, the Speech-Act type should be the easiest type to acquire for *because* (e.g. De Ruiter et al., in press). Thus, to contribute to a better understanding of children's acquisition of these connectives, this thesis investigates the effects of this functional variation on children's production and comprehension of *because* and *if*, and also explores how acquisition of these pragmatic functions is related to complexity and input patterns. These aims are addressed via mixed measures (production, accuracy, response time, eye-tracking) over three separate studies. In Chapter 3, mothers' and children's *because* and *if* Speech-Act sentences are analysed for both form and function to provide more information about the types of Speech-Act sentences children produce and how these relate to input. In Chapter 4, children's comprehension of Content and Speech-Act *because*- and *if*-sentences are compared via accuracy and response time measures on a behavioural task. In analysing patterns associated with comprehension and processing of these two pragmatic types, evidence for both input and complexity are considered. In Chapter 5, eye-tracking, accuracy and response time data provide detailed information about children's ability to predict the functional meaning (Content, Epistemic and Speech-Act) signalled by these adverbial connectives. Overall, the data show that children's

acquisition of the different pragmatic functions is highly influenced by patterns in the input, although the evidence for this varies with the methodology used. These findings are used to critically evaluate the cognitive complexity and usage-based approaches in terms of their role in explaining acquisiton of these connectives. The results are also discussed in terms of their implications on existing and future research in this area, as well as what they contribute to an understanding of children's pragmatic awareness.

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1 Chapter One - Background

1.1 Chapter overview

The aim of this chapter is to introduce the main linguistic theories and concepts relevant to this thesis. To start, I will briefly discuss the relevance of the acquisition of complex sentences to child language development. Following that, I will give an overview of complex sentences in general, before focusing on complex adverbial sentences. Next, I will discuss pragmatic factors related to these sentences, focusing specifically on causal (*because*) and conditional (*if*) adverbial sentences. The chapter will conclude with a summary of the key points from this chapter in terms of this thesis.

1.2 Why study acquisition of adverbial connectives?

With regard to patterns associated with her daughter Laura's (aged 15-36 months) acquisition of connectives (i.e. those words such as *because, if, so, when*, etc. which connect clauses to form one complex sentence), Braunwald (1985) said "the acquisition of connectives permits Laura to clarify her perceptions of the relationship between the external objective world and her own and others' subjective psychological experiences" (p. 525). She describes this as a time in development during which "the relationship among language, thought, and intentionality is becoming more abstract" (Braunwald, 1985, p. 520). Braunwald's (1985) arguments present this stage as one that is critical in development: she shows this is a time when children are learning how to use increasingly complex structures to clearly communicate ideas about newly-acquired concepts (i.e. those expressed by the connectives). However, this is not an easy task for children. Braunwald (1985) notes that acquisition of connectives is reliant on understanding the relationship (which she describes as arbitrary in the Sassurian sense; Braunwald, 1985, p. 513) between the words, themselves, and specific patterns of both semantic and pragmatic meaning they convey.

The difficulty of acquiring these words is reinforced from a grammatical perspective, where adverbial connectives sit within the category of function words. In contrast to content words (such as nouns and verbs), Flores d'Arcais (1984) says:

> Function words are characterized by several syntactic, lexical, and semantic properties which make them rather different from content words. Most of these words have poor semantic content, do not bear reference, have a clear relational function in the

> sentence, and are hardly used in isolation. Even for the educated adult speaker, some of these words are often difficult to define (p. 354).

Even though there is evidence that infants can recognise function words (e.g. Shi, Werker, & Cutler, 2006 for evidence that 18-month-olds recognise determiners) and toddlers have some understanding of the meanings associated with them (e.g. see Kedar, Casasola, & Lust, 2006 for evidence that children recognise determiners as being different from the connective *and*), function words – and connectives, in particular – have been shown to be more challenging for children than content words (e.g. Flores D'Arcais, 1984). For example, Flores D'Arcais (1984) found that, in a series of reading tasks, children (aged approximately 7 – 12) had difficulty categorising connectives semantically and were slower to identify connectives and prepositions as words than they were with content words. When considered alongside the fact that children first produce these connectives as toddlers (e.g. Bloom, Lahey, Hood, Lifter, & Fiess, 1980; Braunwald, 1985; Diessel, 2004), this provides support for Braunwald's (1985) claim that acquisition of connectives is "gradual". As such, investigating acquisition of adverbial connectives allows for insight into children's ability to resolve and communicate specific semantic and pragmatic meanings in complex syntactic structures at different stages in development.

Further to this, some authors have suggested a relationship between understanding complex *because*- and *if*-sentences and educational achievement (e.g. Badger & Mellanby, 2018; Donaldson, 1986; Svirko, Gabbott, Badger, & Mellanby, 2019), while others have shown that young children use complex causal sentences (i.e. those containing causal connectives) with peers and teachers to achieve specific pragmatic goals (e.g. Kyratzis, Ross, & Köymen, 2010; Orsolini, 1993). Thus, if the emergence of these connectives allows for insight into a critical point in linguistic and psychological development (e.g. Braunwald, 1985), studying their later comprehension and use allows for insight into more advanced reasoning abilities and pragmatic understanding (e.g. Donaldson, 1986).

1.3 An introduction to complex sentences

Unlike a simple sentence, where a single idea is expressed in a single clause, a complex sentence expresses the relationship between two or more ideas via two or more clauses (Ambridge & Lieven, 2011; Diessel, 2004). Complex sentences may occur as a result of

coordination (the joining of two equal, independent clauses) or subordination (the joining of a main and subordinate clause, where the latter is dependent on the former) (Bowerman, 1979; Tallerman, 2005). In terms of subordinate clauses, Bowerman (1979) described the functions and provides examples for three main types: complement, relative and adverbial (see also Diessel, 2004), the latter of which is the focus of this thesis.

In an adverbial clause, the subordinate clause typically modifies the verb in (or, as will be seen later, the entirety of) the main clause (Bowerman, 1979).

e.g. Mary left *before/after/when/because you came* (Bowerman, 1979, p. 286)

As is evident from this example, adverbial clauses can express various semantic relationships through the use of different connectives. In the above example, *before, after* and *when* all indicate different temporal relationships, whereas *because* indicates a causal one (Bowerman, 1979).

1.4 Pragmatic influence on structuring of complex adverbial sentences

The structure of a complex adverbial sentence has a degree of flexibility, where a speaker can use a main-subordinate order (*The vegetables were cold because they had been in the fridge*) or a subordinate-main order (*Because they had been in the fridge, the vegetables were cold)*. Chafe (1984) argued that the two orders serve different functions, whereby preposed adverbial clauses (subordinate-main order) tend serve as a "guidepost" for the rest of the utterance, whereas postposed adverbial clauses (main-subordinate order) function more as comments or to provide unfamiliar information (see also Ford, 1993 for related arguments; and Ford & Thompson, 1986 for related discussion on conditional clauses, specifically).

Diessel (2005) expanded on this, arguing certain orders are more likely to be used with certain connectives. Specifically, he argued that conditional sentences commonly occur in a subordinate-main order and causal sentences commonly occur in a main-subordinate order, while temporal sentences occur regularly in both orders, but are likely to occur in a subordinate-main order when the event in the subordinate clause happened before the event in the main clause. This means that temporal and conditional sentences tend to be ordered to reflect the chronological order of events described, which Diessel (2005) calls "iconic". Ford (1993) relates a similar pattern based on conversation analysis of English-

speaking adults' spoken conversation and argues that ordering is motivated by a relationship between meaning and discourse function (Diessel, 2005 makes similar arguments based on a corpus of written and spoken English). For example, she argues there is a relationship between the hypothetical nature of *if* and its usefulness in establishing "temporary discourse realities" (Ford, 1993, p. 146) at the beginning of an utterance, while the explaining and elaborating function of *because*-clauses mean they often appear after the main clause (see Donaldson, 1986 for related argument regarding clause ordering with *because* in comparison to *so*). Thus, both Ford (1993) and Diessel (2005) show how discourse function, which is linked to the semantic relationship a connective expresses, motivates structure of complex adverbial sentences.

Diessel (2005) also points out that discourse-function motivations for clause ordering, however, appear to often be in conflict with processing biases. Despite the fact that speakers do often use a subordinate-main order, it has been argued that complex adverbial sentences are actually easier to process cognitively in a main-subordinate order (see Clark, 1973 for a discussion of derivational simplicty; and Diessel, 2005 for an analysis based on Hawkins' Performance Theory of Order and Constituency, e.g. Hawkins, 1990 as cited in Diessel, 2005). Despite this, both Clark (1973) and Diessel (2005) found that pragmatics can "override" (Diessel, 2005) processing preferences and encourage subordinate-main ordering when appropriate to the discourse. This reinforces the influence discourse functions have on the use and meaning of complex adverbial sentences.

1.5 Functional variation in causal and conditional complex adverbial sentences

1.5.1 Sweetser's (1990) model

Clause ordering is not the only type of pragmatic variation related to complex adverbial sentences. Sweetser (1990) proposed a model illustrating how the relationships expressed by some causal, conditional and adversative connectives may vary functionally. She described three categories, which she called Content, Epistemic and Speech-Act. The application of the model to *because* and *if* is outlined below:

1. **Content**: functions to express the "real-world" cause (*because)* or sufficient conditions (*if)* for an event/state.

Causal example: John came back because he loved her (Sweetser, 1990, p. 77)

Conditional example: If Mary goes, John will go (Sweetser, 1990, p. 114)

While the causal example is relatively straightforward (i.e., as Sweetser, 1990, explains, in this example, the causal relationship is one where John's love caused him to return), Sweetser (1990) provides some clarification regarding the relationship between the clauses for conditional Content sentences:

> In the content domain, then, conditional *if-then* conjunction indicates that the realization of the event or state of affairs described in the protasis[1] is a sufficient condition for the realization of the event or state of affairs described in the apodosis…if the real-world state of affairs includes Mary's going, then it will also include John's going… Here the connection between antecedent and consequent may be a causal one; Mary's going might bring about or enable John's going, or Mary's not going could in some way cause John's not going (p. 114)

2. **Epistemic**: the main clause expresses a conclusion that the speaker draws based on evidence expressed in the subordinate clause.

   Causal example: John loved her, because he came back (Sweetser, 1990, p. 77)

   Conditional example: If John went to that party, (then) he was trying to infuriate Miriam (Sweetser, 1990, p. 116)

In both of these examples, the speaker bases conclusions (main clause) on knowledge they have about John and the associated events (subordinate clause).

3. **Speech-Act**: the main clause is a speech act, for which the subordinate clause provides an explanation (*because*) or condition(s) (*if*).

   Causal example: What are you doing tonight, because there's a good movie on (Sweetser, 1990, p. 77)

   Conditional example: If you went to the party, did you see John? (Sweetser, 1990, p. 120)

In order to understand this last category, a general understanding of Speech Act theory is relevant. Searle (1969) used the term "speech acts" in reference to "the production or

[1] Literature on conditionals often uses the terms *apodosis* and *protasis* in reference to conditional sentences. According to the Oxford English Dictionary (online), the apodosis is "the concluding clause of a sentence, as contrasted with the introductory clause, or *protasis*; now usually restricted to the consequent clause in conditional sentences" ("Apodosis, N.," 2020). Due to the alignment of these definitions with the terms "main clause" and "subordinate clause" in complex adverbial sentences, the latter terms will be used when referring to both *because*- and *if*-sentences for the purpose of consistency.

issuance of a sentence token under certain conditions" (p. 16). He said these have three components: utterance acts, propositional acts and illocutionary acts. Searle's (1969) use of the latter term aligned with Austin (1962), who argued that utterances contain locutionary acts, illocutionary acts and perlocutionary acts, which relate to the production, function and effect of an utterance, respectively. More specifically, he contrasted illocutionary acts to locutionary acts, by saying the former was "performance of an act in saying something as opposed to performance of an act of saying something" (Austin, 1962, pp. 99–100). In response to an earlier categorisation proposed by Austin (1962), Searle (1976) classified illocutionary acts into categories (Representatives, Directives, Commissives, Expressives, Declarations) based on the specific act they perform, the "direction of fit" (i.e. whether words are an attempt to reflect or change the world) and the associated psychological state. Specific illocutionary acts are also often associated with particular verbs. This started with Austin (1962), and was then updated with Searle's (1976) revised categorisation. More recently, Vanderveken (1990) offered a detailed list, discussion and analysis of different performative verbs and the associated illocutionary acts[2]. For example, Vanderveken (1990) provides some of the following associations:

- Assertives (Representatives in Searle, 1976) include stating and telling;
- Directives include commanding and forbidding;
- Commissives include refusing and promising;
- Expressives include complimenting and bragging; and
- Declaratives include resigning and forgiving.

Although in Searle (1969), an illocutionary act is a part of a speech act, there is often overlap between these terms, particularly in developmental research, with both being used to describe the particular pragmatic function of utterances (such as assertions or requests) in a discourse (e.g. Reeder, 1983; Ryckebusch & Marcos, 2004; Snow, Pan, Imbens-Bailey, & Herman, 1996). This, perhaps, is not surprising, given Searle (1969), himself, seemed to alternate between the two, adopting the term "illocutionary act" in

[2] Some verbs appear in more than one category. For example, Vanderveken (1990) lists "certify" under both assertives and commissives.

place of what he had previously referred to as “complete speech acts” in his book *Speech acts: An essay in the philosophy of language* (p. 23). While a more detailed discussion of the differences between these two labels is outside the scope of this thesis, highlighting this overlap is relevant to a discussion of the terminology I will use hereafter. Specifically, although other authors (e.g. Kyratzis, Guo, & Ervin-Tripp, 1990; Sweetser, 1990) use the term “speech act” to refer to the main clause in Speech-Act sentences (e.g. in “*Be careful, because I don’t want that to break”*, “*Be careful”* would generally be referred to as a speech act), for purposes of clarity in this thesis, except where referring to labels or direct quotes from existing literature, I will use the term “Speech-Act” to refer only to the pragmatic category and “illocutionary act” to refer to the main clause of Speech-Act sentences.

In returning to Sweetser’s (1990) model, given this overview of Speech Act theory, it is clear to see that, in Sweetser’s (1990) Speech-Act examples, the relationship between the clauses is neither related to real-world events/sufficient conditions nor conclusions. Instead, production of the subordinate clause is related to the performance of an illocutionary act. In the causal example, the speaker is explaining his reason for making the enquiry; in the conditional example, the speaker is defining the conditions for the asking of the question.

1.5.2 Other models of pragmatic variation for *because* and *if*

The relevance of the model proposed by Sweetser (1990) is highlighted by its overlap with varying other models which attempt to describe pragmatic differences in how connected clauses relate to one another. For example, Redeker (1990) used the terms “ideational” and “pragmatic”, where the latter can be further subdivided into “rhetorical” and “sequential”. In Redeker’s (1990) model, an ideational utterance “entails the speaker's commitment to the existence of that relation in the world the discourse describes” (p. 369), while clauses in a rhetorical utterance are primarily related via the underlying intentions prompting their use, and sequential utterances have no such connection between them, but both still relate to a single discourse. As such, there is similarity between Redeker’s (1990) ideational and Sweetser’s (1990) Content. There is also some overlap between Redeker’s (1990) rhetorical and sequential and Sweetser’s (1990) Speech-Act and Epistemic categories, although there is no clear alignment between the

individual categories. That is, while Redeker (1990) does not provide very many examples, based on her descriptions, it appears that Speech-Act overlaps with both rhetorical and sequential, but it seems less likely there would be overlap between sequential and Epistemic. Van Dijk (1979) used the terms "pragmatic" and "semantic", where the former concerns the relationship between illocutionary acts and the latter concerns the relationship between facts. This model appears to be even more similar to Sweetser's (1990) than Redeker's (1990), with Van Dijk's (1979) semantic category aligning with Sweetser's (1990) Content and his pragmatic category aligning with Sweetser's (1990) Epistemic and Speech-Act (combined).

With regard to causals specifically, Zufferey, Mak and Sanders (2015) also used just two categories to contrast the way in which causal relations vary pragmatically. Similar to the models of Redeker (1990) and Van Dijk (1979), in Zufferey et al.'s (2015) model, Sweetser's (1990) Speech-Act and Epistemic are categorised separately from Content (where the former two are called "subjective" relationships and the latter is called "objective" in Zufferey et al., 2015). Pander Maat and Degand (2001; see also Degand & Pander Maat, 2003), however, proposed an alternative approach, where they argued that the pragmatic differences between causal sentences are best presented in terms of a continuum based on the extent to which the speaker is involved in constructing the causality. The categories within this framework, ordered from lowest to highest, are: volitional, non-volitional, causal epistemic, noncausal epistemic, speech act type 1, speech act type 2 (Degand & Pander Maat, 2003; Pander Maat & Degand, 2001). Despite the difference in approach to framing the difference between the sentence types, there is still similarity between Pander Maat and Degand's (2001; Degand & Pander Maat, 2003) framework and Sweetser's (1990) categories, such that volitional and non-volitional generally align with Content and there is overlap between Pander Maat and Degand's two epistemic and two speech act categories and Sweetser's Epistemic and Speech-Act categories, respectively[3].

[3] Not all frameworks addressing pragmatic differences have quite the same overlap in their focus, however. Donaldson's (1986) model of explanations had three categories: empirical (e.g. The window broke because the ball hit it), intentional (e.g. John wound up the toy because he wanted it to go) and deductive (e.g. (We can tell that) the window broke because there is glass on the ground)(all examples from Donaldson, 1986, p. 6). While there is some overlap between Donaldson's (1986) empirical and intentional and Sweetser's (1990) Content, Donaldson's (1986) deductive appears to be more in line with Sweetser's (1990) Epistemic.

With regard to pragmatic approaches focused just on conditionals, Haegeman (1984) differentiated between conditions relevant to an event and those relevant to an utterance. The labels Haegeman (1984) uses for these categories change, where the former is initially called an "occurrence conditional" before being called a "central conditional", while the latter is initially referred to as an "utterance conditional" before being called a "peripheral conditional" and then later, both "speech act conditional" and finally "relevance conditional". The use of the term "relevance conditional" is in relation to Sperber and Wilson's early work on Relevance Theory (cited as "forthcoming" in Haegeman, 1984), on which Haegeman (1984) bases many of her arguments. Broadly, she states that, within Sperber and Wilson's theory (e.g. Sperber & Wilson, 1987), relevance is the primary driver for communication. Based on this, Haegeman (1984) shows that *if*-clauses in speech act/relevance conditionals can heighten the relevance of an utterance by:

a. assigning reference, e.g. "I, ... if it's the same man, I haven't yet read his application"

b. specifying ambiguous phrases, e.g. "They only live in a quite small semi-detached house, but they've got a lot of nice things, if you know what I mean"

c. accessing concepts, e.g. "the fault — if it's a fault — is to be found in the System"

d. providing background for assumptions, e.g. "they became the sort of the, you know, Piggies of the form, if you remember Lord of the Flies, you know, they were the…"

e. providing linguistic context, e.g. "how did you have such odd tutors, if you were doing English?"

(all examples from Haegeman, 1984, p. 486)

In a similar way, Warchał' (2010) presents a framework which includes the Content and Epistemic categories from Sweetser (1990), but based on Quirk, Greenbaum, Leech and

However, the prototypical deductive in Donaldson's (1986) model includes what she calls "deductive markers", like the "we can tell" in the deductive example. However, the use of those phrases make Epistemic sentences in Sweetser's (1990) model more likely to read as Content (see Sweetser, 1990, p. 85). Furthermore, Donaldson's model has no reference to Speech-Act. Therefore, Donaldson's model appears to focus on more specific differences between what is largely one pragmatic type in Sweetser's model, with only some overlap into Sweetser's Epistemic.

Svartvik (1985) describes several additional categories for the functions covered in Sweetser's Speech-Act:

1. **Speech act - Politeness**: e.g. *If you will recall*, Goffman (1976) even doubted, with good dialectical reasoning and exemplification, the very notion that … (example modified from Warchał, 2010, p. 144)
2. **Speech act - Relevance**: e.g. However, *if one adopts Rizzi's (1997) split C analysis* the conjuncts could be maximal projections … (example modified from Warchał, 2010, p. 148).
3. **Metalinguistic**: e.g. To its credit, *if not success*, such asemantic methodological restrictions are far from trivial (Warchał, 2010, p. 148).
4. **Reservation**: e.g. *If I am correct*, this class includes at least mass terms and some second-order definite descriptions, which are nominals rather than adjectival (Warchał, 2010, p. 145).
5. **Concessive**: e.g. What this plausibility amounts to is fairly obvious intuitively in particular examples, *if painful to specify precisely without going into considerable detail about how various bits of information are, or are not, taken to be consistently about a single individual* (Warchał, 2010, p. 146).
6. **Rhetorical**: e.g. *If the lack of semiotic analyses of so blatantly 'semiotic' a phenomenon as 'brand' is to be accounted for in the same way as the absence of treatises on water written by goldfish*, so much the worse (Warchał, 2010, p. 146).

It is interesting to note that the approaches to the application of a pragmatic model to *if*-sentences tend to further subdivide Speech-Act functions, whereas, with the exception of Pander Maat and Degand (2001; Degand & Pander Maat, 2003) (who take a slightly different approach in general), approaches to analysing *because*-sentences tend to rely on Sweetser's (1990) three categories (e.g. Evers-Vermeul & Sanders, 2011; Kyratzis et al., 1990; Spooren & Sanders, 2008; Zufferey, 2010) or combine Speech-Act with Epistemic (e.g. Zufferey et al., 2015). However, although different models draw the categorical boundaries slightly differently and examine the functions from slightly different perspectives, overall, they do appear to agree that *because*- and *if* can both be used to signal different pragmatic meanings.

Although I have highlighted many models which address pragmatic variation, this thesis will primarily rely on Sweetser (1990) to explore acquisition of *because* and *if.* This is largely because, unlike most other models, which either provide a broad overview of pragmatic variation as relevant to adverbial connectives in general (e.g. Redeker, 1990) or focus specifically on either causals (e.g. Pander Maat & Degand, 2001) or conditionals (e.g. Haegeman, 1984; Warchał, 2010), Sweetser (1990) provides a detailed discussion of the application of the model to both *because* and *if*. Additionally, Zufferey's (2010) cognitive complexity account (which will be outlined in Chapter 2 and is relevant to the research aims of the studies in Chapters 4 and 5), relies on Sweetser's (1990) model, particularly as she argues there are key differences between Speech-Act and Epistemic which may be overlooked if the categories are combined. This is also in accordance with the frameworks used in Kyratzis et al. (1990) and De Ruiter, Lemen, Brandt, Theakston and Lieven (in press), which report production patterns associated with Sweetser's (1990) Content, Speech-Act and Epistemic categories. As these are referenced in relation to overall input/usage frequencies in naturalistic production (which will be discussed further in Chapter 2 and are relevant to the studies in Chapters 3, 4 and 5), adopting this framework allows for consistency in the patterns discussed and reported.

1.6 Differences in the application of the pragmatic categories to *because* and *if*

Although the same pragmatic model can be applied to these two connectives overall, there are some specific patterns associated with how the connectives are used in the different categories, which appear to be related to semantic differences between *because* and *if.* For example, semantically, *if* is somewhat more complex than *because*, as it can express simple (e.g. *My friend will be happy if I share my cookies*), hypothetical (e.g. *My friend would be happy if I shared my cookies*) and counterfactual (e.g. *My friend would have been happy if I had shared my cookies*) meaning. While De Ruiter et al. (in press) found all three types in child-directed speech, they also found that some conditional meanings are more frequent with certain pragmatic types. In particular, while Speech-Act is almost always simple conditionality (95% simple, 3% hypothetical and 1% counterfactual[4]), Epistemic and Content are slightly more variable (Epistemic: 82% simple;

[4] 1% was reported as "unclear".

14% hypothetical, 4% counterfactual; Content: 81% simple, 17% hypothetical, 2% counterfactual).

Another key difference between application of the pragmatic categories to *because* and *if* relates to the Speech-Act type. Sweetser (1990) explained that for causal utterances, when the main clause is in the interrogative or imperative form, it almost always signals a Speech-Act. For example, it is difficult to interpret an utterance like "stop running because you will fall" as Content or Epistemic; rather, the fact that the listener may fall is the reason the speaker has issued the command to stop running. For conditional sentences, however, the presence of imperative or interrogative main clauses appears to be a less consistent cue. Van der Auwera (1986) argued that a conditional sentence with an interrogative main clause like "*if you inherit, will you invest?*" (p. 198) is a "speech act about a conditional". He shows how, in this kind of sentence, the entire utterance is an illocutionary act (in this case, a question), wherein the subordinate clause is actually providing a sufficient condition for an event (investing) rather than a separate illocutionary act. As such, it can be seen to fit within Sweetser's (1990) Content[5]. Van der Auwera (1986) also provides a similar account for some imperative clauses (e.g. *if you phone Mary, ask her to dinner;* Van der Auwera, 1986, p. 199). Van der Auwera (1986) differentiates these kinds of sentences from "conditional speech acts", such as "*Where were you last night, if you wouldn't mind telling me?* or "*Open the window, if I may ask you to*" (both examples from Van der Auwera, 1986, p. 199), which are "not about any conditional relation between *p* and *q*, but represent *p* as a condition for a speech act about *q*" (Van der Auwera, 1986, p. 199), and therefore align with Sweetser's (1990) Speech-Act category.

In this discussion, Van der Auwera (1986) also indicates another pattern associated with *if* Speech-Act. Specifically, in relation to his use of Lauerbach's (1979, as cited in Van der Auwera, 1986) term "commentative" for conditional speech acts, he argued that, in these, the subordinate clause serves as "a comment on a conversational or politeness maxim and functions as a politeness or opting out device" (Van der Auwera, 1986, p.

[5] Sweetser (1990) also briefly makes reference to these kind of Content sentences with imperative/interrogative main clauses, where the connective functions within the illocutionary act, particularly in relation to the infrequency with which they occur with causal connectives (see p. 155)

199). This also has overlap with Sweetser (1990), who also explained that Speech-Act conditionals often relate to politeness functions (e.g. “If it's not rude to ask, what made you decide to leave IBM?”; example from Sweetser, 1990, p. 118) (see also Brown & Levinson, 1987; Warchał, 2010).

In contrast to the politeness often associated with *if* Speech-Act, *because* Speech-Act appears to be more strongly associated with contentious statements or providing direction (e.g. Diessel & Hetterle, 2011; Ford, 1993; Ford & Mori, 1994; Hood & Bloom, 1979; Kyratzis et al., 1990). However, some caution must be applied regarding this conclusion. Specifically, of the studies cited above in support of this, none have specifically reported this in relation to *because* Speech-Act alone. That is, for some of the studies, the pattern was reported in discussion of *because* in general (Ford, 1993; Ford & Mori, 1994), while others include other causal connectives in their analysis (e.g. *so*) (Diessel & Hetterle, 2011; Hood & Bloom, 1979; Kyratzis et al., 1990). Furthermore, although Kyratzis et al.’s (1990) argument was in relation to causal Speech-Acts, in particular, the coding scheme they used may have had a bias for “control acts” in the Speech-Act category, as illocutionary acts such as assertions were seemingly excluded from this category in their coding scheme (see related points raised by Evers-Vermeul & Sanders, 2011). However, given the consistency of this finding and the description of these patterns, it does seem plausible this is a pattern which can be associated with *because* Speech-Act (even if it does not *only* relate to *because* Speech-Act). For example, in a cross-linguistic study of the use of causal connectives, Diessel and Hetterle (2011) state that one of the primary functions of causal clauses were to explain or justify a “controversial statement” (p. 46), suggesting that, although they do not use the label “Speech-Act”, specifically, they are describing Speech-Act use. Furthermore, given that Speech-Act has been shown to be the most frequently produced pragmatic type with *because* for adults (at least in child-directed speech; De Ruiter et al., in press), it is possible to see how overall patterns associated with *because* would likely have relevance to Speech-Act, specifically.

In section 1.4, I referred to an argument by Ford (1993), where she suggested that clause ordering differences between *because* and *if* were related to a combination of the semantic meaning and the best functional application of that meaning. The clause-

ordering differences between the two connectives appears to be further emphasised across the pragmatic types in child and child-directed speech. As also noted in section 1.4, *because* occurs far more frequently in main-subordinate order (e.g. De Ruiter et al., in press; Diessel, 2005; Ford, 1993; Kyratzis et al., 1990). In fact, data from both Kyratzis et al. (1990) and De Ruiter et al. (in press) show that, averaged across the three pragmatic types, *because* only appears in a subordinate-main ordering around 1% of the time in child and child-directed speech. It is interesting to note, however, that when subordinate-main ordering occurs with *because*, it is predominately with Content (De Ruiter et al., in press; Kyratzis et al., 1990). Specifically, data from De Ruiter et al. (in press) shows that about 70% of subordinate-main ordered sentences with *because* are Content. With *if*, however, ordering is more variable by pragmatic type. De Ruiter et al. (in press) show that Content and Epistemic are most likely to occur in subordinate-main order (67% of Content and 79% of Epistemic are in this order), while Speech-Act is more likely to occur in main-subordinate order (69%). This possibly relates the "commentative" (Lauerbach, as cited in Van der Auwera, 1986) function of *if* Speech-Act sentences discussed by Van der Auwera (1986), which following Ford's (1993) theory, may make them a better fit after the main clause. Indeed, Ford (1993) suggests that isolated *if* clauses often support illocutionary acts (offers, in particular) made previously in the discourse.

Therefore, although both connectives express all three pragmatic types, like with the clause ordering patterns of the connectives, in general (i.e. those noted in Diessel, 2005; Ford, 1993), there are some semantically-driven differences in how the categories apply to the connectives. This makes comparing these two connectives all the more interesting. That is, while comparing comprehension across the two connectives allows for an exploration of how generalisable the impact of this kind of pragmatic variation is, by closely analysing any differences in acquisition across the connectives related to pragmatic function, there is the opportunity to evaluate how acquisition of pragmatic meaning may also be influenced by factors such as these semantically-driven patterns and, as will be discussed in Chapter 2, frequency in speech. With regard to frequency, in particular, Ambridge, Kidd, Rowland and Theakston (2015) argue these kinds of interactions are helpful in providing detail about the factors that impact learning.

1.7 Summary

In summary, corpus research (e.g. Chafe, 1984; De Ruiter et al., in press; Diessel, 2005; Diessel & Hetterle, 2011; Ford, 1993; Ford & Mori, 1994; Ford & Thompson, 1986; Kyratzis et al., 1990) and theoretical approaches (e.g. Haegeman, 1984; Pander Maat & Degand, 2001; Sanders, 2005; Sweetser, 1990; Van Dijk, 1979) have shown that both structure and connective use in complex adverbial *because*- and *if*-sentences are linked to pragmatics. The latter point is particularly relevant as not all adverbial connectives can express all kinds of pragmatic variation (Sweetser, 1990). For example, Sweeter (1990) suggests that the connective *but* may not exist in Content form. Relatedly, while studies such as Diessel (2008) and De Ruiter et al. (in press) show that temporal connectives like *before* can perform a Speech-Act function (although they also show this is rare, comparatively), I cannot find any evidence that *after* regularly performs this function[6], nor can I think of any situation in which either would express an Epistemic meaning. However, despite Sweetser's (1990) model extending equally well to both *because* and *if*, there are some different patterns of use for the connectives across the pragmatic types. Comparing comprehension of the pragmatic types across the two connectives allows for a more detailed account of how pragmatic variation impacts these connectives and how this relates to other factors associated with them (e.g. Ambridge et al., 2015). These latter ideas will be discussed more in Chapter 2 – Introduction, along with their relevance to child language acquisition, in particular.

[6] Technically, a sentence like *after having said all that, I think this is a really good idea* could be an *after* Speech-Act sentence, although, arguably, most speakers would likely omit the *after*.

2 Introduction

2.1 Chapter overview

This chapter will work toward an overall research framework for this thesis, by addressing gaps in the child language acquisition literature in terms of the pragmatic meaning of *because* and *if*. I will begin with a brief discussion of the relevance of this topic at a macro level, where it has potential to contribute to a more general understanding of pragmatic language development. I will then discuss how studying children's acquisition of the different pragmatic meanings (in terms of Sweetser's, 1990 model) will contribute to a better understanding of the factors influencing acquisition of these connectives, in general, and may have relevance for explaining why children appear to have such difficulty with these connectives in comprehension tasks (e.g. Emerson & Gekoski, 1980), despite competent production patterns (e.g. Donaldson, 1986; A. E. McCabe, Evely, Abramovitch, Corter, & Pepler, 1983). Following this, I will introduce and evaluate the two main theoretical approaches that have been used to investigate acquisition of *because* and *if* from a pragmatic perspective: the usage-based account (e.g. Tomasello, 2001) and the cognitive complexity account (e.g. Zufferey, 2010). After summarising key points raised throughout this chapter, I will then present the key research questions for this thesis and outline the methodological approaches I will take to investigate them.

2.2 The relevance of a pragmatic account of connective acquisition

Pragmatics is not easily defined, particularly in reference to semantics (e.g. Birner, 2013; Matthews, 2014; Matthews, Biney, & Abbot-Smith, 2018). In fact, not only does Matthews (2014) address the amount of work that has been dedicated to just attempting to define the term, she also notes that, in the absence of a cohesive developmental theory, she often focuses her work in terms of particular, relevant theoretical approaches, rather than attempting to define what pragmatics is or is not. That said, for the purposes of providing a general overview of the importance of studying acquisition of *because* and *if* from a pragmatic perspective, some definition of pragmatics is necessary. For this, the "'brass tacks' definition" provided by Stephens and Matthews (2014, p. 14) is a helpful starting point, where they define pragmatics as "the ability to *use* speech and gesture appropriately, taking the demands of the physical context and the needs of the interlocutor into account" (Stephens & Matthews, 2014, p. 14). Insofar as being related to

word learning specifically, Grassman (2014) also helpfully explains that children use "pragmatic information" to learn new words, which

> comprises everything in a word usage event that is explicitly or implicitly provided by the speaker (through language, intonation, gesture, and behavior) as well as in the context of the speaker's word use (in the physical context as well as in the prior discourse) (p. 141)

Therefore, as argued by Clark (2014) children need to learn both "how and when" (p. 107) words are used. However, Tomasello (2000) notes that strategies which are often used to help children acquire object labels (e.g. naming and pointing), are likely less helpful in the acquisition of function words (see Chapter 1 – Background for discussion of difficulty in acquiring function words in comparison to content words, e.g. Flores D'Arcais, 1984). Despite this, in a review of several studies, Tomasello (2000) argues that children rely on social-cognitive skills, like intention reading, to help discern word meaning, even in the absence of such overt cues (see also related discussions in Clark, 2014; and Grassmann, 2014).

In the case of *because* and *if*, determining the correct pragmatic meaning is important, as misinterpretation of one pragmatic meaning as another may render a non-sensical or incorrect interpretation (Donaldson, 1986; Kyratzis et al., 1990; Sweetser, 1990; Zufferey, 2010). For example, a sentence like *I'm big too, because you're really big* can be an appropriate use of *because* Speech-Act or, depending on context, *because* Epistemic, but it makes little sense from a *because* Content perspective. As such, children need to learn that, even while performing the same syntactic function and expressing the same semantic meaning, these terms can express different pragmatic meanings and that these pragmatic meanings can drastically change the overall meaning of a sentence.

Thus, studying acquisition of these connectives via a pragmatic lens allows for insight into the age at which children are sensitive to, and able to resolve, these subtle, but important, differences in meaning. By exploring these patterns in both speech and understanding, as well as at different points in development, there is also the opportunity to assess how this awareness changes with both age and measure (i.e. production, comprehension, processing). Furthermore, given that the socio-cognitive skills required to produce and understand meaning differ across the pragmatic types (this will be discussed in detail in section 2.4.2), studying acquisition of these connectives allows for a better

understanding of children's ability to use different socio-cognitive skills to establish pragmatic patterns in speech and then use these to correctly interpret and express functional meaning.

2.3 The role of pragmatics in contributing to a better understanding of children's acquisition of *because* and *if*

In addition to a providing information about children's general pragmatic skills, the main benefit of exploring pragmatic understanding of *because* and *if* is to contribute to a more complete picture of the factors influencing children's acquisition of these connectives. Indeed, it has been raised before that a better understanding of the different pragmatic patterns in children's comprehension and use of these kinds of sentences can contribute to a better understanding of children's acquisition of these connectives, in general (e.g. De Ruiter et al., in press; Donaldson, 1986; Kyratzis et al, 1990; Orsolini, 1993). This is particularly relevant, given that the existing literature does not seem to present a clear conclusion about when children acquire *because* and *if* (e.g. compare Emerson & Gekoski, 1980 with Amidon, 1976 or French, 1988 for comprehension and with Bloom et al., 1980 and Diessel, 2004 for production). However, while several studies have focussed on the acquisition of *because* and *if* (*because,* in particular), the vast majority have tested comprehension using sentences expressing what Sweetser (1990) calls Content causality/conditionality (e.g. Amidon, 1976; Badger & Mellanby, 2018; Bebout, Segalowitz, & White, 1980; De Ruiter, Lieven, Brandt, & Theakston, 2020; De Ruiter et al., 2018; Emerson, 1979, 1980; Emerson & Gekoski, 1980; French, 1988; Homzie & Gravitt, 1977; Johnson & Chapman, 1980; Johnston & Welsh, 2000; Kuhn & Phelps, 1976; Peterson & McCabe, 1985; Reilly, 1986). This means, particularly from a comprehension perspective, conclusions about acquisition do not consider how children's understanding of these connectives may either be based on, or influenced by patterns associated with, the Speech-Act or Epistemic meanings.

Furthermore, rather than exploring how acquisition is influenced by the pragmatic variation expressed by these connectives, comprehension research has typically focused on how children's comprehension of these connectives (in Content sentences) relates to

various semantic factors, such as iconicity (De Ruiter et al., 2018)[7] and causal direction (being able to differentiate cause-effect from effect-cause, e.g. Kuhn & Phelps, 1976)(see Donaldson, 1986; Kyratzis et al., 1990 for related arguments for causals). In general, (as noted briefly in the previous paragraph) this has yielded a relatively inconsistent picture of acquisition of these connectives, with little consensus about whether young children:

- do (e.g. De Ruiter et al., 2018) or do not (e.g. Amidon, 1976; Emerson & Gekoski, 1980) better understand iconic sentences;
- can (e.g. French, 1988) or cannot (e.g. Emerson, 1979, 1980) understand the ordering component of causal/conditional meaning;
- do (e.g. Peterson & McCabe, 1985) or do not (e.g. Corrigan, 1975; Donaldson, 1986) understand Physical causality better than Psychological[8] causality;
- better understand familiar (e.g. French, 1988; Johnston & Welsh, 2000) or "impersonal" (Peterson & McCabe, 1985) causality; or
- do (e.g. Reilly, 1986) or do not (e.g. Badger & Mellanby, 2018) understand hypothetical conditionals.

Furthermore, although some studies report high levels of comprehension by or around age five (e.g. Amidon, 1976; Johnston & Welsh, 2000; Peterson & McCabe, 1985), Emerson and Gekoski (1980) argued that this might be due to a reliance on "available contextual cues" (pp. 222-223) rather than an understanding of the connectives, themselves. As such, they concluded that children do not fully acquire these connectives until about age nine or ten. It has also been argued that young children's understanding of *because*, in particular, is limited to certain contexts, such as those expressing familiar causes (e.g. French, 1988; Johnston & Welsh, 2000) and strongly impacted by methodology (e.g. Peterson & McCabe, 1985; see also review in Donaldson, 1986). For example, Peterson and McCabe (1985) showed that children's ability to identify the cause in *because* sentences was only above chance at about age six, and not reliable until

[7] As explained in Chapter 1 – Background, in these sentences there is a match between the chronology of the events and the clause order (see also discussion of "order-of-mention" e.g. Clark, 1971), e.g. In an iconic sentence like "Because it heard the cat, the bird flew away" the clauses are ordered so that they match the order of the actual events; this is not the case in a non-iconic sentence like "The bird flew away because it heard the cat". Donaldson (1986) offers a review, and is particularly critical (as will be discussed below), of the focus on this type of ordering in causal connective comprehension studies.

[8] These terms are based on Piaget (1928/1999) and generally align with the Physical and Affective categories used by Corrigan (1975), which are explained later in this section.

around age eight. However, when props were provided to support memory, children performed consistently well on these same sentences at age four. Therefore, while the existing literature on comprehension of *because* and *if* does not provide a clear picture of exactly when children can fully understand these connectives or the factors that reliably influence comprehension, overall it does suggest that children's comprehension of *because* and *if* is rather tenuous until relatively late in childhood.

However, in examining production patterns associated with these connectives, very different patterns emerge. That is, in general, children first produce *because* sometime around 2;6 (e.g. Bloom et al., 1980 reported a mean of 2;8 based on four children; Braunwald, 1985 reported production around 2;2 for a single child; Diessel, 2004 reported a mean of 2;5 based on five children), with *if* appearing a few months afterwards (e.g. 2;10 in Bloom et al., 1980; 2;5 in Braunwald, 1985; 3;0 in Diessel, 2004). These connectives – *because,* in particular – also appear frequently in the speech of young children. For example, Diessel (2004) studied the production of twelve connectives (*after, and*, *because, before, but, if, or, since, so, until, when, while)* by children (1;8 – 5;1) and found that *because* accounted for 19.6% of the connectives studied (second only to *and*, which accounted for more than half the connectives children produced), while *if* was the sixth most frequent, accounting for 3.5% of the connectives studied[9]. Additionally, using densely sampled data from two children aged between two and five years old, De Ruiter et al. (in press) showed that children produced *because* in complex adverbial form over 1000 times. While they only produced *if* in complex adverbial form about a third as frequently, this still accounted for more than 300 instances of it based on 372 hours of sampling. This suggests that *because* and *if* are not just frequent in comparison to other connectives, but that they appear frequently overall in the speech of young children. Furthermore, in terms of competence with these connectives, children's speech shows little evidence that they regularly confuse cause and effect with *because* (e.g. Donaldson, 1984, 1986; Hood & Bloom, 1979; A. McCabe & Peterson, 1985) or produce logical errors

[9] Although 3.5% may seem like only a small proportion, this is largely because *and* was produced so frequently. When this is removed, the figures reported by Diessel (2004) show that *if* would account for closer to 9%. Additionally, given that half of the connectives (*or*, *after*, *while*, *until*, *before*, *since)*, all accounted for less than 1% in Diessel (2004), *if* can be seen as frequent in comparison (De Ruiter et al., in press also report similar patterns for *because* and *if* in comparison to *before* and *after*, specifically).

with *if* (A. E. McCabe et al., 1983), suggesting they generally understand the semantic meanings of these connectives. Therefore, although children have difficulty demonstrating understanding of these connectives in comprehension studies, they appear to produce them both frequently and competently from a young age (Donaldson, 1984, 1986 also highlights this with regard to *because*, in particular).

However, the production data also reveals another relevant pattern. That is, as it has been noted before (e.g. De Ruiter et al., in press; Donaldson, 1986; Kyratzis et al., 1990), the type of sentences on which children are tested are not necessarily the type of sentences they produce. In particular, despite the focus on Content sentences in comprehension research, all three pragmatic types appear in the speech of preschool-aged children, with Speech-Act sentences appearing with equal, or higher, frequency to Content (De Ruiter et al., in press; Kyratzis et al., 1990). Given that forms which perform multiple functions in speech have been argued to be more difficult to acquire (e.g. Slobin, 1982), it is possible that this pragmatic variation has complicated children's acquisition of these connectives and, in particular, made the tasks typically involved in comprehension studies more challenging than would be expected. For example, as suggested by Donaldson (1986) (albeit in relation to a different framework for causal connectives), children may have difficulty distinguishing one type of pragmatic meaning from another or understanding there are different patterns of usage, in general. Alternately, it is possible that the presence of this pragmatic variation may have more specific influences on children's understanding of what the connectives mean, such as their understanding of how causal and conditional events are ordered. Support for this comes from Pander Maat and Degand (2001; Degand & Pander Maat, 2003). They argue that non-volitional causal relationships (aligning with Sweetser's Content)

> obey certain temporal constraints. Given that the state of affairs *p* is valid at time point or interval t_1 and the state of affairs *q* is valid at t_2, t_2 cannot precede or start earlier than t_1; and, in the case that t_1 and t_2 are not identical, the causal event itself takes place somewhere between t_1 and t_2 (Pander Maat & Degand, 2001, p. 217).

Conversely, Degand and Pander Maat (2003) state that for Speech-Act causals "causal situation time (t_2) and speaking time (t_s) obligatory [sic] coincide, i.e. a speech-act cannot take place at another time than the speaking time. As for the epistemic relations, t_2 and t_s

very often coincide but this is not obligatory [sic] the case" (p. 179). Donaldson (1986) makes a related argument. In her description of temporal ordering in what she calls "deductive" relationships (which, as noted in footnote 3 of Chapter 1 – Background, sometimes appear to align with Sweetser's, 1990, Content and sometimes with Epistemic), she argues it is not clear if the ordering relates to the events about which the conclusion is drawn/evidence is provided or the processes related to drawing of the conclusion, itself. Although Donaldson (1986) raises a similar concern over ordering in what she calls "intentional" relationships (which, like her "empirical" relationships, appear align most closely with Sweetser's, 1990, Content), suggesting that the type of ordering tested in many experimental studies is not consistent in any of Sweetser's (1990) pragmatic types, Donaldson (1986) also argues that meaningful temporal ordering is "much more debatable" (p. 177) outside empirical relationships. Taken altogether, this suggests that, as shown by Donaldson (1986) the focus on temporal ordering to assess understanding of these connectives may be problematic overall, but that it may be particularly problematic given the fact that the temporal ordering differs so much across the pragmatic types and may, therefore, be a difficult concept for children to acquire.

Furthermore, if children first acquire "meaningful" words (Slobin, 1985), it might be that this pragmatic variation not only makes it harder for children to acquire these connectives, in general, but that children have difficulty understanding Content sentences because this is not the primary function they associate with these connectives (e.g. De Ruiter et al., in press; Kyratzis et al., 1990). In particular, given the frequency with which they produce Speech-Act sentences, it is possible that children strongly associate these connectives with that function (De Ruiter et al., in press; Kyratzis et al., 1990). (Examples of children's early Speech-Act sentences in the corpora analysed in Chapter 3 (and also in De Ruiter et al., in press) are "let's get it away . (be)cause we can do some blue", Billy, 2;09:27; and "they can go on the bus if they want", Olga, 2;09:24.) Kyratzis et al. (1990) offer an argument in support of this idea, where they suggest that children first produce Speech-Act sentences because they are practically useful. That is, Kyratzis et al. (1990) argued that children's causal Speech-Acts were primarily related to "control acts" and thus, were functionally valuable. In discussion of Kyratzis et al.'s (1990) argument about the practicality of Speech-Acts, Evers-Vermeul and Sanders (2011) called this a "social-

pragmatic complexity approach" (p. 1647), wherein children first acquire the pragmatic type that is the most helpful. Pander Maat and Degand's (2001; Degand & Pander Maat, 2003) model offers some further support for this idea. In their continuum (discussed in Chapter 1 – Background), Speech-Acts appear at the far end, where speaker involvement is the highest. Pander Maat and Degand (2001) highlight the fact that the causal relationships in these utterances are constructed entirely by the speaker and for the present discourse; they are not reliant on events or patterns from the external world in the way Content and Epistemic (called non-volitional, volitional, causal epistemic and non-causal epistemic in Pander Maat & Degand 2001; Degand & Pander Maat, 2003) are. If, then, the causal and conditional clauses are at the discretion of the speaker in Speech-Act sentences, it is possible that a.) there might be patterns in the types of clauses children produce and when they produce them and b.) they might have a particular salience. If this is the case, it is possible to see how these pragmatic meanings might compete with, or even usurp, a more "objective" (e.g. Pander Maat & Degand, 2001; Zufferey et al., 2015) Content meaning, particularly given the frequency with which they appear in speech (De Ruiter et al., in press; Kyratzis et al., 1990).

However, despite all of these theoretical possibilities, very little is known about children's comprehension of the different pragmatic types, let alone how or whether the presence of this type of variation might impact their acquisition of these connectives. In fact, there are no developmental studies (of which I am aware) that have directly compared either of these connectives across the pragmatic types Sweetser (1990) described in English. There is, however, some evidence of a difference between children's comprehension of Content and Epistemic from Corrigan (1975)[10]. Although Corrigan (1975) did not compare the pragmatic types exactly as described by Sweetser (1990), there is overlap between Corrigan's categories (which were adapted from Piaget, 1928/1999) and Sweetser's.

[10] Donaldson (1986) seemed to report a similar finding regarding English-speaking children's (5 – 10 year olds) understanding of "empirical" (most closely aligning with Sweetser's, 1990 Content) and "deductive" (most closely aligning with Sweetser's, 1990, Epistemic). However, in the only study directly comparing the two, the deductive sentences had what Donaldson (1986) called "deductive markers", such as "we can tell that", which she found were not regularly used by the youngest children (5-year-olds) in her study. Additionally, (as noted in Chapter 1 – Background, footnote 3) as these can arguably turn Epistemic sentences into Content (see discussions on Donaldson, 1986, p. 106; and Sweetser, 1990, p. 85, which also highlight the difference between the frameworks used by the two authors), her results are difficult to interpret in lines with Sweetser's (1990) model.

Specifically, Corrigan's (1975) "Affective causality (e.g. Peter cried because Jane hurt him; Corrigan, 1975, p. 196) and "Physical causality" (e.g. She stayed home from school because she was sick; Corrigan, 1975, p. 196) generally align with Sweetser's (1990) Content, while Corrigan's "Concrete Logical causality" (e.g. John had a white block because there were only white ones; Corrigan, 1975, p. 196) generally aligns with Sweetser's (1990) Epistemic. In Corrigan's (1975) study, children (aged 3 – 7) had to complete sentences (e.g. The boy threw a stone. The window broke because…; Corrigan, 1975, p. 196) and classify sentences (such as the examples above, presented in both effect-cause and cause-effect order) as being true or false. She found that, overall, acquisition of Physical and Affective causality preceded Concrete Logical causality. In Sweetser's (1990) terminology, this would mean that Content is understood before Epistemic (a finding which has some support cross-linguistically; see Zufferey et al., 2015), providing evidence that not all pragmatic meanings are acquired equally. However, as Corrigan (1975) does not provide a comparison for Speech-Act, this study does not provide a full account of how children's understanding of *because* may relate to different pragmatic functions.

In summary, existing experimental literature on children's comprehension of *because* and *if* presents a relatively inconsistent picture about acquisition, suggesting that children's understanding of these connectives is fragile for many years after children begin producing them, although they may be competent at demonstrating comprehension of certain aspects of causal or conditional meaning under certain conditions at a young age (e.g. Amidon, 1976; De Ruiter et al., 2018; Donaldson, 1986; Johnston & Welsh, 2000; Peterson & McCabe, 1985). Conversely, children's productions of *because* and *if* appear to have pragmatic associations that are generally overlooked by the existing experimental literature (De Ruiter et al., in press; Kyratzis et al., 1990). Therefore, investigating pragmatic patterns associated with the production and comprehension of these connectives has two main advantages in terms of a general understanding about the acquisition of these connectives. First, there is the opportunity to determine the extent to which children's difficulty with demonstrating understanding of Content sentences is related to the pragmatic variation of these connectives, in general. Second, we can

discover whether children's production of these connectives is strongly related to a specific pragmatic function and how this, in turn, may relate to their comprehension.

2.4 Factors affecting pragmatic understanding of *because* and *if*

Comparing pragmatic patterns associated with children's production and comprehension of these connectives provides an opportunity to test predictions from relevant theoretical accounts. Although the literature on the acquisition of these pragmatic types is limited, two main approaches have been discussed to explain children's acquisition of these pragmatic meanings: input/usage patterns (e.g. Tomasello, 2001) and cognitive complexity (e.g. Zufferey, 2010). Both perspectives offer predictions about the pragmatic types that children should acquire first, although they do not necessarily align. In the sections that follow, I will outline these theories and discuss their relevance to acquisition of the pragmatic meanings expressed by *because* and *if*.

2.4.1 Input/usage patterns

A usage-based approach to language acquisition argues that children's understanding of how to use language comes from the language they hear - with more frequent forms having an advantage - and these patterns are then reinforced and expanded upon in their own speech (e.g. Tomasello, 2001). In general, then, from a usage-based perspective, one would expect a relationship between the pragmatic types children hear and those they produce most frequently and that these would also be the ones they first understand. However, language acquisition is rarely that simple, and it has been shown that overall frequency often interacts with other semantic, pragmatic and structural factors to impact acquisition (e.g. see Ambridge et al., 2015; Lieven, 2010; Lieven & Behrens, 2012 for review and discussion). As noted by Ambridge et al. (2015), however, this is useful, as investigation of these patterns allows for insight into the features of language or factors in discourse which influence acquisition (see also Lieven & Behrens, 2012). For example, in a study comparing children's production of verbs to those they hear in input, taking into account variation in syntactic frames, Naigles and Hoff-Ginsberg (1998) found a negative correlation between the frequency of a verb in "the highly salient utterance-final position" (p. 97) and the flexibility children showed in producing it. They argued that, in this position, the verb always appears in bare form (e.g. without complements). As such, hearing the verb more frequently in this final position restricts children's understanding

of different ways they can use that verb. Therefore, while they also showed that overall input frequency predicted verb use, this finding suggests that specific patterns associated with how a word is produced can interact (albeit negatively in this case) with input frequency to impact acquisition.

More evidence that frequency interacts with other factors, and in particular, pragmatic factors comes from Cameron-Faulkner, Lieven and Theakston (2007). In studying the negation of zero-marked verbs in the speech of, and input to, a single English-speaking child between 2;3 and 3;4, they found that the child's earlier use of the *not* + verb construction to express failure and inability could be explained by the higher frequency with which his primary caregiver (mother) used this construction for these specific functions. By contrast, the child's retention of the earlier acquired *no* + verb construction to express prohibition and rejection could also be explained by the frequency with which this construction was used with these functions in the input. They also found a related pattern in the later shift toward *n't* negation (e.g. *can't, don't*), where, for example, the child produced *don't* for prohibition and *can't* for inability before any other *n't* construction for those functions, which were patterns that aligned with input frequencies for those form-function mappings. Thus, Cameron-Faulkner et al. (2007) show that acquisition of a form is influenced by an interaction between the frequency of that form in the input and the function for which it was used, and also that the evidence for this changed with development.

In terms of investigating pragmatic patterns in speech, a usage-based approach, which Grassman (2014) calls "radically pragmatic" (p. 152), appears to be particularly suitable. That is, as Grassman (2014) points out, usage-based accounts assume children establish meaning by learning when speakers use words, and what they mean to communicate in doing so. Thus, this approach seems particularly relevant to investigating children's ability to detect differences in functional meaning and how this understanding is evidenced in children's own speech and comprehension. However, as Lieven (2016) points out, much of the work on syntax acquisition from a usage-based perspective has focused on the acquisition of structure, rather than meaning (which she hypothesises is a response to the generativist focus on abstract structure). Yet as Lieven (2016), also points out, from a usage-based perspective, understanding form-meaning mapping is of critical importance.

Additionally, Ambridge et al. (2015) note the lack of information about how children's growing semantic and pragmatic knowledge relates to input frequency over the course of development. Therefore, by investigating pragmatic patterns in the *because*- and *if*-sentences produced by, and to, young children, there is the opportunity to contribute to our understanding of how children construct functional meaning for function words in complex sentences based on patterns from naturalistic speech. In particular, in analysing patterns in the input, particularly in relation to children's own production and comprehension of these connectives, there is the opportunity to develop a better appreciation of the elements in naturalistic speech which support, or hinder, this acquisition process.

Indeed, in looking at the input and production patterns associated with pragmatic use of *because* and *if* in child and child-directed speech there is evidence that acquisition is impacted by more than overall input frequency. As noted in section 2.3, preschool-aged children produce all three pragmatic types of both *because* and *if*, although not with equal frequency. To be more specific, in exploring the relationship between input and production for 14 English-speaking children aged between two and five years old, De Ruiter et al. (in press) compared the pragmatic proportions produced by both mothers and children and found that while both groups primarily produced Speech-Act with *because,* the children's proportional production of it was not necessarily reliant on their mothers'. For example, children produced *because* Speech-Act proportionately more frequently than their mothers (75.5% vs 62.9%). Although this comparison is based on descriptive figures, it does suggest that the children's usage of this pragmatic type does not consistently reflect input. Furthermore, De Ruiter et al. (in press) note the case of one child (for whom there was a great deal of data), whose *because*-sentences were 73% Speech-Act, even though this pragmatic type only accounted for 46% of his mother's *because*-sentences (a difference that was statistically significant). Additionally, although the mothers consistently favoured the Content function with *if*, children produced *if* Content and Speech-Act in similar proportions, but with a high degree of individual variation (as indicated by standard deviation).

From a usage-based perspective, then, one might consider what other factors interact with frequency to help explain these patterns. For example, in terms of the patterns for *if*,

if is far less frequent than *because* overall (De Ruiter et al., in press; Diessel, 2004). It is therefore possible that children are just less confident in how to use the different pragmatic meanings with *if* and are therefore less consistent in their production patterns (e.g. Ambridge et al., 2015 discusses how children acquire words with higher absolute frequencies earlier). Alternatively, there might be a particular functional meaning associated with either Content or Speech-Act (for example, the politeness function associated with *if* Speech-Act, e.g. Sweetser, 1990. See discussion Chapter 1 – Background) that is generally less consistent in child speech than in adult speech. By contrast, a particular functional meaning associated with *because* (e.g. the use of it with "control acts", reported by Kyratzis et al., 1990), may make *because* Speech-Act more useful for children than for their mothers, and also in comparison to their own use of *if* Speech-Act. This may, therefore, explain why it is used more frequently. As such, by investigating more specific patterns associated with how these connectives are generally used by children and their caregivers, we can gain a better idea of the factors influencing understanding of the different pragmatic types, which can then be tested experimentally to provide a more robust depiction of the acquisition process (e.g. Ambridge et al., 2015).

2.4.2 Cognitive complexity of the pragmatic types

From a cognitive complexity perspective (e.g. Sanders, 2005; Zufferey, 2010), predictions about acquisition are determined somewhat differently than predictions based on input/usage. More specifically, in a framework discussed in detail by Zufferey (2010), particularly in regard to French-children's acquisition of sentences coordinated by causal connectives (e.g. *puisque, parce que*), Content sentences are seen as the easiest, while Speech-Act and Epistemic sentences are harder to acquire because they contain metarepresentations. That is, Zufferey (2010) shows how a Speech-Act utterance such as "Is Max coming? Because he's invited" could be rephrased as "The speaker asks if Max is coming because he's invited" (examples from Zufferey, 2010, p. 104), while an Epistemic utterance like "Max is ill, because he didn't come to work today" could be rephrased as "The speaker believes Max is ill, because he didn't come to work today" (examples from Zufferey, 2010, p. 103). Therefore, in both Speech-Act and Epistemic utterances, the main clause contains a metarepresentation: in Speech-Act, these are about the illocutionary act performed; in Epistemic, these are about a belief. However, of the two, Zufferey (2010)

considers Epistemic meanings to be much harder to acquire than Speech-Act because interpreting metarepresentations related to beliefs requires Theory of Mind. More specifically, Zufferey (2010), drawing on Sperber (1997) says Speech-Act sentences require metacommunicative skills, while Epistemic require metacognitive skills.

From a processing perspective, Zufferey (2010) also argues that there are differences in how listeners compute meaning of the different pragmatic types:

> the comprehension process involved in the use of a connective in the content domain is limited to the retrieval of the utterance's basic explicature. In the domain of speech acts, this process applies at the level of higher-level explicatures, and is related to the construction of a metarepresentation. In the epistemic domain, this process requires the derivation of an implicature. These processes all involve a different processing cost (Zufferey, 2010, p. 106).

As an example of the type of implicature required by Epistemic utterances, Zufferey (2010) refers back to her example "Max is ill, because he didn't come to work today", where, in order to understand this sentence, a listener must have some sort of additional knowledge that there is a relationship between illness and being absent from work. As such, Zufferey (2010) argues that the information expressed explicitly in this type of sentence is not sufficient to understanding the meaning.

Zufferey (2010) also provides some evidence for her theory that the cognitive skills for the different pragmatic types are attained at different times. In drawing a distinction between the skills required for Speech-Act (i.e. those related to creating a metarepresentation about an utterance) and those required for Epistemic (i.e. those related to creating a metarepresentation about a belief), she compared the emergence of these pragmatic types in children's speech to the emergence of verbs associated with the same skills. Specifically, she analysed the speech of four French-speaking children (aged between 1;9 – 4;3) to determine when they first produced the communication verbs *dire* (to say) and *demander* (to ask) and the mental state verbs *penser* (to think) and *croire* (to believe). She then compared the age at which these first appeared in the speech of these children relative to the age at which Speech-Act and Epistemic causal connectives first appeared. She found a close relationship between the age at which the communicative verbs and Speech-Act causals appeared (around 2;6 for the verbs and 2;9 for the Speech-Act causals), and a similar association between the first appearance of mental state verbs and

Epistemic causals (3;1 for both). From this she concluded that metacommunicative abilities were acquired before metacognitive.

However, as is clear from a review in Zufferey (2010), these ages do not signal definitive acquisition of these concepts. For example, in a review of literature on acquisition of Theory of Mind (i.e. literature on acquisition of mental state terms, e.g. Shatz, Wellman, & Silber, 1983; modals e.g. Byrnes & Duff, 1989; Papafragou, 1998; evidential information, e.g. O'Neill & Gopnik, 1991; and embedded syntax, e.g. Smith, Apperly, & White, 2003), she shows that the evidence for metacognitive skills in children's speech increases with age, but varies with task. For example, in relation to Theory of Mind, in particular, Zufferey (2010) summarises the evidence from all the studies she reviews as showing that

> children start producing the lexical items related to theory of mind around the age of three. However, it is also quite possible that these first uses do not yet reflect a full grasp of their semantic and pragmatic properties, since the same children often fail comprehension tasks involving these items until the age of four or even five years (p. 94).

Similarly, there is evidence that metacommunicative skills also develop over time. For example, although (as discussed above) Zufferey (2010) provides some evidence that children possess metacommunicative skills before they turn three, Howes and Matheson (1992) show that the level of metacommunicative skill in children's play increases with development. More specifically, they show that it is not until around the child's fourth birthday that they begin to use metacommunicative skills in play (e.g. developing and amending a script for play) with any real frequency. Thus, while Zufferey's (2010) data presents a relationship between Speech-Act and Epistemic connective use and meta-communicative and -cognitive skill, respectively, her model offers the opportunity to assess how these emerging skills relate to the pragmatic use and understanding of these connectives, and how this changes over development and with measure (i.e. production, comprehension, processing).

However, there appears to be some gaps in Zufferey's (2010) predictions that deserve attention. Although, Zufferey (2010) argues that Epistemic, in particular, is most difficult and is, therefore, last acquired, her model is less clear about how the differences in complexity between Content and Speech-Act relate to acquisition. That is, while Zufferey

(2010) argues that Speech-Act requires metacommunicative skills, based on her own analyses and a review existing literature, she is unable to find a clear pattern of acquisition between Content and Speech-Act. She suggests this is likely due to the fact that the skills required for Speech-Act are acquired before children first produce these connectives. Additionally, based on frameworks by Gibs and Moise (1997; as cited in Zufferey, 2010) and Recanati (1993; as cited in Zufferey, 2010), Zufferey (2010) argues that the background information needed to interpret Speech-Act sentences is "invisible". As such, she suggests that these do not pose any additional processing demands in comparison to Content.

However, although Zufferey (2010) suggests Content and Speech-Act may not be more demanding to process and that Speech-Act are less complex than Epistemic, there may be an argument that children still might have more difficulty with Speech-Act in comparison to Content. In a study comparing French- and Dutch-children's (aged five- to eight-years-old) comprehension of objective (Sweetser's Content) with subjective (Sweetser's Epistemic) sentences presented in the context of stories, Zufferey et al. (2015) found that even the oldest children responded more accurately to questions about objective causality than subjective. They argued this might be at least partially explained in terms of cognitive complexity, where the additional complexity of the subjective sentences made them harder to understand in comparison to objective, even though children should have acquired the relevant Theory of Mind skills required to interpret the subjective sentences years prior. Based on this kind of reasoning, then, it is possible to see how young children might have more difficulty with Speech-Act than Content, even if the actual processing mechanisms are not different. Specifically, if children's difficulty with Epistemic (at least in comparison to Content) can still be explained in terms of complexity many years after the requisite cognitive skills have been acquired, it is plausible to assume that, although the difference in complexity is less significant, children may be similarly impacted by the difference in cognitive complexity between Content and Speech-Act at a much younger age. Indeed, Zufferey (2010) emphasises that, despite both Content and Speech-Act having explicit meaning and there being no clear pattern in terms of which is produced first, the two are not equal in terms of cognitive complexity. Furthermore, although Zufferey (2010) was unable to find a difference between children's *production* of Content

and Speech-Act based on complexity, that does not mean there will not be a difference in their ability to *understand* the different relationships. However, without data on comprehension of Speech-Act, we do not know how well children understand these sentences at all, let alone how they compare to the other pragmatic types.

2.4.3 Evaluating these approaches via existing research

I have so far outlined how two approaches put forward in exiting literature (i.e. the usage-based and cognitive complexity approaches) can be used to study acquisition of the pragmatic functions of these connectives. I have also highlighted some initial gaps in terms of the predictions each account makes based on patterns in some existing data. What comes next is to compare them more directly in terms of the patterns reported in existing research.

Although the previous sections have defined the usage-based and complexity accounts as being quite different from one another, it is important to note that the two notions are not necessarily inherently separable. For example, given Zufferey (2010) explores the role of input on order of acquisition and notes that input does likely influence language acquisition, it is unlikely a cognitive complexity account would exclude the notion of input frequency entirely. That is, it seems unlikely this account would assume that children would still understand a Content sentence much more easily than Epistemic if the child had never heard the former and the latter were highly frequent. Relatedly, Tomasello's (2001) arguments related to a usage-based approach account for the fact that, to understand a word, children have to understand both its form and function – which in the case of these connectives, includes their inherent complexity. In support of this argument, Tomasello (2000, 2001) relates the example of a stapler, arguing that children have to understand that the two "sub-functions" of properly placing the papers in the stapler and the subsequent pushing down of the top of the stapler contribute to a broader function of binding previously separate pieces of paper. He argues that, without understanding the sub-functions, children will not be able to understand how to use different staplers that may have a slightly modified design; the ability to adapt innovatively to the use of a new stapler requires a proper understanding these sub-functions. He then explains that, relatedly, when children hear language, they must not only understand the speaker's goal in producing that sentence, but also the meaning and

function of its composite parts. As such, from a usage-based account, the different metarepresentations (i.e. those from Zufferey, 2010) should be considered to be part of the form-function mappings that children must learn for these connectives in their different pragmatic forms, which then (as shown in De Ruiter et al., in press.; Kyratzis et al., 1990) vary in frequency. Thus, the notions of input and complexity are not entirely in opposition to one other. However, despite this, given the different focuses of the two approaches, the primary predictions from the two accounts differ and it is these predictions from both accounts which this thesis uses to build its framework for comparing the two approaches.

With regards to comparing the primary predictions from both accounts, the data on children's comprehension of these pragmatic types (or lack thereof) does little to provide evidence for or against either account. That is, as noted in section 2.3, the only study (of which I am aware) comparing children's comprehension of the pragmatic types in English is Corrigan (1975), who found (in Sweetser's, 1990, terms) that Content was understood before Epistemic. However, this study did not include a comparison to Speech-Act. Thus, as Epistemic is infrequent in both input and children's speech (De Ruiter et al., in press; Kyratzis et al., 1990; Zufferey, 2010) and is considered most cognitively complex (Sanders, 2005; Zufferey, 2010), either account could potentially explain children's higher performance with Content on this study.

While more attention has been given to children's production of the pragmatic types, this is still rather limited (particularly with regards to English-speaking children) and, as has been discussed in the preceding sections, also fails to provide complete or consistent evidence for either account. Furthermore, the data presented in relation to the two accounts appears to be somewhat contradictory. That is, although De Ruiter et al. (in press) and Kyratzis et al. (1990) showed that both children and their mothers primarily used *because* to express a Speech-Act function, Zufferey (2010) was unable to determine a pattern of acquisition for Content and Speech-Act. Furthermore, in exploring the role of input, she was unable to find evidence that input patterns predicted acquisition.

It seems, however, the difference in these findings can be explained methodologically. First, Zufferey's (2010) findings were based on acquisition of French causal connectives

and her comparison to previous literature included studies of English- and Dutch-speaking children, meaning linguistic differences may be partially responsible for her difficulty in establishing a clear pattern. By contrast, De Ruiter et al. (in press) and Kyratzis et al. (1990) both based their findings on English-speaking children. Second, Zufferey's (2010) findings were primarily based on the age at which the different pragmatic meanings were first produced, while De Ruiter et al.'s (in press) findings were based on the proportional frequency of the pragmatic types in speech during a particular developmental window (i.e. age two to five). Although Kyratzis et al.'s (1990) analysis included both, they only reported a very small number of Speech-Act utterances at the youngest age (i.e. approximately four, based on calculations of the figures presented in Kyratzis et al., 1990). As this age group spanned a relatively large timeframe (i.e. 2;4 – 3;6) and the corpus contained data from several children, it is difficult to ascertain how much more frequently these were actually produced in comparison to the other pragmatic types or at what time during the developmental window these appeared.

Rather than being contradictory, then, the patterns found in these studies may mean that a usage-based approach is better at predicting how children will use the connectives pragmatically, while, as suggested by Zufferey (2010), cognitive complexity impacts when children first produce the pragmatic meanings. If this is the case, it may mean that cognitive complexity has stronger influence earlier in the acquisition process, whereas input patterns have a stronger influence on later production. However, based on the gaps in existing literature (as discussed in sections 2.4.1 and 2.4.2), it is difficult to ascertain how much either of these impacts acquisition, let alone the point in development at which they do so.

In summary, while both cognitive complexity and usage-based approaches may be helpful in explaining children's acquisition of the pragmatic meanings of *because* and *if*, there are numerous gaps which hinder our ability to fully understand the influence of either factor. These gaps can best be summarised as follows. First, De Ruiter et al. (in press) and Kyratzis et al. (1990) provide some evidence in favour of a relationship between input and production, although not necessarily that input frequency is the only factor. As such, more data is needed on what other factors in the input might explain children's pragmatic usage of these connectives. Conversely, Zufferey (2010) argues in favour of a complexity

account, although one where little is known about difference between Content and Speech-Act. This latter point makes it difficult to determine whether there should be a complexity-driven difference in children's production and comprehension of the Content and Speech-Act relationships. Additionally, although De Ruiter et al. (in press), Kyratzis et al. (1990) and Zufferey (2010) show that Epistemic sentences are less frequent and/or later produced, it remains unclear as to whether this is because they are infrequent in the input (De Ruiter et al., in press) or more difficult meanings to acquire (Sanders, 2005; Zufferey, 2010). Relatedly, insofar as comprehension goes, given that there is no experimental data on comprehension of the Speech-Act meaning, it is unclear whether the difference between Content and Epistemic (as reported in Corrigan, 1975) is best described in terms of input patterns or cognitive complexity, or whether there even is a difference in complexity between Content and Speech-Act that impacts acquisition of these two pragmatic types, at all. Therefore, more data on production and comprehension of these pragmatic types, and of Speech-Act, in particular, is needed to be able to better ascertain the extent to which either factor impacts acquisition of the pragmatic meanings.

2.5 Introduction summary

In summary, as noted in Chapter 1 – Background, there are three pragmatic meanings of the adverbial connectives *because* and *if* (Sweetser, 1990). However, this chapter discussed how comprehension of these connectives has primarily only been studied in terms of the Content meaning and the results from these studies often present contradictory findings, which taken altogether, suggest children's understanding of these connectives is rather fragile and dependant on certain methodologies (e.g. De Ruiter et al., 2018; Donaldson, 1984, 1986; French, 1988; Peterson & McCabe, 1985). However, children's speech not only suggests they are relatively competent in using these connectives (e.g. Donaldson, 1984, 1986; Hood & Bloom, 1979; A. E. McCabe et al., 1983; A. McCabe & Peterson, 1988) but also shows a high proportion of Speech-Act (De Ruiter et al., in press; Kyratzis et al., 1990). Furthermore, there are some specific pragmatic patterns of production reported in corpus studies (e.g. De Ruiter et al., in press; Diessel & Hetterle, 2011; Ford, 1993; Ford & Mori, 1994; Kyratzis et al., 1990) and arguments presented in theoretical accounts (e.g. Pander Maat & Degand, 2001; Sweetser, 1990;

Van der Auwera, 1986), which may help explain why children have difficulty understanding these connectives, particularly when they are typically tested on their semantic understanding of only one pragmatic type (i.e. Content). However, this chapter also discussed how the two main approaches to studying pragmatic acquisition of these connectives (usage-based; cognitive complexity) do not provide enough information to be able to conclude whether either, or both, can explain acquisition of these pragmatic meanings.

Based on the gaps in the literature (summarised in section 2.4.3), there are some key issues to be addressed before we have a clear idea of how this pragmatic variation impacts acquisition and how much each factor can explain these patterns. The first is regarding the frequently produced (De Ruiter et al., in press; Kyratzis et al., 1990) Speech-Act type. In addressing whether there are specific patterns in the Speech-Act sentences children hear and produce, there is the opportunity to better understand both the role of input on children's production of this pragmatic type and also whether there are any usage patterns (for either connective) which might be considered particularly useful or salient and might, therefore, influence the meaning children first acquire (e.g. Evers-Vermeul & Sanders, 2011; Kyratzis et al., 1990; Slobin, 1985). The second is regarding the complexity differences between Content and Speech-Act. In establishing how children's comprehension differs for the two pragmatic types, there is the opportunity to determine whether there are differences in cognitive complexity between the two which impact children's acquisition of the different pragmatic meanings and how this changes with age. In building on the former two points, the third point relates to the issue of whether children's understanding of either of these connectives is primarily based around a single pragmatic meaning and which factors influence this. In determining this, there is the ability to not only directly compare the influence of both usage-based patterns and cognitive complexity, but also establish a clearer picture about how much of children's difficulty with understanding Content sentences can be attributed to the this pragmatic variation.

2.6 Thesis framework

Based on this summary, the research questions for this thesis are 1. (a) Are there particular functional uses of *because* and *if* Speech-Act sentences that might make them

particularly salient for children; and (b) How do these relate to those they hear in input? 2. (a) Is there a difference in children's ability to understand *because* and *if* in Content and Speech-Act sentences; and (b) Can this be explained in terms of patterns in naturalistic speech and/or cognitive complexity? 3. (a) Do children have a preferred pragmatic function for either *because* or *if*; and (b) Can this be explained in terms of patterns in naturalistic speech and/or cognitive complexity?

To address these questions and explore patterns related to production, comprehension and processing, I will use a multi-method approach, using corpus, behavioural and eye-tracking methods. The benefits of using multiple methods to address a research topic are supported by Ambridge and Rowland (2013), who suggest that, given the potential impact of the specific demands of individual tasks used to assess language acquisition, it is important to ensure evidence comes from different approaches (see Emerson, 1979 for related arguments based on children's comprehension of causal connectives, specifically). As children's ability to understand *because*- and *if*-sentences, specifically, has been shown to vary by task and be impacted by task demands (e.g. Amidon, 1976; Donaldson, 1986; Emerson & Gekoski, 1980; French, 1988; Peterson & McCabe, 1985), this seems particularly relevant when studying acquisition of these connectives.

More specifically, in Chapter 3, I will examine patterns associated with Speech-Act sentences in both input and production to address the first research question for this thesis. In this study, longitudinal naturalistic corpus data from 14 mother-child dyads allow for a comparison of patterns in naturalistic speech, which can help contribute to a better understanding of the factors influencing acquisition (Lieven & Behrens, 2012). Specifically, based on more general patterns of typical usage of *because* and *if* Speech-Act sentences, where *because* are typically associated with contentious illocutionary acts (e.g. Diessel & Hetterle, 2011; Kyratzis et al., 1990), while *if* has associations with politeness (e.g. Sweetser, 1990) (see Chapter 1 - Background), I will analyse patterns in the form and function of the *because* and *if* Speech-Acts produced by children and their mothers, in an attempt to determine whether these sentences have any consistent patterns which may influence acquisition of these connectives. In Chapter 4, I will address the second research question of this thesis through investigating preschoolers' (aged 3-5) comprehension of Content and Speech-Act sentences via a forced choice behavioural

task. As noted by Ambridge and Rowland (2013), this type of task is particularly useful in avoiding ambiguity in the child's response via a relatively simple design (i.e. in comparison to other methods such as acting-out tasks). Through this, I collect both accuracy and response time measures, providing information not only about the overall ability to interpret the different sentences types, but the time it takes to do so. By comparing these two pragmatic types, I also evaluate the evidence for the effects of both input and cognitive complexity on comprehension of the pragmatic types. In Chapter 5, I will address the third research question for this thesis by exploring children's ability to predict the pragmatic meaning a connective expresses in a particular discourse. In this study, all three pragmatic types (Content, Epistemic, Speech-Act) will be tested for both *because* and *if*. Here, the forced-choice design allows for accuracy and response time measures, as in the study in Chapter 4, but in this study, these are also complemented by eye-tracking data. This is particularly useful because it allows insight into children's online processing of sentences (e.g. Borovsky, Elman, & Fernald, 2012), which can then be compared across the pragmatic types. Thus, use of the three measures allows for detection of patterns related to the meaning children expect the connectives to express, which can then be evaluated in terms of the factors that might contribute to these patterns.

Following the data chapters in this thesis (Chapters 3, 4 and 5), I will then offer a Discussion chapter. In this chapter, all studies will be summarised and evaluated in terms of their efficacy of addressing the research questions. I will then summarise what these studies, when taken together, contribute to our understanding of children's acquisition of *because* and *if*, as well as the evidence for the influence of input patterns and/or cognitive complexity. Through this, I will then evaluate these theories and consider what they each contribute to an understanding of preschoolers' pragmatic language acquisition. I will also address what these findings tell us about children's pragmatic competence, in general, during this developmental window.

3 A comparison of the pragmatic patterns in the spontaneous *because*- and *if*-sentences produced by children and their caregivers

This chapter addresses the first research question of this thesis: (a) Are there particular functional uses of *because* and *if* Speech-Act sentences that might make them particularly salient for children?; and (b) How do these relate to those they hear in input?

The study in Chapter 3 has been submitted to a journal for publication. The author and title information for the submitted manuscript are:

Lemen, H.C.P., Lieven, E.V.M. & Theakston, A.L. A comparison of the pragmatic patterns in the spontaneous because- and if-sentences produced by children and their caregivers.

3.1 Abstract

Findings from corpus (e.g. Bloom, Lahey, Hood, Lifter, & Fiess, 1980; Diessel, 2004) and comprehension (e.g. Emerson & Gekoski, 1980; De Ruiter, Theakston, Brandt, & Lieven, 2018) studies show that children produce the adverbial connectives *because* and *if* long before they seem able to understand them. However, although children's comprehension is typically tested on sentences expressing the pragmatic relationship which Sweetser (1990) calls "Content", this is not the only pragmatic type that they hear (De Ruiter, Lemen, Brandt, Theakston, & Lieven, in press; Kyratzis, Guo, & Ervin-Tripp, 1990). Specifically, children also hear and produce sentences expressing "Speech-Act" relationships (De Ruiter et al., in press; Kyratzis et al., 1990). To better understand the possible influence of pragmatic variation on children's acquisition of these connectives, we coded the *because* and *if* Speech-Act sentences of 14 British English-speaking mother-child dyads for the type of illocutionary act they contained, as well as the phrasing of the *because*- and *if*-clause. Analyses revealed that children's *because* Speech-Act sentences were primarily explanations of Statements/Claims, while their *if* Speech-Act sentences typically related to permission and politeness. Furthermore, while children's *because*-sentences showed a great deal of individuality, their *if*-sentences closely resembled their mothers, containing a high proportion of recurring phrases which appear to be abstracted from input. We discuss how these patterns might help shape children's understanding of each connective and contribute to the children's overall difficulty with *because* and *if*, as indicated by the aforementioned existing literature.

3.2 Introduction

The age at which children comprehend sentences containing the adverbial connectives *because* and *if* appears to be surprisingly late relative to the age at which they first produce them. More specifically, *because* generally appears in the speech of young children around the age of two-and-a-half and *if* first appears around the age of three (Bloom, Lahey, Hood, Lifter, & Fiess, 1980; Diessel, 2004), but some studies have concluded that children do not fully understand the relationships these connectives express until they are eight or nine years old (e.g. Emerson & Gekoski, 1980). Various methods, such as matching sentences with pictures (e.g. De Ruiter et al., 2020, 2018; Emerson, 1979; Emerson & Gekoski, 1980; Kuhn & Phelps, 1976), elicited

production/sentence completion (e.g. French, 1988; Johnston & Welsh, 2000), act-out tasks (e.g. Amidon, 1976; French, 1988), judgments of acceptability/truth (e.g. Emerson, 1980; Johnson & Chapman, 1980; Peterson & McCabe, 1985) and retelling stories (e.g. Homzie & Gravitt, 1977), have been used to determine the extent to which various factors, including clause order (e.g. Amidon, 1976; De Ruiter et al., 2020, 2018), iconicity (e.g. De Ruiter et al., 2018; Emerson, 1979), explicit connective use (e.g. Homzie & Gravitt, 1977) and familiarity with the relationships expressed (e.g. French, 1988; Johnston & Welsh, 2000) impact children's understanding of these connectives and the relationships they signal. Despite these differing perspectives and methodologies, based on the types of test items used, it appears that almost all of the studies from this existing body of research share one core assumption: that children's understanding of these connectives is based on only one particular type of pragmatic meaning (see Donaldson, 1986 for related arguments).

According to a model by Sweetser (1990), however, these connectives can express three different pragmatic relationships (Content, Epistemic, Speech-Act) (see also e.g. Haegeman, 1984; Kyratzis et al., 1990; Pander Maat & Degand, 2001; Redeker, 1990; Van Dijk, 1979; Warchał, 2010; Zufferey et al., 2015 for related theories). Furthermore, while the sentences used to test children's comprehension of these connectives primarily express the Content relationship (e.g. Amidon, 1976; De Ruiter et al., 2020, 2018; Emerson, 1979, 1980; Emerson & Gekoski, 1980; French, 1988; Homzie & Gravitt, 1977; Johnson & Chapman, 1980; Johnston & Welsh, 2000; Kuhn & Phelps, 1976; Peterson & McCabe, 1985), corpus data show that the Speech-Act type is also frequent in input and production, occurring in higher or similar proportions to the Content type in children's naturalistic speech (De Ruiter, Lemen, Brandt, Theakston, & Lieven, in press; Kyratzis et al., 1990). This provides support for the idea (e.g. De Ruiter et al., in press; Donaldson, 1986; Kyratzis et al., 1990) that the types of causal and conditional relationships young children hear and produce spontaneously do not necessarily align with the kinds on which they are tested.

In terms of how these input/production patterns may be expected to influence comprehension, it has been argued that children first acquire the forms they find most meaningful (e.g. Slobin, 1985). Additionally, a usage-based approach would predict a

relationship between the distributional properties of the input and a child's own understanding and use of a form (e.g. Kirjavainen, Theakston, & Lieven, 2009; Lieven, Salomo, & Tomasello, 2009; Tomasello, 2001). As such, we would expect that investigating patterns in how children hear and produce these connectives would be critical to understanding acquisition. However, the existing literature provides little information on these pragmatic patterns, instead often focusing on semantic understanding of the connectives (e.g. whether children make "mistakes", such as confusing cause with effect, McCabe & Peterson, 1985; or tracking developmental patterns in children's ability to use *if* to express different semantic concepts, such as predictive and hypothetical relationships, Reilly, 1986). Furthermore, when studies have investigated these pragmatic patterns, this tends to be in broader categories (e.g. including both *because* and *so* in the same study, Kyratzis et al., 1990). However, given that *because*- and *if*-Speech-Act sentences are produced so frequently in the speech by, and to, young children (De Ruiter et al., in press; Kyratzis et al., 1990), failing to understand how this pragmatic type, in particular, is used risks overlooking salient patterns which may contribute to children's understanding of what these connectives mean. By investigating specific functional patterns in Speech-Act sentences, this study aims to provide a fuller picture of how children hear and use *because* and *if* and the extent to which meaningful patterns may be associated with this pragmatic type.

In this paper, we will first present theoretical accounts of pragmatic language use and findings from corpus data through which we establish typical pragmatic usage of the connectives *because* and *if*, focusing on Speech-Act usages. Then, through analysis of *because*- and *if*-Speech-Act sentences produced by 14 English-speaking mother-child dyads, we investigate the extent to which these patterns exist in the speech of young children relative to the input they hear. We will then offer a discussion on these overall patterns in children's speech and implications for future research.

3.3 A pragmatic approach to *because* and *if*

3.3.1 General pragmatic patterns

Although there have been many studies investigating children's comprehension of the connectives *because* and *if*, the stimuli for these studies are typically designed to test understanding of semantic cause-effect or conditional relationships (e.g. "she hears the

doorbell, if/because she presses the button", De Ruiter et al., 2020, 2018) (see also e.g. Amidon, 1976; Emerson, 1979, 1980; Emerson & Gekoski, 1980; French, 1988; Peterson & McCabe, 1985), rather than the functional meaning of the connectives. As such, the causal/conditional relationships in these sentences are usually between states/events, and thus align most closely with what Sweetser (1990) calls Content relationships. However, according to Sweetser's (1990) model (see also Kyratzis et al., 1990), *because* and *if* can express three different types of pragmatic relationships between clauses:

4. **Content**: presents a "real-world" explanation (*because)* or sufficient condition (*if)* for an event/state.

   Causal example: John came back because he loved her (Sweetser, 1990, p. 77).

   Conditional example: If Mary goes, John will go (Sweetser, 1990, p. 114).

5. **Epistemic**: the main clause expresses a conclusion that the speaker draws based on evidence expressed in the subordinate clause.

   Causal example: John loved her, because he came back (Sweetser, 1990, p. 77)

   Conditional example: If John went to that party, (then) he was trying to infuriate Miriam (Sweetser, 1990, p. 116).

6. **Speech-Act**: the main clause is a speech act and the subordinate clause provides the speaker's reason for the speech act (*because*) or conditions associated with its performance (*if*).

   Causal example: What are you doing tonight, because there's a good movie on (Sweetser, 1990, p. 77).

   Conditional example: If you went to the party, did you see John? (Sweetser, 1990, p. 120).

At this point we would like to offer clarification on the terminology that we will use in the paper. Although most authors (including Sweetser, 1990) use the term "speech act" for the main clause of Speech-Act sentences (e.g. "What are you doing tonight" in the above causal example from Sweetser (1990, p. 77)), to avoid confusion between Speech-Act (the pragmatic category) and speech act (the main clause of Speech-Act sentences), we will hereafter use the term "illocutionary act" for the latter. Briefly, the idea of illocutionary acts is tied to speech act theory, wherein Austin (1962) explained that utterances contain both locutionary and illocutionary acts, and the latter is the "performance of an act in

saying something as opposed to performance of an act of saying something" (pp. 99-100). Searle (1969) later used the term "speech act" to align with Austin's (1962) definition of illocutionary acts before adopting the latter label, himself. As such, while a theoretical discussion on the similarities/differences between speech acts and illocutionary acts is not the focus of this paper, we feel that this terminology is appropriate (for the purposes of this paper) to refer to the pragmatic functions performed by these main clauses.

While other approaches also acknowledge that these connectives express different pragmatic meanings (e.g. Haegeman, 1984; Pander Maat & Degand, 2001; Redeker, 1990; Van Dijk, 1979; Warchał, 2010; Zufferey et al., 2015), the differences are often framed in alternative ways. Addressing the pragmatic differences via a scalar approach, Pander Maat and Degand (2001) show that there are differences in the degree to which the information contained in causal sentences is related to the reality of events in the world around the speaker. In their model, they provide six categories of causal relationships, which differ in terms of speaker involvement (defined by Pander Maat & Degand, 2001 as the amount a speaker is involved in constructing the causal relationship that is expressed). These categories, ordered in ascending order of speaker involvement, are: non-volitional, volitional, causality-based epistemic, non-causal epistemic, speech act type 1 and speech act type 2 (Pander Maat & Degand, 2001). While this perspective differs from the three-category model Sweetser (1990) proposed, there is overlap between the frameworks: the former two categories in Pander Maat and Degand (2001) generally align with Sweetser's Content, the middle two with Sweetser's (1990) Epistemic, and the final two with Sweetser's (1990) Speech-Act. Within Pander Maat and Degand's (2001) framework, as speaker involvement increases, the amount that the causal relationship expressed is tied to "real-world" states/events decreases. That is, they argue that at one end of the continuum there are non-volitional sentences, where the speaker merely "reports" (p. 217) a real-world cause-effect relationship, and at the other end there are speech act relationships, which "appear in discourse in response to the interactional needs of a specific/potential interlocutor, not to present facts or draw conclusions concerning the real world" (p. 225). Thus, Pander Matt and Degand (2001) show that information contained in Content sentences, and to a lesser extent Epistemic

sentences[11], is more restricted by events which are separate from the speaker; Speech-Act relationships, by contrast, are entirely of the speaker's own construction, semantically and pragmatically.

3.3.2 Functional trends in adults' Speech-Act *because* and *if*

Given, then, that Speech-Act sentences are entirely subject to a speaker's discretion in both form and function, it is interesting to note that adults seem to use them in particular ways. Diessel and Hetterle (2011) argue that, for adults cross-linguistically, *because*-clauses are often independent from the main clause. They also argue that these clauses function to offer "justifications or explanations of the controversial statement" (p. 46). Ford (1993) presents a similar account, arguing that *because*-clauses are used when speakers want to expand upon utterances which are perceived as posing a difficulty to an interaction (see also Ford & Mori, 1994). Furthermore, she explains that these *because*-clauses can express different types of information, including background information and more detail (Ford, 1993). Therefore, *because*-Speech-Act clauses can vary in content, but have a particular function: to provide the listener with more information about any illocutionary act which may be viewed as contentious within a discourse.

In contrast to *because*-clauses, Speech-Act *if* has an association with politeness (e.g. Brown & Levinson, 1987; Sweetser, 1990; Van der Auwera, 1986; Warchał, 2010). For example, Brown and Levinson (1987) show that *if*-clauses often function as hedges, which are associated with politeness. Furthermore, Sweetser (1990) discusses an entire subset of *if* Speech-Act sentences, which she calls "politeness conditionals" (p. 118), but also explains that even "given conditionals" (e.g. "If (as we both know) you were at the party, how's Harry these days?, Sweetser, 1990, p. 129), seem more polite than illocutionary acts without the conditional subordinate clause. The association with politeness also appears to be entrenched in the form, as well as function: both Sweetser (1990) and Van der Auwera (1986) suggest that Speech-Act *if*-clauses like *"if I may say so"* (Sweetser, 1990, p. 118) and "*if I may ask you to*" (Van der Auwera, 1986, p. 199) are idiomatic expressions of politeness (see also Brown & Levinson, 1987). Specifically with regard to *if*

[11] Pander Maat and Degand (2001) argue that, while causality-based epistemic sentences are still tied to events in the real-world (i.e. the speaker draws a conclusion about something based on evidence they observe in the world), noncausal epistemic are only based on regular patterns in the world, on which speakers can draw conclusions.

I may say so, Sweetser (1990) claimed that it has "become so idiomatic that it no longer has any genuine conditional value; for most speakers it simply marks politeness rather than carrying its literal meaning" (pp. 118-119). Therefore, although any illocutionary act can be justified (*because*-clauses) or have any conditions attached to its performance (*if*-clauses), there is evidence to suggest that adults use Speech-Act *because* and *if* to serve specific, and relatively consistent, functions in discourse, which may not be entirely reliant on semantic notions of cause or condition.

3.4 Pragmatic patterns in children's speech: how are *because* and *if* used?

3.4.1 General pragmatic patterns in children's *because* and *if*

There is evidence that children are sensitive to the fact that *because* and *if* can express all three of Sweetser's (1990) pragmatic functions (Content, Speech-Act and Epistemic). For example, Kyratzis et al. (1990) analysed both *because*- and *so*-sentences from 21 children, aged 2;7 – 11;1 in naturalistic speech data. They found that, while children aged 3;7 – 6;6 produced causal sentences in all three pragmatic categories, Speech-Act was the most common and was the only type produced by children 3;6 and younger. This pattern also seems to hold in some other languages; of the codable causal utterances produced in naturalistic speech (via connectives *want* and *omdat: "because"; dus: "*so"; *daarom: "that's why"*) by 12 Dutch children, aged 1;6 – 5;6, Speech-Act sentences were produced most frequently (Evers-Vermeul & Sanders, 2011), and data from a single French-speaking child between the ages of 0;10-4;01 showed that she favoured the Speech-Act function with *parce que* ("*because*"; Sekali, 2012). These studies suggest that, at least for English-, Dutch- and French-speaking children, usage of adverbial sentences coordinated with a causal connective is not strongly tied to the cause-and-effect Content relationships that are normally tested in studies such as De Ruiter et al. (2020, 2018) or Emerson (1979, 1980; & Gekoski, 1980).

As well as corroborating Kyratzis et al.'s (1990) finding that children produce all three pragmatic types with *because* but favour the Speech-Act function, De Ruiter et al. (in press) found evidence that children also express all three pragmatic functions with *if*. Using dense naturalistic corpus data from two English-speaking mother-child dyads, they investigated a wide range of syntactic and pragmatic elements for *because*, *if*, *before* and *after*. In contrast to the patterns they found in children's *because*-sentences, they found

that Content-sentences were the most frequently (about 75%) produced pragmatic type for children's *if*-sentences. De Ruiter et al. (in press) also provided some context for these patterns in the children's data by comparing them to the pragmatic proportions produced by the children's mothers (primary caregivers). For both connectives, they found that the mothers' patterns were generally similar to the proportions reported for children, with both mothers producing more Speech-Act with *because* and Content with *if*. To confirm these findings, they later coded the pragmatic function of *because*- and *if*-sentences produced by a further 12 mother-child dyads (using corpus data from Rowland & Theakston, 2009; Theakston & Rowland, 2009) and found that the patterns held for both groups and connectives, except for children's *if*. Specifically, when the data from the additional children were considered, children produced almost as many *if*-Speech-Act sentences as *if*-Content (52.6% Content vs. 45% Speech-Act), despite the mothers still showing a preference for *if*-Content (69.2%). Therefore, a preference for *because* Speech-Act was relatively consistent across mothers and children, but there was more individual variation in children's pragmatic usage of *if*, where children did not consistently show the same preference for Content as their mothers.

3.4.2 Functional trends in children's Speech-Act *because* and *if*

In terms of evidence of how Speech-Act sentences are used (as discussed in terms of patterns in adults' speech in section 3.3.2), we are not aware of any studies directly comparing functional patterns in young English-speaking children's *if*-clauses, specifically, and what evidence does exist is inconsistent. For example, while McCabe et al. (1983) found that young children primarily use *if* to bribe or threaten, Bowerman (1986) found no evidence of this. Additionally, without more information about the bribes or threats in McCabe et al. (1983), it is not clear how frequently these were Speech-Act sentences rather than Content sentences (e.g. compare "I will let you have those books if you let me play with that new toy" (Content) versus "I've got two books you can have, if you are going to let me play with that new toy" (Speech-Act)). As such, it is difficult to tell whether this function is closely associated with one pragmatic type over another, if indeed it can be clearly associated with one at all.

There is, however, some evidence that, like adults (e.g. Diessel & Hetterle, 2011; Ford, 1993; Ford & Mori, 1994) children also use *because*-clauses to explain utterances which

may be deemed contentious in a discourse. Although we have found no study in English which has examined functional patterns in young children's *because*-sentences, exclusively, Hood and Bloom (1979) found that children's causals, in general, related to the issuing of directives (such as "*could you read this to me cause I don't know how*"; p. 12) or the stating of intentions (such as "*I want some milk cause I have a cold"*; p. 14), both of which often expressed a negative meaning or relationship. Diessel (2004) also shows that young children use both *because* and *so* to express information about their own interests/goals. Furthermore, Kyratzis et al. (1990), found that most of children's Speech-Act causals "justified control acts" (p. 209). However, the findings of these studies were based on production of both *because* and *so*, meaning is it is not entirely clear how much these patterns can be ascribed to Speech-Act *because,* alone*.* Additionally, Kyratzis et al.'s (1990) coding scheme stated that, while the main clauses for Epistemic and Content sentences were assertions, the main clause of the Speech-Act sentences were responses, interrogatives and direct and indirect imperatives (p. 208), suggesting the possibility that their coding of Speech-Act sentences might have been biased towards those types of utterances (a criticism also raised by Evers-Vermeul & Sanders, 2011). Interestingly, there does appear to be some cross-linguistic evidence that children's *because* sentences function like those of adults. In discussion of the results of her study investigating how Italian-speaking children use perché (*because*) with both their teachers and their peers, Orsolini (1993) argued that

> *because* has an indexical nature. It displays the link between "dispreferred" or "unexpected" actions and claims, on the one hand, and communicative acts that inform the addressee of the speaker's intentions and knowledge on the other (Orsolini, 1993, p. 116).

While these studies provide some indication that children's *because*-Speech-Act sentences serve a specific function, differences in methodology (e.g. connectives included in the study, coding scheme differences, first language of the participants) means this data paints only a vague picture about how English-speaking children use Speech-Act *because* and whether there are consistent and/or salient functional patterns associated with its usage by, and to, young children.

Overall, we appear to have conflicting patterns for the two connectives with regards to how their usage aligns with functional patterns in input. In adult speech, Speech-Act *if*-

clauses are strongly associated with politeness, sometimes taking an idiomatic form (e.g. Brown & Levinson, 1987; Sweetser, 1990; Van der Auwera, 1986). As such, they are arguably well suited to be abstracted verbatim. Despite this, children's proportions of *if* Speech-Act are less consistent (De Ruiter et al., in press), suggesting that, if children do use *if* Speech-Act to express politeness in this way, they do not necessarily produce it with the same frequency as their mothers and that there is more individual variation with its usage, in general. By contrast, although the overall proportion with which young children produce *because* Speech-Act sentences is similar to what they hear in the input (De Ruiter et al., in press; Kyratzis et al., 1990), *because* Speech-Act sentences are very speaker- and discourse-specific and can vary greatly in the information they express (e.g. Ford, 1993; Pander Maat & Degand, 2001). This means that it seems unlikely that all of children's *because* Speech-Acts (which account for the majority of their total *because*-sentences, De Ruiter et al., in press; Kyratzis et al., 1990) are sentences they have directly copied from their input. However, without knowing more about how children produce *because* and *if* Speech-Act sentences, and how this relates to input, we are not able to draw conclusions about whether these connectives express any consistent or salient functional meaning for children.

3.5 The present study

3.5.1 Framework

Given the high proportions with which Speech-Act *because*- and *if*-sentences appear in the speech of young children (De Ruiter et al., in press; Kyratzis et al., 1990), as well as their associations with particular functions in adult speech (e.g. Diessel & Hetterle, 2011; Ford, 1993; Sweetser, 1990), there is reason to believe that these connectives may have a functional meaning for children over and above the cause-effect/sufficient condition meanings they express in Content form. As such, we expect that investigating more specific patterns in how children hear and use this pragmatic type will have two key benefits. First, in identifying patterns in how children produce Speech-Act sentences, we will gain a better understanding of the patterns associated with children's usage of this pragmatic type. Second, by comparing whether children's patterns resemble their mothers' in terms of a.) function and b.) form (phrasing), we will develop a better idea of whether children are abstracting broader functional patterns or simply copying utterances directly from input. This information will give us a better idea of whether there

are salient patterns associated with the Speech-Act usage which may influence children's understanding of what these connectives mean. In line with this, the research questions for this study are:

1. What types of illocutionary acts do children and caregivers produce alongside their *because*- and *if*-Speech-Act clauses; and
2. Is there evidence of recurring phrases in the subordinate clauses of children's Speech-Act sentences which may be indicative either of copying directly from the input or their learning of idiomatic phrases?

To address these research questions, we analysed the types of illocutionary acts co-occurring with these *because*- and *if*-clauses, as well as the phrasing of the subordinate clauses in both child and caregiver speech.

3.5.2 Methods

3.5.2.1 Corpus

Data from two mother-child dyads, Thomas and Gina, from the Max Planck corpus (Lieven et al., 2009) were analysed. These data can be found on the CHILDES website (MacWhinney, 2000). The total data available contains 379 hours of recording for Thomas, recorded during the time he was aged 2;00:12 – 4;11:20, and 118 hours for Gina, recorded while she was aged 3;00:01 – 4;02:29. To avoid including data from a developmental period when children typically do not produce complex sentences (Bloom et al., 1980; Diessel, 2004), and to provide an approximately equal number of utterances for the two children, Thomas's data before the age of 2;06:12 was not included in the present study. A summary of the data included is in Table 3.1.

Table 3.1: Recorded hours for Thomas and Gina corpora

Thomas				**Gina**			
Age	**No. hours**	**Frequency of recordings**	**Mean MLU**	**Age**	**No. hours**	**Frequency of recordings**	**Mean MLU**
2;06:12 – 3;02:12	154	5 x 1 hour recordings each week, every week	2.59	3;00:01 – 3;01:11	30	5 x 1 hour recordings per week, every week	2.89
3;03:02 – 3;11:06	43	5 x 1 hour recordings, 1 week per month	3.64	3;02:00 – 3;11:06	40	5 x 1 hour recordings, 1 week per month	3.39

4;00:02 – 4;11:20	57	5 x 1 hour recordings, 1 week per month	3.60	4;00:00 – 4;01:11	29	5 x 1 hour recordings per week, every week	3.93
				4;02:29 – 4;07:29	19	Multiple (between 1 – 4) recordings one or two weeks a month	3.59
Total	254	**Mean**	3.28	**Total**	118	**Mean**	3.45

The mothers' data was taken from the six-week period following their child's third birthday. This resulted in 26 hours of recording for Thomas's mother and 30 for Gina's mother. The recordings for Thomas and Gina were done at their home or at the child study centre at the University of Manchester over one-hour sessions. The mothers and children engaged in a number of activities, including mealtimes, play-time and general conversation. Both children came from two-parent families living in a major urban area of the UK and from middle-class backgrounds. In addition, data from twelve mother-child dyads (seven female children) in an additional corpus of data (Rowland & Theakston, 2009; Theakston & Rowland, 2009) were coded. These data were not available on the CHILDES website, but were held by one of the co-authors on this paper. For each mother-child dyad in this corpus, there are 22 hour-long recordings, two in every three-week period, plus three further hours of recordings at each of the start, middle and end of the study period. The children ranged in age at the first recording from 2;08 – 2;11 (mean 2;10) and were between 3;04 – 4;01 (mean 3;06) on the final recording. MLUs on the first recording ranged from 2.41 – 3.79 (mean 3.22) and from 2.92 – 4.15 (mean 3.43) on the final recording. Recordings took place in the family home during a play context.

3.5.2.2 Procedure

The files were processed using CLAN (MacWhinney, 2000), using the Keyword search (kwal) for both connectives at both the Mother and Child tier for each dyad. For the Thomas and Gina data, 20 lines were included before the line with the connective and three after; for the additional 12 dyads, which were processed several months after the Thomas and Gina data, ten lines were included before and three were included after. This CLAN processing at the connective level was done by the lead author of De Ruiter et al. (in

press) for the Thomas and Gina data and by the lead author of the present paper for the additional 12 dyads.

Following this processing, data were coded. Only complex adverbial *because*- and *if*-sentences (i.e. those with a clearly identifiable main and subordinate clause and where *because* or *if* functioned as a connective between the clauses) were coded. Isolates (where there was no main clause, such as *because I like to*, Thomas, 3;03:07) and where *because* or *if* appeared in non-complex adverbial forms (such as "*Is that because of Fireman Sam's helmet*" [Thomas' mother, 3;00:03] or *I'll see if I can find the milk* [Gina's mother; 3;00:08]) were removed. Additionally, only sentences that were functionally and structurally interpretable were included, so some utterances that were incomplete or that contained a significant number of words that could not be transcribed were removed. That is, if the speaker finished enough of the utterance that both the function and key structural/semantic elements could be coded, the item was kept; if these things could not be identified or key elements were not able to be transcribed, the utterance was removed from the dataset. The remaining data were then coded for pragmatic type. Using the model proposed by Sweetser (1990), each item was coded as Content, Speech-Act or Epistemic, as detailed in De Ruiter et al. (in press). A pragmatic type coding scheme is provided in Appendix 3.1. All coding for Pragmatic Type, Illocutionary Act and Subordinate Clause phrasing was carried out by the lead author of this paper.

3.5.2.3 Coding

After the Pragmatic Type coding, all sentences which were coded as Speech-Act in De Ruiter et al. (in press) (according to the categories as described in Appendix 3.1) were then coded for the following:

Illocutionary act type: To determine functional patterns in these sentences, the specific illocutionary act performed in the main clause was identified. The labels used were modified and reduced from Snow, Pan, Imbens-Bailey and Herman (1996) whose coding scheme captured some extremely fine distinctions between categories (e.g. differentiating between "agree to carry out act requested or proposed by other" and "agree to do for last time"). While this level of detail is useful in some analyses, it was overly specific for the broader patterns of illocutionary act use we were investigating. Therefore, the categories were collapsed to reflect 13 broad illocutionary acts: Ask,

Agree, Approve/Praise, Command, Disagree, Disapprove, Permit, Promise/Offer, Request/Suggest, State intent, State/Claim, Threaten, Warn/Advise.

Subordinate clause phrasing recurrence: To determine if any children were either simply copying subordinate clause phrasing their mothers produced (which may vary by child) and/or producing subordinate clause phrasing that may be considered idiomatic (which we would expect to then appear frequently in more than one corpus), the phrasing of the subordinate clauses was examined. While idiomatic phrases, by nature, typically have a set form, they may be subject to some variation (for example, as argued by Reagan (1987, p. 418), both "*Pull Barbara's leg*" and "*Pull Kathy's leg*" are variations of the idiomatic form "*Pull X's leg*"). The same seems to be possible with idiomatic phrases in *if*-clauses. For example, Van der Auwera (1986, p. 199) states that the subordinate clause in "*If I can speak frankly, he doesn't have a chance"* is idiomatic. Arguably, however, it would have the same meaning if the speaker had produced the subordinate clause *If we can speak frankly* instead. Thus, to investigate phrasing patterns, a coding scheme was required that provided insight into specific phrasing, but also left some room for flexibility. As such, the first verb phrase (VP) in each subordinate clause was identified. Recurring VPs were then investigated more closely to determine the extent of recurrence. To ensure that the wording for all VPs could be evaluated, any sentences in which the first VP in the subordinate clause had any unclear or incomplete information were removed, for example, *er no . (be)cause I need +//. [+ IN]* (Billy, 3;01:02). This resulted in the removal of an additional 136 Speech-Act sentences across all speakers (15 (1.5%) from the mothers' *because;* 115 (6.4%) from the children's *because*; 2 (0.7%) from mother's *if;* 4 (1.9%) from children's *if*)).

All VPs started at the first verb in the subordinate clause, ignoring all words before the verb (e.g. subjects, adverbs, additional connectives). Verb forms were noted ignoring variation in person, number, tense and polarity, e.g. *it's nice* was coded as *be nice*. Additionally, in the cases of multi-clausal subordinate clauses, the VP was only coded up to the end of the first clause after *because* or *if* (e.g. "*because normally when we see them round the corner they're here in a few minutes"*; Thomas's mother, 3;00:07, becomes "*see them round the corner"*). This meant that any phrases that were repeated, but slightly

modified to particular circumstances of the discourse, would be identifiable for further examination.

3.5.2.4 Reliability

Approximately 15% of the illocutionary acts were coded by an independent researcher. The average free marginal kappa was .71 for *because*-sentences and .76 for the *if*--sentences, which is substantial agreement (Landis & Koch, 1977).

Disagreement between coders most often arose for illocutionary acts where the coders had different interpretations of speaker's primary intention in a given context and there no reliable cues in the form of the utterance which could help discern between the most likely options (see Reeder, 1983 for a discussion of these kinds of issues in coding children's illocutionary acts). For example, there was some disagreement for *because* Agree for sentences where the illocutionary act was "yeah", "yes" or "no" such as in "*yeah . (be)cause that can't go there*" (Bob, 3;06:07). In examples such as this, disagreement occasionally arose when the coders differed in opinion as to whether the "yeah" was expressing agreement with another speaker's idea (in which case it would be Agree) or whether it was affirming an idea that the present speaker had already stated or providing a response to a question the other speaker may have about that idea (in either case it would be State/Claim). Similarly, difficulty occasionally rose between Request/Suggest and Command when coders had different perceptions as to whether the speaker was requesting something (Request/Suggest) or whether they expected their instructions to be followed (Command), e.g. "you have to show me then (be)cause I don't know which you mean" (Rebecca, 3;01:07). Additionally, particularly with *if*, there was sometimes disagreement as to whether the speaker was giving the listener permission, in general, or directly offering them something, e.g. "you can have this stamp if you want" (Gina, 3;00:30). Full details of the coding instructions, including examples, for the illocutionary acts is found in Appendix 3.2).

3.6 Results

The total number of *because* and *if* sentences in the corpus was 5806 (3137 from the children and 2669 from the mothers). Within the children's data, there were 2426 *because*-sentences (1785 Speech-Act) and 711 *if*-sentences (214 Speech-Act). Within the

mothers' data, there were 1586 *because*-sentences (976 Speech-Act) and 1083 *if*-sentences (292 Speech-Act) (see Table 3.2[12]).

Table 3.2: Summary of total utterances, utterances by connective and Speech-Act utterances by speaker

Speaker	Total no. utterances	No. *because*	% *Because* Speech-Act	No. *if*	% *if* Speech-Act
INPUT					
Alice	124	83	76%	41	37%
Billy	112	70	63%	42	33%
Bob	11	8	63%	3	33%
Gina	658	421	73%	237	27%
Helen	142	73	68%	69	26%
Ivy	50	28	43%	22	14%
Jack	75	32	62%	43	26%
Lucy	73	40	70%	33	30%
Mary	179	96	67%	83	39%
Olga	141	81	68%	60	33%
Rebecca	183	88	60%	95	37%
Sid	59	29	62%	30	20%
Steve	93	64	59%	29	24%
Thomas	769	473	46%	296	19%
Mean input	**190.6**	**113.3**	**62.9%**	**77.4**	**28.4%**
CHILDREN					
Alice	4	3	100%	1	100%
Billy	128	103	69%	25	4%
Bob	122	115	77%	7	57%
Gina	566	439	75%	127	24%
Helen	150	126	79%	24	38%
Ivy	116	90	83%	26	58%
Jack	42	30	53%	12	67%
Lucy	140	98	77%	42	36%
Mary	268	195	62%	73	30%
Olga	260	207	71%	53	60%
Rebecca	59	41	88%	18	72%
Sid	347	272	70%	75	17%
Steve	125	110	78%	15	47%
Thomas	810	597	75%	213	21%
Mean children	**224.1**	**173.3**	**75.5%**	**50.8**	**45.0%**

[12] De Ruiter et al. (in press) reports pragmatic coding for the Thomas and Gina data, repeated here, but provides only average values for the additional 12 dyads, full details reported here.

Descriptive data were used to explore the patterns in the speech of the different groups, with one-sided Wilcoxon signed rank comparisons used to assess the significance of any observed differences. The analysis was done in R (R Core Team, 2018) version 3.5.1 ("Feather Spray") using the coin package (Hothorn, Winell, Hornik, van de Wiel & Zeileis, 2019), with the default Pratt method (Pratt, 1959) for zeros and ties.

3.6.1 Illocutionary acts

The illocutionary acts produced by the mothers for each connective were compared to those produced by the children. *Because* illocutionary acts are reported first, followed by *if.* For both connectives, results are presented first for children and then for mothers.

3.6.1.1 Because

The most common illocutionary acts children produced with their *because*-sentences were State/Claims (M = 38.2%; SD = .116), followed by Commands (M = 27.1% SD = .089) and Request/Suggests (M = 8.3%, SD = .05). Disapprove, Promise/Offer and Threaten occurred rarely with *because* in the children's data (none accounted for more than 4% of any child's productions). Although there was some individual variation within the children, the trends were largely consistent (see Figure 3.1).

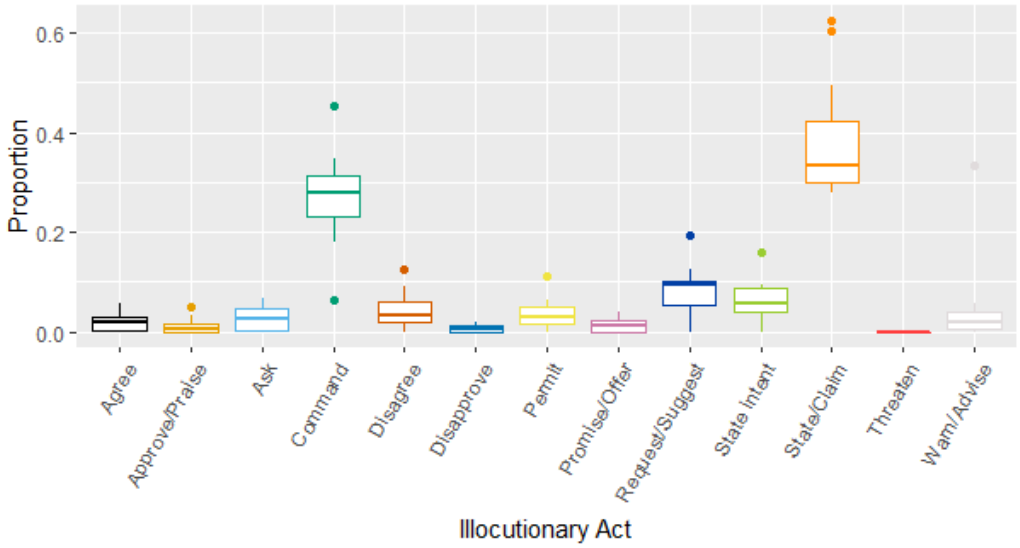

Figure 3.1: Children's *because* illocutionary acts

The primary illocutionary act performed with the mothers' *because*-sentences was Command (M = 36.8%; SD = .102), followed by State/Claim (M = 14.5%, SD =.086) and Request/Suggest (M = 12.4%; SD = .078). Like with the children, there was a relatively high degree of consistency between the mothers. Disapprove, Disagree and Threaten

were rarely produced by any of the mothers with *because* (none accounted for more than 5% of any mother's *because*-illocutionary acts) (see Figure 3.2).

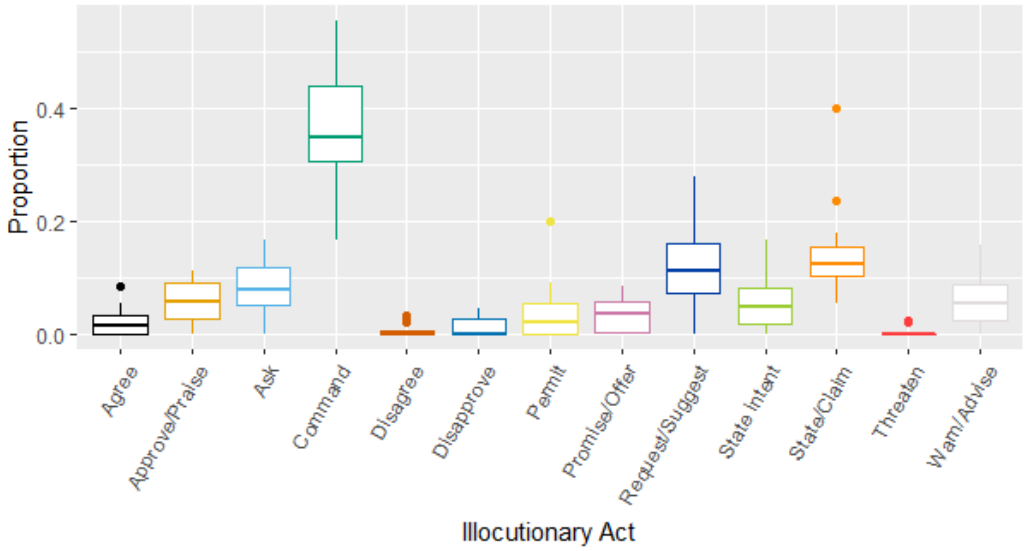

Figure 3.2: Mothers' *because* illocutionary acts

In comparison to their mothers, the children produced proportionately more State/Claims (38.2% vs. 14.5%, Z = 3.296, p = .001) and Disagrees (4.4% vs. 0.6%, Z = 2.826, p = .017). The output of the Wilcoxon tests for *because* are summarised in Table 3.3, with Figure 3.3 providing a visual comparison. Significance (p) values have been adjusted using the Bonferonni correction for multiple comparisons by multiplying the unadjusted p value by the number of comparisons (13). Adjusted values over 1 were rounded to 1 (e.g. the unadjusted p value for *because* Commands was .9952 and when this is multiplied by 13, it yields a value over 1).

Table 3.3: Summary of Wilcoxon signed rank comparison of child and mother illocutionary acts with *because*

	Children		**Mothers**		**Significance**		
Illocutionary act	**Mean**	**SD**	**Mean**	**SD**	**Y/N**	**p**	**Z**
Ask	.028	.023	.080	.056	N	1	-2.449
Agree	.021	.019	.021	.026	N	1	0.126
Approve/Praise	.012	.016	.058	.037	N	1	-3.078
Command	.271	.089	.368	.102	N	1	-2.668
Disagree	**.044**	**.036**	**.006**	**.011**	**Y**	**0.017**	**2.826**
Disapprove	.007	.008	.012	.019	N	1	-0.159
Permit	.036	.029	.040	.056	N	1	0.282
Promise/Offer	.013	.013	.033	.029	N	1	-2.328
Request/Suggest	.083	.050	.124	.078	N	1	-2.166
State intent	.061	.043	.053	.049	N	1	0.628
State/Claim	**.382**	**.116**	**.145**	**.086**	**Y**	**0.001**	**3.296**

Threaten	0	0	.003	.008	N	N/A	N/A
Warn/Advise	.043	.085	.058	.049	N	1	-1.507

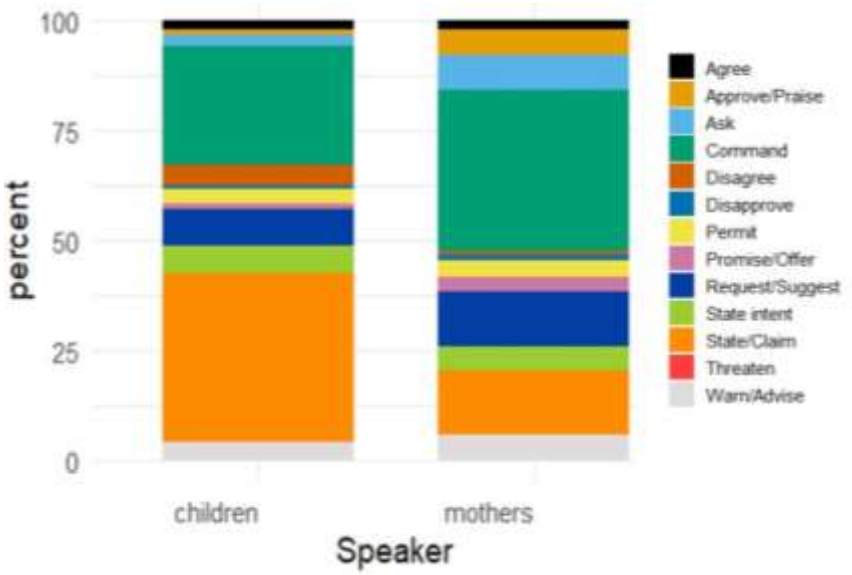

Figure 3.3: *Because* Illocutionary act types – children versus mothers

3.6.1.2 If

We next examined the children's and mothers' *if*-sentences to establish whether they showed similar patterns of usage. Different patterns emerged from what was found with the *because*-sentences. Permit was the most frequent *if*-illocutionary act for the children (M = 39.8%, SD = .239), followed by State/Claim (M = 18.8%, SD = .258) and Request/suggest (M = 10.9%, SD = .108). No child produced any Disagrees with *if* and only one child produced any Threats (accounting for only 3% of her *if* illocutionary acts). Figure 3.4 shows the patterns of children's *if* illocutionary acts.

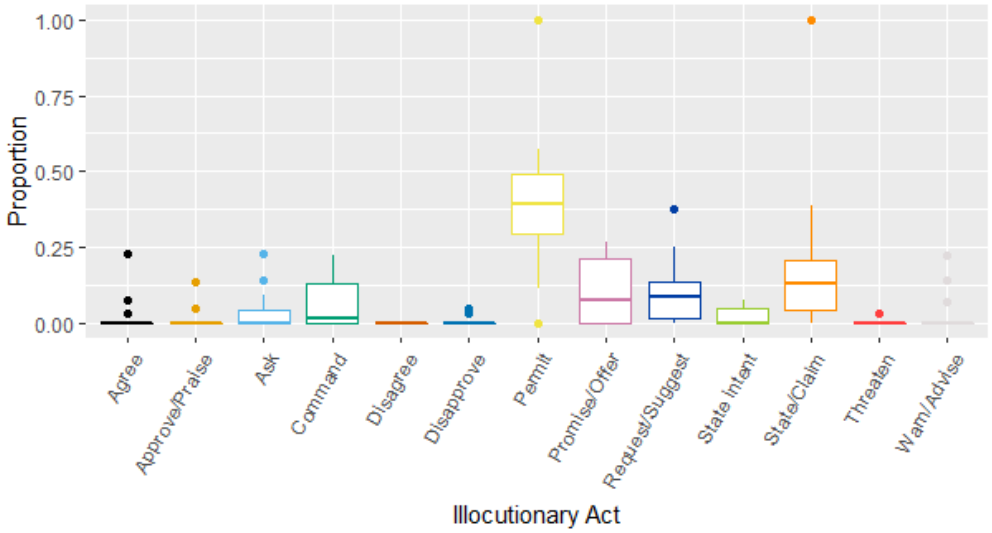

Figure 3.4: Child if illocutionary acts

Like the children, Permit was the most frequently produced *if*-illocutionary act for the mothers (M = 19.9%, SD = .096, followed by Ask (M = 16.6%, SD = .255) and State/Claim (M = 15.5%, SD = .124, see Figure 3.5).

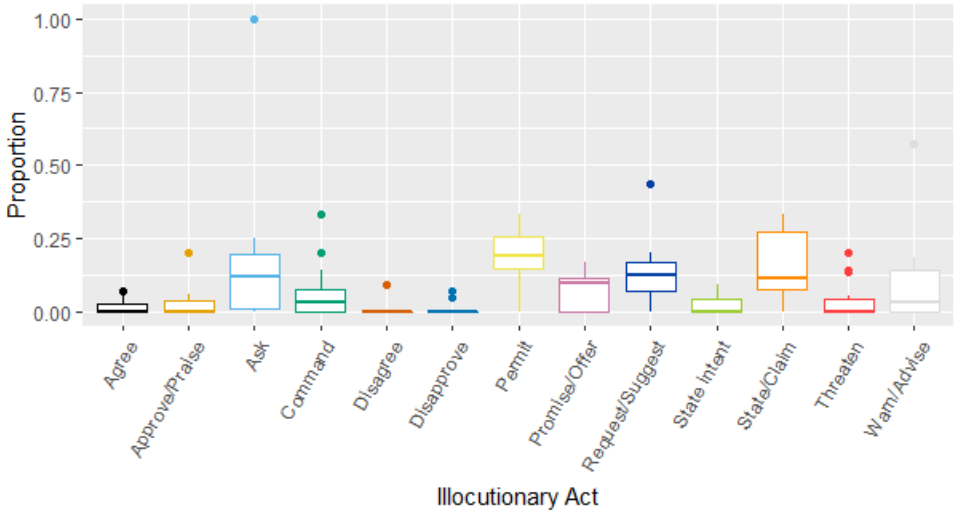

Figure 3.5: Mother if illocutionary acts

After applying the Bonferonni correction for multiple comparisons, there were no differences between the proportions in which children and mothers produced the different illocutionary acts with *if* (see Table 3.4 and Figure 3.6).

Table 3.4: Summary of Wilcoxon signed rank comparison of child and mother illocutionary acts with *if*

	Children		Mothers		Significance		
Illocutionary act	**Mean**	**SD**	**Mean**	**SD**	**Y/N**	**p**	**Z**
Ask	.039	.070	.166	.255	N	1	-2.199
Agree	.024	.063	.016	.025	N	1	-0.169
Approve/Praise	.016	.038	.026	.055	N	1	-0.808
Command	.063	.076	.068	.097	N	1	0.031
Disagree	0	0	.006	.024	N/A	N/A	N/A
Disapprove	.006	.015	.008	.022	N	1	-0.576
Permit	.398	.239	.199	.096	N	0.229	2.103
Promise/Offer	.105	.104	.074	.062	N	1	1.211
Request/Suggest	.109	.108	.128	.113	N	1	-0.565
State intent	.020	.033	.022	.033	N	1	-0.035
State/Claim	.188	.258	.155	.124	N	1	0.063
Threaten	.002	.009	.038	.069	N	1	-1.992
Warn/Advise	.031	.069	.093	.153	N	1	-2.066

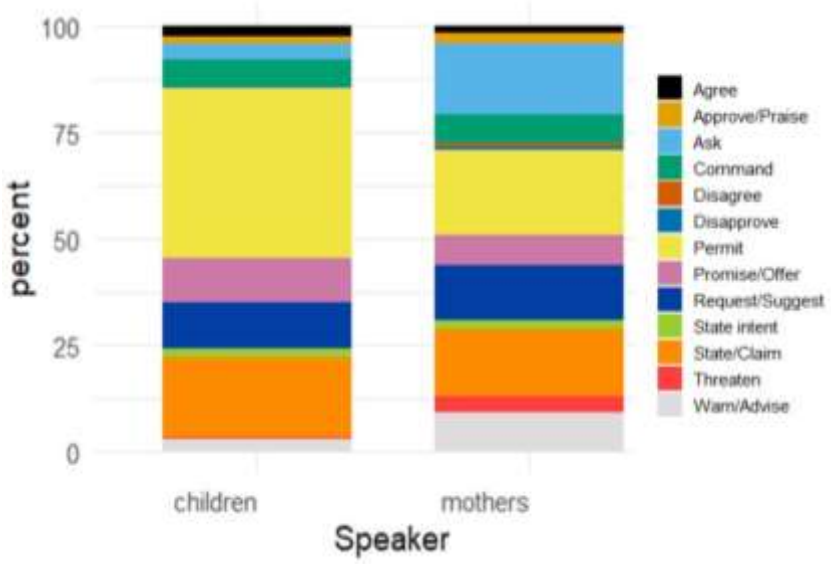

Figure 3.6: *If* Illocutionary act types comparison – children versus mothers

3.6.2 Clause Recurrence

We next looked at patterns in the subordinate clause phrasing to see if children were producing the same subordinate clause phrases as their mothers or whether there were any patterns which may be indicative of more generally accepted idiomatic usage. To explore whether these patterns exist, we compared the most frequently produced Speech-Act VPs for each connective across the dyads.

3.6.2.1 Because VPs

Overall, the children produced 1449 different VPs in their 1679 *because*-Speech-Act sentences and mothers produced 901 different subordinate clause VPs in their 961 *because* Speech-Act sentences. Table 3.5 shows the most frequently repeated *because* subordinate clause VPs for both speakers within each dyad, including the number of times each speaker produced that VP. Where a speaker did not have any repeated forms (and therefore no form(s) was/were more frequent than any others), an N/A is recorded. No *because* VP was produced more than six times by any speaker, nor accounted for more than 5% of any child's total *because* Speech-Act sentences. Only one dyad (Gina and her mother) shared their most frequently produced form, *look* (e.g. *no . (be)cause look* , Gina; 4;00:27). However, for Gina and her mother, this VP only accounted for about 1% of each speaker's *because*-Speech-Acts, and for Gina this was tied with three other VPs. *Look* was also among the most frequent *because* VP for six other speakers (but not for their interlocutors), although it was never produced more than six times by any speaker. This

means that several speakers produced it, but not repeatedly. Therefore, for *because*, there was no evidence that any of the children were consistently copying the subordinate clause phrasing their mothers used. Additionally, although *look* appears to be a phrase that speakers sometimes use alongside *because*-Speech-Acts, there is not any strong evidence this or any other *because*-Speech-Act subordinate clause phrase has any consistent or idiomatic usage that is used repeatedly by multiple speakers.

Table 3.5: Most frequently repeated *because* verb phrase(s) for each speaker

Corpus	**Most frequently repeated *because* Speech-Act VP(s) (N = number of times produced)**	
	Child	**Mother**
Alice	N/A	N/A
Billy	***Can go*** (N = 2; 3.2%)	N/A
Bob	***Be the omega+ranger*** (N = 3; 3.7%)	N/A
Gina	***Be a big girl; Be nice; Look; Need it*** (N = 4; 1.2% each)	***Look*** (N = 4; 1.3%)
Helen	***Be the teacher*** (N = 3; 3.5%)	N/A
Ivy	***Look; Be her birthday again; Do*** (N = 2; 3% each)	N/A
Jack	N/A	***Look*** (N = 2; 10%)
Lucy	***Be going to sleep; Look*** (N = 2; 3% each)	***Be wet*** (N = 2; 7.4%)
Mary	***Be very good; Be a big girl; Be quite difficult; Like elephants; Do work*** (N = 2; 1.8% each)	***Look*** (N = 2; 3%)
Olga	***Be the mummy; Be her mummy*** (N = 3; 2.2% each)	N/A
Rebecca	N/A	N/A
Sid	***Look*** (N = 3; 1.7%)	N/A
Steve	***Be broken*** (N = 4; 4.9%)	***Start moving*** (N = 2; 5.3%)
Thomas	***Look*** (N = 6; 1.4%)	***Can see; Be upstairs; Be nothing else; Will break; Get dirty*** (N = 2; 0.9% each)

3.6.2.2 If VPs

Table 3.6 shows the most frequently produced *if* Speech-Act VPs for each speaker. For *if*, the children produced 91 different subordinate clause VPs in their 210 *if* Speech-Act sentences and the mothers produced 196 different subordinate clause VPs in their 290 *if* Speech-Act sentences. In three dyads the same VP (*want*) was the most frequently produced by both speakers, accounting for between 23.5% - 65.5% of these speaker's *if* Speech-Act sentences. There were also more general patterns across the data.

Specifically, the VPs *want, like* and *want to* were all produced by several speakers (*want*: 11 children, 9 mothers; *like*: 8 children, 7 mothers; *want to*: 7 children, 5 mothers), and for 20 of the 24 speakers, one of these was the most frequently produced Speech-Act VP (see Table 3.6). No other *if* Speech-Act VP was produced more than 4 times in the overall datasets for either children or mothers (as such, no others accounted for more than 2% of the children's dataset or 1% of the mothers').

Table 3.6: Most frequently repeated *if* verb phrases for each speaker

Corpus	**Most frequently repeated *if* Speech-Act VP**	
	Children	**Mothers**
Alice	N/A	***Want*** (N = 4; 26.7%)
Billy	N/A	***Want*** (N = 5; 35.7%)
Bob	***Want*** (N = 2; 50%)	N/A
Gina	***Want*** (N = 13; 43.3%)	***Want*** (N = 16; 25%)
Helen	***Want to*** (N = 2; 25%)	***Like*** (N = 5; 27.8%)
Ivy	***Want*** (N = 4; 30.8%)	N/A
Jack	***Like*** (N = 3; 37.5%)	N/A
Lucy	***Want*** (N = 7; 46.7%)	N/A
Mary	***Want*** (N = 11; 50%)	***Like*** (N = 14; 45.2%)
Olga	***Want*** (N = 21; 65.6%)	***Want*** (N = 5; 25%)
Rebecca	***Want*** (N = 5; 38.5%)	***Want*** (N = 8; 23.5%)
Sid	***Like*** (N = 2; 15.4%)	N/A
Steve	***Want to*** (N = 3; 42.9%)	N/A
Thomas	***Want*** (N = 9; 20.9%)	***Like*** (N = 6: 10.7%)

Overall, these recurring forms (*want, like, want to*) account for a large proportion of the data for both groups. Their usage is more consistent in the children's data accounting for just over half of all *if*-Speech-Acts; for mothers, they account for almost a quarter (see Table 3.7).

Table 3.7: Proportions of frequently recurring VPs in the data

	Children	**Mothers**
Want	34.3% (SD = .282)	12.7% (SD = .124)
Like	10.3% (SD = .119)	7.8% (SD = .129)
Want to	7.6% (SD = .124)	2.5% (SD = .049)
Total	52.2%	23.0%

Given the extensive overlap in verb phrases used in *if* subordinate clauses, we then examined the subjects of these VPs and the illocutionary acts with which they co-occurred to determine any more specific patterns of usage. Of the 194 VPs that took one of these forms across the two speaker groups, 175 (90.2%) had the subject *you* (mothers':

M = 100%, SD = 0; children: M = 80%, SD = 0.229). This means the mother's subordinate clauses for all of these sentences were either the specific phrases "*if you want", "if you like",* or "*if you want to"* and the children also preferred this phrasing, although they did occasionally change the subject. With regard to illocutionary acts, all three of these VPs were primarily produced with Permits, Request/Suggests and Promise/Offers (see Figure 3.7), suggesting these recurring forms also have a very limited function.

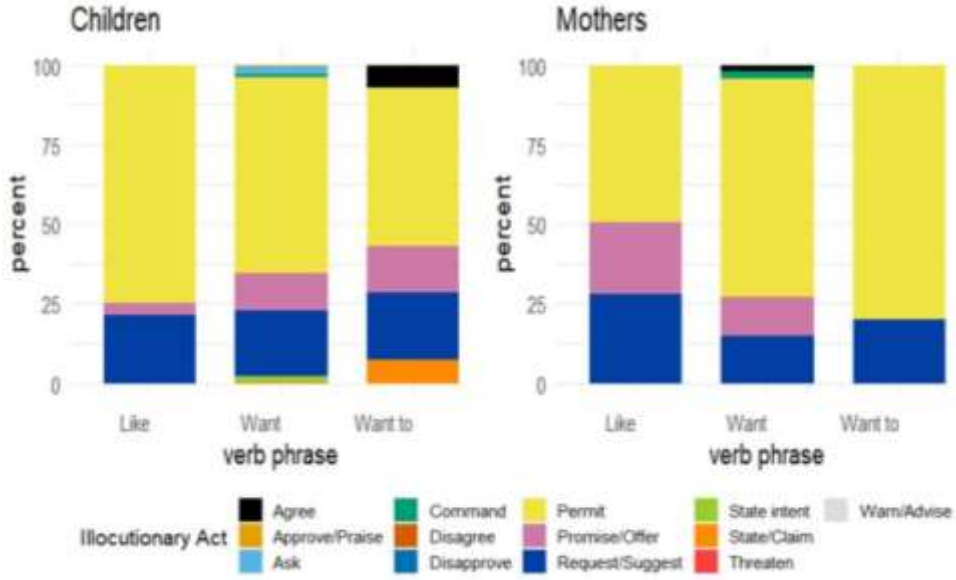

Figure 3.7: Comparison of illocutionary acts produced alongside the frequently produced *want, like* and *want to if* VPs

To summarise, while mothers and children both use *because* to explain Commands, children produce it to explain State/Claims and Disagreements proportionately more frequently than their mothers. With *if,* there were no significant differences between children and their mothers in the proportional use of any illocutionary act. While there were no consistent patterns in the phrasing of *because*-Speech-Act clauses, there was evidence of repetitive phrasing in the *if*-clauses of both mothers and children, with these forms accounting for more than half of the children's *if*-Speech-Act sentences. As such, it seems that while children's *because*-sentences broadly reflect their mothers' pragmatically, they differ slightly in primary function and have little resemblance in form. By contrast, their *if* Speech-Acts sentences are similar to their mothers in terms of both function and repetitive phrasing.

3.7 Discussion

In this study, we aimed to provide more insight into children's understanding of how the adverbial connectives *because* and *if* function by investigating patterns in the Speech-Act sentences (Sweetser, 1990) that they hear and produce. Specifically, we coded *because* and *if* Speech-Act sentences for the illocutionary act performed in the main clause, as well as the phrasing of the subordinate clause. The analyses revealed some clear, although opposing, patterns for the two connectives, which we will discuss below.

With *because*, both mothers and children produced a large number of Commands (children 27.1%, mothers 36.8%). However, while this was the most frequently produced illocutionary act for the mothers, it was not for the children. Instead, State/Claim was the most frequently occurring illocutionary act in the children's speech (38.2%) and they produced these proportionately more frequently than their mothers (14.5%). Additionally, although it was low frequency overall, the children produced proportionately more Disagrees with *because* than their mothers (4.4% vs. 0.6%). Thus, although there are related patterns in mothers' and children's productions of *because* Speech-Act sentences, children do show some patterns of usage that are different from their mothers.

The specific illocutionary act patterns observed in the children's data seem to indicate that their *because* Speech-Acts serve a different function to that suggested by Kyratzis et al. (1990), who reported that children's causal Speech-Act clauses mainly accompanied "control acts". Although this seems to be at least partially corroborated in the present study by the high number of Commands the children produced, these were not the most frequently produced illocutionary acts in our children's *because* data. Rather, our data showed that children produced more explanations of Statements/Claims (e.g. *yes . because it's cold,* Helen, 3;02:12) than any other illocutionary act with *because*. Thus, while the children's *because* Speech-Acts are regularly related to their own interests (thus aligning with patterns in children's causal speech, in general, as reported in Diessel, 2004; Hood & Bloom, 1979), their primary function may not be as "coercive" as Kyratzis et al. (1990, p. 210) suggest. Rather, these *because*-clauses may primarily function to increase co-operative discourse. This idea is based on Ford and Mori (1994), who shows that in adult speech "causal connectors are used in the service of negotiating agreement (or

managing disagreement) between interlocutors" (pp. 52-53)(see also Orsolini, 1993 for related arguments regarding Italian children's use of *perché* (*because*)). Additionally, Sweetser (1990) claimed that explaining one's utterance can help the speaker prevent being perceived as rude. With regard to child discourse, specifically, Kyratzis, Ross and Koymen (2010) give further support to the argument in their study of justifications in peer discourse. Although the boys in their study did not produce enough data for statistical comparisons, Kyratzis et al. (2010) argued that girls (aged 3;7 – 5;4) produced more causal connectives with justifications that "validated" (i.e. expanded upon or agreed with a peer's statement/idea) than "opposed" (i.e. rejected a peer's action or idea). Our maternal input data is also consistent with the idea that *because* Speech-Act has a broadly co-operative function. Although mothers primarily produced Commands, these did not appear to have the sole intent of controlling their children. Rather, the commands were often instructions aimed to help their children and/or prevent a generally negative consequence, with a subordinate clause that then provided the child with an explanation as to why this directive was applicable (e.g. *put your cardigan on , babes . (be)cause I think you're getting a little bit of a cough <and cold> [>],* Gina's mother, 3;00:04). Although these kinds of explanations can be produced without a connective (e.g. as two independent sentences, such as *put your cardigan on. I think you are getting a little bit of a* cough), Kyratzis et al. (2010) argue (following Chafe, 1984) that the use of a connective "focuses attention on the reason and does not allow the main clause to be asserted strongly" (p. 122) (although cf. Orsolini, 1993). One possibility is that the patterns observed in the input to children teach them that Speech-Act *because* enables them to draw attention to their explanation – and thus act more co-operatively in the discourse – even when producing illocutionary acts that are self-focused.

If this is the case, given the usefulness of this function, as well as the frequency with which *because* Speech-Acts are heard and produced by young children, it is possible that this pragmatic meaning is the one that is the most salient, and thus prioritised in acquisition (see Slobin, 1985). Although they argued that the primary function of Speech-Act causals in child speech is somewhat different than the function we have described here, Kyratzis et al. (1990) make a similar argument regarding the usefulness of this pragmatic type and its presence in the speech of young children. Evers-Vermeul and

Sanders (2011) label this approach a "social-pragmatic complexity approach" (p. 1647), where there is a relationship between the usefulness of a connective's function and the ease with which a child acquires it, a theory that overlaps with Slobin's (1985) argument that children prioritise meaningful language. Ford (1993), drawing on Schiffrin (1987, as reported in Ford, 1993), suggested that adults may sometimes use *because to* mean "what I have just said may be clarified through what I am about to say" (p. 135). In a related way, then, for young children, *because* may mean something like "the reason I just said that is…". This, then, would give further support to Kyratzis et al.'s (1990) (see also De Ruiter et al., in press) hypothesis that children's difficulty in understanding *because* reflects the fact that experimental studies primarily use Content sentences as their stimuli. This may be especially problematic when interpretation of *because* in these studies relies on an understanding of the cause-effect ordering in Content sentences (e.g. De Ruiter et al., 2018; Emerson, 1979; Emerson & Gekoski, 1980) (see related arguments in Donaldson, 1986). In these studies, understanding an ordering relationship is critical to being able to interpret the sentence correctly. In Speech-Act sentences, however, the sentence meaning is not bound by this same sort of ordering (i.e. both the illocutionary act and the explanation for it occur in the present discourse, Degand & Pander Maat, 2003; Pander Maat & Degand, 2001). As such, when the type of *because*-sentences that children hear/produce most frequently does not require understanding of an ordering relationship, it is perhaps not surprising that they struggle with experimental stimuli testing this understanding.

With regard to *if,* different patterns emerge. First, for both children and their mothers, the most frequently produced illocutionary act was Permit (children: 39.8%, mothers: 19.9%) and there were no significant differences in the proportional frequency with which any illocutionary act appeared in the children's data in comparison to their mothers'. Thus, we see a clear difference between *because* and *if*: while children's *because* Speech-Act sentences align with their mothers only in terms of broad functional patterns, both the function and the form of their *if*-Speech-Act sentences aligned with those produced by their mothers. Second, although we have argued above that subordinate clauses in *because* Speech-Acts have a co-operative function, the illocutionary acts they accompanied were primarily related to the child's own interest (State/Claims and

Commands). By contrast, *if* illocutionary acts were often focused on their addressee. Permission accounted for approximately 40% of children's *if* productions, primarily occurring with subordinate clauses that took the form "*if you like/want (to)*"*,* which appear to relate to the listener's, rather than speaker's, interest. Thus, in alignment with Sweetser (1990), for children as well as adults, *if* Speech-Acts seem to be strongly associated with politeness. Finally, these recurring VPs constitute another clear difference between Speech-Act *because* and *if*. While there were no consistent patterns in the VPs produced with *because*, the forms *if you want (to)* and *if you like* appeared repeatedly in the speech of many speakers from both groups and were associated with specific illocutionary acts. Their consistency of usage suggests that these are "idiomatic" (e.g. Sweetser, 1990; Van der Auwera, 1986) forms, devoid of true conditional meaning and not specific to individual discourse. In contrast, for the other *if* VPs, there were no consistently recurring patterns; rather they were generally tailored to individual discourse in some way, such as by expressing given information (see Sweetser, 1990; Van der Auwera, 1986)(e.g. *if you're looking for the trailer*. *I know where the car is;* Thomas, 4;04:03). Given the frequency with which these idiomatic forms were heard performing a specific function in input (accounting for 23% of the *if* Speech-Acts in input, mainly with Permits, Promises/Offers and Request/Suggests), it is possible to see how these could be acquired as entire phrases with a specific functional rather than conditional meaning. - These may be idiomatic phrases which function solely to signal politeness, similar to Sweetser's (1990) arguments regarding "*if I may say so"-clauses*. More specifically, these appear to be set phrases which let the listener know that their preference is being prioritised in the present discourse. This aligns with Tomasello's (2001) idea of "holophrases", which are either single words or set phrases that children abstract from their input and use to relate a particular communicative meaning. From this perspective, the inclusion of idiomatic *if* sentences as Speech-Acts may overinflate the frequency with which children hear and produce this pragmatic type (e.g. see Kirjavainen et al., 2009, p. 1097, for a related argument that *excuse me* is a "frozen phrase" which cannot be used to gauge children's understanding of the verb + *me* construction). Indeed, in comparison to the figures reported in De Ruiter et al. (in press) showing children produce a higher proportion of *if* Speech-Act sentences than their mothers (but with a high degree of individual variation), when these idiomatic sentences are removed from the data, the

proportions of children's *if* pragmatic types (i.e. Content, Epistemic, Speech-Act) match their mothers much more consistently (e.g. both children and their mothers produce 23-24% Speech-Act and 72-75% Content), and the individual variation (as indicated by the standard deviation) for the children's Speech-Act and Content types is reduced (Speech-Act: .258 vs .138; Content: .249 vs. .142). This suggests that the frequency with which individual children produced these idiomatic forms largely contributed to the high degree of variation in children's *if* Speech-Act as reported in De Ruiter et al. (in press). Therefore, when these forms are removed, children's pragmatic proportions are not only far more consistent but also, like their mothers, favour the Content relationship with *if.*

If this is the case, it means that the pragmatic type children are most commonly tested on in experiments is the kind they hear and use most frequently with *if*. Unlike with *because*, then, where we have suggested above that the salience and frequency of the Speech-Act type may contribute to children's difficulty with Content stimuli, pragmatic variation seems less helpful in explaining the difficulty children have with *if* in comprehension studies such as De Ruiter et al. (2018). However, *if* is more complex semantically than *because*. While *because* contains the semantic aspects of causality and, at least for some pragmatic types (see Degand & Pander Maat, 2003; Pander Maat & Degand, 2001), ordering (e.g. Emerson & Gekoski, 1980), *if* can require understanding of additional concepts like hypotheticality, contingency and inference (Bowerman, 1986), and sentences expressing simple, hypothetical and counterfactual conditionality are all found (in varying levels of frequency) in the speech of, and to, young children (De Ruiter et al., in press). Furthermore, unlike *because* sentences, which primarily occur in main-subordinate order, *if*-sentences are more varied, occurring in both main-subordinate and subordinate-main (Diessel, 2004, 2005), and the proportions in which they occur in either order changes with pragmatic type, such that Content is more likely to occur in subordinate-main, while Speech-Act is more likely to occur in main-subordinate (De Ruiter et al., in press). Thus, while the pragmatic variation and Speech-Act patterns discussed here do not seem to fully explain children's difficulty with demonstrating understanding of *if*, in and of themselves, they likely provide an additional level of complexity to a connective which is already very complicated to acquire (see De Ruiter et al., in press for related arguments). All this noise in the form-meaning and form-function

mapping of *if* may simply cause children to have more difficulty with it than other connectives (see e.g. Slobin, 1982 for discussion on how acquisition is complicated by noise in form-function mapping).

To summarise, our study has shown clear patterns in children's usage of *because*- and *if*-clauses, supporting the idea that Speech-Act clauses express particular functional meaning for children. For *because*, we argue that this is a way of achieving goals/promoting their ideas in a co-operative manner; for *if, it* is a way of expressing politeness. Furthermore, we also offer evidence that a large portion of children's *if* Speech-Acts are somewhat idiomatic and as such do not express a conditional relationship. Of those utterances that do express conditionals, children actually favour Content relationships with *if*-sentences. However, while the patterns here tell us more about children's usage of this pragmatic type, without data on children's comprehension of these kinds of sentences, particularly in comparison to the more commonly assessed Content relationship (e.g. Amidon, 1976; De Ruiter et al., 2018; Emerson, 1979, 1980; Emerson & Gekoski, 1980; French, 1988; Peterson & McCabe, 1985), we cannot be certain whether the patterns presented here actually relate to children's comprehension, either of the Speech-Act function specifically, or of the connectives overall. As such, at present, we are exploring this via experiments designed to determine how comprehension of these connectives changes with pragmatic type. In doing this, we hope to provide more information, not only about children's understanding of what these connectives mean and how they typically function, but also about children's sensitivity to the pragmatic relationships these connectives express.

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3.9 Appendix

3.9.1 Appendix 3.1: Pragmatic coding

1. Because

The labels for these are CONTENT, EPISTEMIC and SPEECH-ACT (based on definitions given in Sweetser, 1990* and Kyratzis et al., 1990**).

a. **CONTENT**: The subordinate clause provides a "real-world" cause for the event in the main clause. The function of these is to explain the specific cause of a state/event mentioned in the main clause.

e.g. He was barking. Because he wanted to get out. (Kyratzis et al, 1990, p. 206)**

e.g. The chef set out the ingredients because he was about to start cooking.

e.g. but I'm just putting it on because I'm cold (Gina; 4;02:30) (from present dataset)

b. **EPISTEMIC**: The subordinate clause provides an explanation of how a speaker arrived at the conclusion expressed in the main clause.

e.g. This is for gardening, because it's fat (Kyratzis et al., 1990, p. 207)**

e.g. The chef is about to start cooking, because he set out all the ingredients.

e.g. or perhaps it isn't Sue because she-'has got some new neighbours (Thomas' mother; 3;00:07) (from present dataset)

c. **SPEECH-ACT**: The subordinate clause explains/justifies a speech act (illocutionary act) that is performed in the main clause (i.e. explains a speech/illocutionary act, instead of providing an explanation about how something occurred.)

e.g. Take the gloves off. Because they'll get dirty. (Kyratzis et al, 1990, p. 206)**

e.g. Pass me the ingredients, because I am about to start cooking.

e.g. yeah . (be)cause I need to get them right . (Gina, 3;07:04) (from present dataset)

* *Kyratzis, A., Guo, J., & Ervin-Tripp, S. (1990). Pragmatic conventions influencing children's use of causal constructions in natural discourse. *Proceedings of the Annual Meeting of the Berkeley Linguistics Society*, *16*, 205–214)

*Sweetser, E. (1990). *From Etymology to Pragmatics: Metaphorical and Cultural Aspects of Semantic Structure (Cambridge Studies in Linguistics).* Cambridge: Cambridge University Press.

2. If

The labels for these are CONTENT, EPISTEMIC and SPEECH-ACT (based on Sweetser, 1990*, with further support from Van der Auwera, 1986***).

a. **CONTENT**: The subordinate clause describes the sufficient conditions for a state or event. The main clause of these can be a speech/illocutionary act, provided the entire utterance is conditional (e.g. If you inherit, will you invest? (Van Auwera, 1986, p. 198).

    e.g. If you get me some coffee, I'll give you a cookie (Sweetser, 1990, p.114)*

    e.g. The chef sets out the ingredients if he is going to start cooking.

    e.g. I'll turn you into a slug if you don't go now (Thomas; 4;10:05) (from present dataset)

b. **EPISTEMIC**: The subordinate clause provides the conditions (evidence) for drawing a conclusion that is expressed in the main clause. The function of these is to verbalise a deduction/inference.

    e.g. If John went to that party, (then) he was trying to infuriate Miriam (Sweetser, 1990, 116)*

    e.g. The chef is going to start cooking, if he is setting out the ingredients.

    e.g. there must be special crayons if they're fifty pound (Gina's mother; 3;00:12) (from present dataset)

c. **SPEECH-ACT**: The subordinate clause defines the conditions for a speech act (illocutionary act). Unlike Content sentences with speech/illocutionary acts in the main clause, in Speech-Act sentences it is the saying of the speech/illocutionary act, itself, that is conditional (e.g. If you saw John, did you talk to him?; Van Auwera, 1986, p. 198).

    e.g. If I may say so, that's a crazy idea (Sweetser, 1990, p.118)*

    e.g. I have set out the ingredients, if you are ready to start cooking.

    e.g. I've got a sweet if he behaves (Thomas; 4;04:05) (from present dataset)

* Sweetser, E. (1990). *From Etymology to Pragmatics: Metaphorical and Cultural Aspects of Semantic Structure (Cambridge Studies in Linguistics).* Cambridge: Cambridge University Press.

*** Van der Auwera, J. (1986). Conditionals and speech acts. In E. C. Traugott, A. T. Meulen, J. S. Reilly, & C.A. (Eds.), *On Conditionals* (pp. 197–214). Cambridge: Cambridge University Press

3.9.2 Appendix 3.2: Illocutionary act coding

Agree – the main clause offers agreement with an idea or statement that the other speaker has said. These do not offer any judgement on behaviour (such as "this is good/bad", etc), but simply state the speaker's agreement with an idea presented.

e.g.1 CHILD: I should get my pyjamas on.

MOTHER: **Yeah. *Because* it is almost bedtime.**

e.g. 2 That's right. *Because* we saw them playing together, didn't we?

e.g. 3 Yes, *if* that really is true

(Note: this may also include sentences where the main clause indicates a negative agreement, like:

CHILD: I didn't like that book, did I?

MOTHER: **No (you didn't) *because* you were overtired and not in the mood to give it a chance**.)

Approve/Praise – the main clause praises or approves of a state, event, behaviour, etc. described or performed. This may be of something the listener or someone else has said or done or may be a general value judgement of something (such as "I like this" or "this is nice").

e.g. 1 This is great *because* look at how much work they've put into this.

e.g. 2 Good boy! *Because* I didn't even have to ask you to pick up your toys.

e.g. 3 This is lovely, *if* you built that all by yourself.

Ask – the main clause asks a question.

e.g. 1 So, what should we eat for dessert, *because* you ate all your dinner?

e.g. 2 Do you think he will, *if* you are such an expert?

(Note: these are when the speaker actually asks a question of the listener. This does not include directives phrased as questions, such as "Can you pick your toys now, *because* it's time for bed?").

Command – the main clause demands/orders a certain behaviour of the listener. Usually this relates to the present or immediate future. The listener, in these cases, is expected to

comply. This may also include indirect commands, such as "can you get me that, *because* I need it".

e.g. 1 Don't do that *because* you'll get hurt.

e.g. 2 You need to hand that to me right now *because* I am tired of asking.

e.g. 3 Put away your blocks, *if* you are really finished with them.

This includes the forbidding of activities, such as:

e.g. 1 CHILD: Can I climb up there?

MOTHER: **No *because* you could hurt yourself.**

e.g. 2 You can't do that all by yourself *because* you are too young.

Disagree – the main clause offers disagreement or refusal of an idea/fact stated by the other speaker. These do not relate to behaviour control; they solely express the speaker's disagreement with the truth of an idea.

e.g. 1 CHILD: This music is too loud.

MOTHER: **No (it isn't) *because* I want to listen to it in the kitchen.**

e.g. 2 MOTHER: We won't be late.

CHILD: **Yes we will, *if* I really have to finish all of my lunch first.**

Disapprove – the main clause primarily functions to express the speaker's disapproval at an event, state, behaviour, etc. This may be of something the listener or someone else has said or done or may be a general value judgement of something (such as "I don't like this" or "this is weird"). They are not related to behaviour control, they simply express a negative judgement of an event/situation/person, etc.

e.g. 1 This is not good *because* this is not what I asked for.

e.g. 2 It's ridiculous when they don't answer *because* they said they would be home.

e.g. 3 That's not okay, *if* you have hit your sister.

Permit – main clause primarily functions to express permission for the listener to do something. This may be via either direct permission ("yes", "you can", etc) or by the lack of forbidding ("I don't mind", "if you want", etc). Generally, this is permission that has been specifically requested (see example 2) or related to an activity where the listener

was not assumed to have permission before (see example 1). Typically, these are more related to a behaviour (e.g. the act of having a cookie) rather than a thing (e.g. being offered a cookie – which would be promise/offer).

e.g. 1 You can have them *because* I know you would like them.

e.g. 2 CHILD: Can I have these?

MOTHER: I don't mind *because* they aren't mine.

e.g. 3 You can play with that toy now, *if* you like.

Promise/Offer – main clause presents a promise or offer to the listener. This may be a promise or offer to do something in the future or the offer of something in the immediate discourse (such as "here is a balloon because I know you like them"). The primary function is to offer something (either a commitment/promise or an actual item).

e.g. 1 I will get them for you *because* you can't reach

e.g. 2 I will bring you home a present *because* they have some nice things there that you will like.

e.g. You can have **this** puzzle, *if* you want.

Request/Suggest - main clause requests or suggests behaviour in the present or future, but without the authority or urgency of a command. In these utterances, the listener could more likely refuse to comply. This also includes the requesting of permission to do something (such as "can I just see that for a minute, *because* I don't understand what you are saying") or requesting assistance.

e.g. 1 We should dance *because* the music is on.

e.g. 2 Could we go to the store *because* I want to see if the new book is in?

e.g. 3 We could call, *if* you think that's a good idea.

State intent – main clause expresses the speaker's plans/commitment to perform an action, including behaviour that is ongoing or intended in the immediate future. Also includes an expression of negative commitment, such as in example 2.

e.g. 1 I am going to make dinner now *because* I think you are hungry.

e.g. 2 MOTHER: Are you going to clean up those toys?

CHILD: **NO, *because* I don't want to.**

e.g. 3 I will do it myself, *if* you aren't going to help.

State/Claim – main clause is a fact or declaration about a state, event, behaviour, etc. This may include a speaker's judgement/opinion, so long as it does not primarily function to provide a positive or negative evaluation (as these would be approve/praise or disapprove, respectively). They can include stream of consciousness utterances about the current situation (e.g. I need to jump higher because I want to reach it) or a response to a question (e.g. MOTHER: which one do you want to wear? CHILD: **I want to wear the blue one because I like the blue one**).

e.g. 1 Her favourite colour is yellow *because* it is the colour of the sun.

e.g. 2 It doesn't matter *because* we can just get some more later.

e.g. 3 It is dark out, *if* you didn't notice.

Threaten – main clause makes a threat.

e.g. 1 I won't give you any more help if you keep doing this *because* I am tired of you not listening.

e.g. 2 You won't be able to go to the party if you do that *because* only good boys can go.

e.g. 3 I will send you straight to your room, *if* you think you can talk to me like that.

Warn/advise – main clause advises or warns the listener of any danger or negative consequences in the present or future, or provides advice, so as to avoid negative consequences for the listener in the future.

e.g. 1 Be careful *because* they could break.

e.g. 2 You should always be gentle with animals *because* they could hurt you if you hurt them.

e.g. 3 I hope you watch where you're going, *if* you are running everywhere.

4 The influence of pragmatic function on children's comprehension of complex *because*- and *if*-sentences

This chapter addresses the second research question of this thesis: (a) Is there a difference in children's ability to understand *because* and *if* in Content and Speech-Act sentences?; and (b) Can this be explained in terms of patterns in naturalistic speech and/or cognitive complexity?

The study in Chapter 4 is in preparation for submission to a journal for publication. The author and title information for the manuscript in preparation are:

Lemen, H.C.P., Lieven, E.V.M. & Theakston, A.L. The influence of pragmatic function on children's comprehension of complex *because*- and *if*-sentences.

4.1 Abstract

In complex adverbial sentences, the connectives *because* and *if* can perform different pragmatic functions (e.g. Content, Speech-Act; Sweetser, 1990), although this is often overlooked in studies investigating children's acquisition of these connectives. In this study, we investigated whether this pragmatic variation is responsible for some of the difficulty young children have in understanding *because*- and *if*-sentences (e.g. Emerson & Gekoski, 1980), and tested the extent to which patterns of acquisition are related to the cognitive complexity (e.g. Zufferey, 2010) or input frequency (De Ruiter et al., in press) of the different pragmatic types. 92 children (aged 3-5; F = 39) and 20 adults (F = 12) took part in a forced-choice picture task where they had to identify correct pictures after hearing Content and Speech-Act *because*- and *if*-sentences. Results showed that children were most accurate on the sentence type where cognitive simplicity and input frequency converge (*If* Content), but this pattern was largely driven by the girls in the study. For response times, children were fastest with the least cognitively complex sentence types. However, for *because* Speech-Act sentences, there was an inverse relationship between response time and input frequency. Taken together, these findings suggest that neither account (cognitive complexity or input frequency) can fully explain the findings on their own. As such, more complex theories related to the abstraction and interpretation of meaning may be needed to explain these patterns.

4.2 Introduction

In order to interpret a complex adverbial sentence like *you can watch a movie if you read some of your book*, a child must understand the relationship between the main clause (*you can watch a movie*) and the subordinate clause (*if you read some of your book*). In this case, a child would need to understand there is a conditional relationship: they will not be permitted to watch a movie if they have not read some of their book. The meaning of this sentence is very different to a sentence like *you can watch a movie and read some of your book*, where there is no conditional relationship. As these kinds of complex sentences play an important role in later social (e.g. Orsolini, 1993) and academic contexts (e.g. Svirko et al., 2019), being able to understand what they mean and how to use them is important.

Several studies have shown, however, that comprehension of complex sentences containing the adverbial connectives *because* and *if* is problematic for young children (e.g. Emerson & Gekoski, 1980). These conclusions have primarily been based on children's understanding of what Sweetser (1990) calls Content sentences (e.g. Amidon, 1976; De Ruiter et al., 2020, 2018; Emerson, 1979, 1980; Emerson & Gekoski, 1980; French, 1988; Johnston & Welsh, 2000). According to Sweetser's (1990) model, Content sentences express "real-world" cause/sufficient condition relationships (e.g. *He misses the bus, because/if he rides his old bike,* De Ruiter et al., 2018, 2020). However, in her model there are two further pragmatic types of causal and conditional sentences (Speech-Act, Epistemic), but these are largely overlooked in experimental research on young children's acquisition of *because* and *if*. This lack of information about children's comprehension of the other pragmatic types means we are left with an incomplete understanding of children's acquisition of these connectives and the factors that may influence the process, particularly as the different pragmatic types vary in terms of the cognitive skills required to interpret them (e.g. Zufferey, 2010) and the frequency with which children hear them in naturalistic speech (De Ruiter, Lemen, Brandt, Theakston & Lieven, in press). Indeed, theoretical accounts in previous literature (e.g. Sanders, 2005) have called for a comparison of these two approaches in an attempt to better understand children's acquisition of these connectives.

Therefore, in order to provide a more complete picture about children's understanding of these complex structures, we investigated whether the presence of this kind of pragmatic variation impacts children's comprehension of these connectives overall, and also the extent to which acquisition is influenced by input patterns and/or cognitive complexity. In the sections that follow, we first provide an account of children's difficulty with the connectives *because* and *if* and the pragmatic model proposed by Sweetser (1990). We then discuss these pragmatic patterns in terms of their predictions from both cognitive complexity (e.g. Zufferey, 2010) and usage-based, input frequency (e.g. Tomasello, 2001) accounts. Finally, we present the current study, describing methodological details before providing the results and discussion.

4.2.1 The production-comprehension disconnect with *because* and *if*

While studies on children's production of adverbial connectives show that children competently produce *because*- and *if*-clauses by about the age of two-and-a-half and three years old, respectively (Bloom et al., 1980; Braunwald, 1985; De Ruiter et al., in press; Diessel, 2004; A. E. McCabe et al., 1983; Reilly, 1986), experimental studies suggest that children have difficulty understanding sentences containing these connectives until much later. More specifically, while some studies have shown that children aged four to six years old can perform above chance in comprehending *because*-sentences which describe familiar events (e.g. bedtime, Johnston & Welsh, 2000; eggs cracking, French, 1988), comprehension of sentences expressing arbitrary causal events (e.g. X occurred *because* Y, where X and Y could logically occur in either order, French, 1988) or unfamiliar causal events (e.g. changing a flat tyre, Johnston & Welsh, 2000) does not occur until years later (French, 1988; Johnston & Welsh, 2000), with some studies suggesting that full acquisition of *because* does not occur until about age ten (Emerson, 1979; Emerson & Gekoski, 1980).

While fewer studies have investigated young children's comprehension of *if,* Emerson (1980) concluded that children were unable to distinguish between logically correct (e.g. *I put on a jumper if the weather gets cold*, Emerson, 1980) and logically incorrect (e.g. *The lake was frozen if we wanted to go skating*, Emerson, 1980) *if*-sentences before the age of seven or eight. Furthermore, Emerson and Gekoski (1980) found that when there are no contextual or event ordering clues (i.e. *X if Y* is just as logical as *Y if X,* with no context to indicate if one order makes more sense), children are unable to perform tasks such as consistently matching sentences to pictures or indicating parallel structures (e.g. X *if Y = If Y, X*). As such, the authors concluded that, like with *because,* children do not possess a full semantic understanding of *if* before about ten years old.

Therefore, children begin producing these connectives when they are toddlers, but seem to be unable to consistently demonstrate comprehension of them until much later in childhood. This seems unexpected, given that even young children's production of these terms typically demonstrates a high degree of competency and suggests that a general understanding of causality and conditionality do not seem to be a problem (see Donaldson, 1986 for related discussion with causals, specifically). For example, McCabe et

al. (1983) showed that young children (2;10 – 7;3) rarely produced logical errors with *if,* while other studies have shown that children rarely make errors in reversing the temporal order of cause and effect with *because* (Donaldson, 1984, 1986; Hood & Bloom, 1979; A. McCabe & Peterson, 1985, 1988). Furthermore, the speech of children as young as two years old has been shown to evidence some understanding of the concepts of hypotheticality, contingency, inference and habituality, which are argued to be required for comprehension of *if* (see Bowerman, 1986 for review and analysis) and experimental studies have shown that toddlers and pre-schoolers can use causal reasoning (e.g. Gopnik, 2012 provides a review). Thus, children appear to possess a relatively robust understanding of how to use the connectives, as well as a general comprehension of the underlying concepts they express.

4.2.2 A comparative complexity across connectives

One possible explanation for this developmental gap between comprehension and production is that it is simply easier for a child to produce something based on their own ideas rather than to interpret the utterance of another (e.g. De Ruiter et al., 2018; Hood & Bloom, 1979; Kuczaj & Daly, 1979; A. E. McCabe et al., 1983). On reviewing studies with other connectives, it appears that this delay is not limited to *because* and *if.* For example, although children produce the connectives *before* and *after* around 3;2 and 3;4, respectively (Diessel, 2004) and can demonstrate comprehension at above chance levels by the age of four (e.g. Blything, Davies & Cain, 2015), they are often shown to be influenced by factors such as clause order and iconicity (e.g. Blything et al., 2015; Clark, 1971; De Ruiter et al., 2018; Johnson, 1975). Furthermore, some studies have shown that children do not consistently perform well on experiments with *before*- and *after*-sentences before the age of six or seven (e.g. Amidon, 1976; Blything et al., 2015).

The size of the gap between production and comprehension of *because* and *if*, however, is large compared to that seen with the temporal connectives, particularly given how frequently young children hear these connectives in the speech of their caregivers. A usage-based framework of language acquisition would typically predict that linguistic items which occur frequently in input will be learned faster than those which occur infrequently (see De Ruiter & Theakston, 2017 for review/discussion). However, the connectives *because* and *if* are produced far more frequently in caregiver speech than the

connectives *before* and *after* (De Ruiter et al., in press; Diessel, 2004). Specifically, De Ruiter et al. (in press) analysed naturalistic corpus data of two children (aged 2;6 – 4;11) in conversation with their mothers and found that mothers produced *because* and *if* (combined) approximately 15 times more often than *before* and *after.* Despite this, in a task directly comparing comprehension of *before, after, because* and *if,* De Ruiter et al. (2018) found that five-year-olds were most accurate with *before* and that response times for *because* and *if* were slower than for the temporal connectives (see also De Ruiter et al., 2020). Taken together, this means that children competently produce, and regularly hear, *because* and *if* from a young age, but have a harder time demonstrating comprehension of them compared to connectives they hear much less frequently.

4.2.3 The influence of pragmatic variation: different pragmatic types of *because*- and *if*-sentences

One important way that *because* and *if* differ from *before* and *after*, however, is that *because* and *if* are more subject to the kind of pragmatic variation described in models such as Sweetser (1990) (e.g. De Ruiter et al., in press)[13]. This is relevant as forms that perform many functions have been shown to be harder for children to learn (e.g. Slobin, 1982). In Sweetser's (1990) model, *because*- and *if*-clauses in an utterance can perform one of three pragmatic functions.

1. Content – provides a "real-world" cause/sufficient condition for a state or event (e.g. The bell rings because/if it is time for school).
2. Epistemic – provides evidence for a conclusion expressed in the main clause (e.g. It must be time for school because/if the bell is ringing).
3. Speech-Act – explains a(n) speech act/illocutionary act[14] (*because*) or defines conditions relating to the performance of a(n) speech act/illocutionary act (*if*) (e.g. I don't want to be late, because/if the bell is about to ring).

While Sweetser's (1990) model is particularly useful in that it provides a detailed discussion of the application of these categories to both causal and conditional connectives, it is not the only one to address and evidence this sort of pragmatic variation

[13] In addition to the Content function, temporal connectives can also perform a Speech-Act function (e.g. *before we leave, does everybody have everything they need?*), but this happens comparatively infrequently in adult (Diessel, 2008; Ford, 1993) and child (De Ruiter et al., in press) discourse.

[14] In line with Lemen et al. (submitted), although other authors (e.g. Sweetser, 1990) refer to the main clause of Speech-Act sentences (e.g. *I don't want to be late* in example 3, above) as "speech acts", we will use the term "illocutionary acts" for this, reserving the label Speech-Act for the pragmatic category.

(e.g. Haegeman, 1984; Pander Maat & Degand, 2001; Redeker, 1990; Van Dijk, 1979; Warchał, 2010; Zufferey et al., 2015). What remains unknown is the extent to which this pragmatic variation may explain children's difficulty in understanding these connectives. Based on both differences in cognitive complexity (e.g. Zufferey, 2010) and input patterns (De Ruiter et al., in press), we would expect that some pragmatic types are easier than others to learn. However, the two perspectives offer some differing predictions about which pragmatic types should be easiest. We discuss both approaches below.

4.2.3.1 Cognitive complexity of the different pragmatic types of because and if

Very little research has been done into children's comprehension of different pragmatic types. In fact, children's comprehension of *because* and *if,* in general, is typically only tested with Content stimuli (e.g. Amidon, 1976; De Ruiter et al., 2020, 2018; Emerson, 1979, 1980; Emerson & Gekoski, 1980; French, 1988; Johnston & Welsh, 2000). The only study (of which we are aware) that compared comprehension of either of these connectives across the pragmatic types in English is Corrigan (1975). She found that in 3-7-year-olds, comprehension of *because*-sentences expressing Epistemic causality (which aligns with what Corrigan, 1975, called "concrete logical causality") occurred later than comprehension of sentences expressing Content causality (which aligns with what Corrigan, 1975, called "physical causality" and "affective causality"). Working within a Piagetian framework (e.g. Piaget & Inhelder, 1969), she suggested that this was related to cognitive development: children did not acquire the concrete logical (Epistemic) relationships until they reached the concrete operational stage of development around 6-7 years of age.

This finding appears to hold cross-linguistically. Zufferey et al. (2015) found that, with causal sentences, Dutch- and French-speaking children had an easier time understanding Content relationships than Epistemic. In their study, French- and Dutch-speaking children aged between 5;1 – 9;11 were read short stories which contained both objective causality sentences (aligning with Sweetser's, 1990, Content causality and Corrigan's, 1975, physical and affective causality) and subjective causality sentences (aligning with Sweetser's, 1990, Epistemic causality and Corrigan's, 1975, concrete logical causality). Children were then questioned on the causal relationships they heard in the stories. They found that for both languages and all age groups the objective (Content) relationships

were easier. They suggested that differences in cognitive complexity between the pragmatic types may be partially responsible for this result. That is, as argued by Zufferey (2010), Speech-Act and Epistemic are more difficult for children than Content because they contain meta-representations, but Epistemic is the hardest because the metacognitive skills it requires are acquired after the metacommunicative skills required for Speech-Act. Kyratzis et al. (1990) also argue that Epistemic causals are more complex based on patterns in the speech of English-speaking children. Furthermore, Zufferey (2010) also argues that Epistemic meta-representations are often implicit and require a more advanced level of reasoning to resolve (see also Sanders, 2005). Therefore, although they acknowledge that children in their study should possess the metacognitive skills required for Epistemic relationships (Zufferey, 2010, suggests children develop these skills around age three), Zufferey et al. (2015) suggest that the additional complexity of Epistemic sentences may still make them more difficult for children in comparison to Content.

While the results from Corrigan (1975) and Zufferey et al. (2015) do provide some evidence that children are sensitive to some of the pragmatic differences within causal relationships, they do little to help explain the production-comprehension disconnect (as they suggest that the pragmatic type that is usually tested should be the easiest type). However, as it has been pointed out (e.g. Sanders, 2005; Zufferey, 2010), the role of input is also important to consider in children's acquistion of these connectives and the pragmatic relationships they express. In particular, given that corpus studies show that Epistemic sentences are infrequent in input compared to Content (De Ruiter et al., in press; Zufferey, 2010), it is possible that children's difficulty with them is due to a lack of experience with interpreting this relationship in the speech of others, rather than any cognitive-related difficulties in understanding it. Thus, we turn to a discussion of *because* and *if* input patterns in the next section.

4.2.3.2 Input of the different pragmatic types

There is evidence that all three pragmatic types are produced with *because* and *if* by caregivers in their speech to young English-speaking children, although not in equal distribution. De Ruiter et al. (in press) analysed the speech of two preschool-aged children (aged 2;6 – 4;11) and their mothers (primary caregivers) using densely collected corpora

and found that with *because*, the mothers primarily produced Speech-Act sentences (59.8%), but Content was the most frequently produced type with *if* (73.2%); Epistemic was infrequent for both connectives. The coding of an additional 12 dyads (using data from Rowland & Theakston, 2009; Theakston & Rowland, 2009) provided further evidence for these patterns. This finding for *because* is anecdotally supported by Kyratzis et al. (1990) who note that "a preliminary analysis of the *adults'* uses of causals in this corpus revealed that a vast majority were also Speech Act-Level causals" (p. 210). Furthermore, more general studies of adult usage of *because* (e.g. Diessel & Hetterle, 2011; Ford, 1993) suggest that in many languages *because*-clauses regularly function to provide explanations for statements, thus seeming to align with Sweetser's (1990) Speech-Act.

Based on input patterns for specific form-function mappings, then, we would expect Speech-Act to be the easiest pragmatic type for *because*, Content to be the easiest pragmatic type for *if* and Epistemic to be the most difficult pragmatic type for both connectives. Therefore, if Speech-Act is the most frequent (easiest) type for *because*, this this might help explain the associated gap between production and comprehension where children struggle with comprehension of lower-frequency Content sentences (see De Ruiter et al., in press; Kyratzis et al., 1990 for related arguments). For *if*, in contrast, children seem to have difficulty understanding Content sentences, which are the the most frequent type in the input. However, approximately a third of the *if*-sentences children hear are non-Content (De Ruiter et al., in press), so one possibility is that noise in the form-function mappings make these connectives more complicated for children than connectives which do not express different pragmatic meanings (see e.g. Slobin, 1982 for discussion of how learning is aided by simpler form-function mapping) (see De Ruiter et al., in press for related arguments). Thus, from this perspective, a frequency account may be more helpful in explaining the difficulty children have with understanding *if* Content sentences than a cognitive account. However, despite these theoretical possibilities, very little is known about whether English-speaking children's comprehension of these connectives is impacted by this pragmatic variation, let alone the amount by which it is influenced by input or cognitive complexity. This is the focus of the present study.

4.3 Present study

4.3.1 Aims and predictions

Corpus data (De Ruiter et al., in press; Evers-Vermeul & Sanders, 2011; Kyratzis et al., 1990) have given support to theoretical accounts (e.g. Sweetser, 1990) that pragmatic variation occurs with the connectives *because* and *if.* What remains unclear is the extent to which this variation contributes to the difficulty English-speaking children appear to have in understanding these connectives. Although the limited experimental research in this area (Corrigan, 1975; Zufferey et al., 2015) suggests children are sensitive to different pragmatic meanings for causal connectives, these studies have only compared Content and Epistemic relationships. Given that both cognitive complexity (e.g. Zufferey, 2010) and input frequency (De Ruiter et al., in press) accounts would predict that Content relationships will be easier than Epistemic, we cannot be certain which factor more strongly predicts acquisition. Moreover, the existing experimental data does not provide us with any information about children's understanding of Speech-Act meanings.

If we turn instead to a comparison of Content and Speech-Act, this provides an opportunity to investigate understanding of the Speech-Act relationship in comparison to the often-tested Content (e.g. De Ruiter et al., 2018, 2020; Emerson, 1979, 1980; Emerson & Gekoski, 1980). It also provides us with the opportunity to gain a better understanding of differences in cognitive complexity across the pragmatic types. That is, Zufferey (2010) argued that, unlike Epistemic sentences, "the enrichment required to understand the use of a connective in the content or the speech act domains is situated at the level of the content explicitly communicated in the utterance" (p. 105). Because of this, she suggested there may not be a "processing cost" (Zufferey, 2010) for Speech-Act relative to Content, despite the former being more complex than the latter. Thus, by comparing comprehension of these two pragmatic types, we will gain a better understanding of the level of cognitive skill required to understand Speech-Act sentences, how it relates to comprehension, and the extent to which this is different from Content.

Furthermore, a comparison between Content and Speech-Act will also allow us to test predictions related to cognitive complexity (e.g. Zufferey, 2010) against those based on input frequency (De Ruiter et al., in press). If there is a difference between Content and Speech-Act based on cognitive complexity, the prediction from this account concerning

the easiest pragmatic type for *because* will differ to the prediction based on input frequency; by contrast, the predictions for both accounts converge for *if*[15]. By comparing children's comprehension of these different pragmatic types for both connectives, we can compare how acquisition changes when these factors converge compared to when they diverge. Further to this, if both cognitive complexity and input frequency impact on the acquisition of these connectives, it is possible that they will play a role at different stages of development. For example, by the time they reach school-age, children are moving toward more consistently complex play with their peers (Howes & Matheson, 1992). As such, it seems plausible that, by this age, they might be less troubled by the meta-communicative demands of the Speech-Act relationship compared to when they are first acquiring these skills as toddlers (e.g. Zufferey, 2010 draws a comparison between acquisition of metacommunicative skills and production of Speech-Act sentences around the age of two-and-a-half). Additionally, as we expect higher frequency forms to be learned earlier than low frequency forms (Ambridge et al., 2015), it seems plausible that younger children might have more difficulty understanding low frequency forms than older children, who are more fluent in the language. Therefore, by comparing comprehension of the most frequent pragmatic types for *because* and *if* at different ages we will gain a better idea of the overall impact, generalisability and longevity of either or both of these factors on children's acquisition of these connectives.

Given this framework, the most direct predictions from these accounts are as follows.

1. If cognitive complexity has the strongest influence on comprehension (irrespective of input patterns), the cognitively simplest type will be easiest for both connectives (i.e. Content).
2. If input patterns have the strongest influence on comprehension (irrespective of complexity differences), then the types children hear most frequently will be the easiest (i.e. Speech-Act *because* and Content *if*).

However, it is also possible that the two factors will interact in support of acquisition (e.g. Ambridge et al., 2015; De Ruiter et al., 2018). Similarly, it is possible that, as discussed above, the influence of these factors (either in isolation or their interaction) could change

[15] Although Zufferey (2010) primarily discusses the cognitive complexity framework in terms of causal connectives, her model (as she notes) is based on differences between the three pragmatic types described by Sweetser (1990), which also includes conditionals. As such, we see no reason why the cognitive complexity account does not equally extend to the different pragmatic types for *if*, particularly as Sweetser (1990) often refers to a causal relationship in regard to conditional connectives.

with age. As such, this study has two main aims: (i) to determine whether input frequency and/or cognitive complexity impact(s) children's comprehension of *because*- and *if*-sentences expressing different pragmatic relationships, and (ii) explore the extent to which these factors interact and/or change with children's development.

4.3.2 Methods

4.3.2.1 Participants

92 monolingual English-speaking children without known language or developmental delays were recruited. This number was based on a power analysis that was performed using R (R Core Team, 2018), which indicated that testing 90 children would give adequate power to find a small effect size[16]. All children were tested either at their school/nursery or at the Child Study Centre at the University of Manchester. 42 children were between the ages of 3;00-4;01 (M = 3;07, SD = 3.6, Female = 18; hereafter referred to as three-year-olds) and 50 were between 4;05-5;07 (M = 5;00; SD = 3.7; Female = 21; hereafter referred to as five-year-olds). One additional child was tested but the data from this child had to be excluded because the child was out of the age range. With regards to the specific age ranges tested, three-year-olds were chosen because this is the time around which both connectives are first produced in children's speech (e.g. Bloom et al., 1980; Diessel, 2004); five-year-olds were chosen because this allowed us to assess developmental changes at an age when children are relying on more advanced metacommunicative skills with peers as they begin to participate more frequently in complex social play (Howes & Matheson, 1992; Kyratzis et al., 2010). Additionally, twenty monolingual, English-speaking adults (Female = 12) were also tested at the University of Manchester to ensure that the test stimuli unambiguously matched with the target sentences.

4.3.2.2 Procedure and materials

This study was approved by the University of Manchester's University Research Ethics Committee, Ref: 2018-3229-5161. "Pragmatics and children's complex sentence comprehension". Children took part in the main comprehension task, as well as some additional language and executive function tasks assessing memory, linguistic skill,

[16] Note, the power analysis was conducted assuming a frequentist approach to analysis. Subsequently, to reflect developments in the field, a Bayesian approach to analysis was adopted – see 'Analysis Strategy' section for details and justification.

cognitive flexibility and understanding of Speech-Act causality. Adults only performed the main comprehension task. All participants completed all tasks in one session, lasting about 30 – 45 minutes for children and about 10 minutes for adults. Children were offered a short break half-way through the session. The details of each task are summarised below.

4.3.2.3 Language and executive function tasks

As noted by De Ruiter et al. (2018), the relationship between comprehension of complex adverbial sentences and individual differences is not currently clear. Thus, following their approach in attempting to control for factors which could possibly confound results (i.e. executive function and general language skills), measures of language, cognitive flexibility, speech act understanding and memory were taken. As in De Ruiter et al. (2018), the scores from these tasks correlating with accuracy and response times were entered into the models as controls and only retained when a model containing them was a better fit of the data. Thus, their inclusion in this study is not based on specific hypotheses, but rather to account for any additional variation in the model which may be more strongly associated with these skills than the ability to understand the connectives. In total, these additional tasks took about 15 minutes. As these tasks were individually short and children were offered a short break half-way through the testing session, the overall length of the testing session is not expected to have had any significant impact on children's performance on the connectives comprehension task. Furthermore, in line with the approved ethics procedure, if a child did not want to complete/start any task, the task was ended immediately/not begun.

4.3.2.3.1 *Speech-Act causality*

The ability to perform the main comprehension task in this study requires an ability to interpret both physical (Content) and Speech-Act causal relationships. To be able to rule out a lack of conceptual understanding as a potential explanation for any difficulty children in their study might have had with *because*-sentences, De Ruiter et al. (2018) included a task assessing understanding of physical causality. In a similar way, the present study included a task assessing Speech-Act causality to ensure that any difficulty children may have with understanding Speech-Act sentences could not be solely attributed to a lack of understanding of the underlying relationship itself. While De Ruiter (2018) showed

that 3.5-5.5 year old children generally understand relationships of physical causality, to measure children's ability to comprehend the idea that certain situations may motivate particular illocutionary acts, children took part in a forced-selection picture task consisting of four trials, where they were presented with two images on laminated paper (e.g. a girl who is crying and throwing her toys around and a girl who has just built a tower of blocks). Children were then asked to point to the picture that what would make their parent/teacher perform a particular illocutionary act (e.g. saying "Well done!"). Due to the importance of this skill to the main task, the data from children who failed this task (accuracy of less than or equal to 50%, N = 2 or more incorrect) were excluded from this study. (Full details of exclusions from the present study are provided in 4.4.1).

Figure 4.1: Example images from Speech-Act causality task. Children were presented with images like the ones above and asked which would make a parent/teacher perform a particular illocutionary act. In the example above, children were asked which picture would make a parent/teacher say *Well done!*

4.3.2.3.2 *Digit span*

A measure of short-term memory was taken via the digit span test (adapted from Wechsler, 2014). In this task children were asked to first repeat a two-digit string of numbers. After they responded, they were given a second two-digit string. As long as children got at least one of the two-digit strings in the set correct, they could proceed to the next set, where novel sequences were one digit longer. Once children got both strings in the set wrong, the task was attempted again with children having to repeat new strings backwards (e.g. if the experimenter said 8-3, the child would have to say 3-8 to be correct). When children got both strings in a backward set wrong, the task ended. Children were given one point for every string of numbers they correctly repeated.

4.3.2.3.3 *Receptive language*

To gain a measure of receptive language skills, children completed the Linguistic Concepts and Sentence Structure sub-tests from the Clinical Evaluation of Language Fundamentals®-Preschool-2 (CELF)(Wiig, Secord, & Semel, 2004). In the Sentence Structure task, children were read a sentence and they were asked to point to the image in a book that matched the sentence. Sentences increased in difficulty, starting with simple sentences and progressing to complex constructions. In the Linguistic Concepts, children were given directions to point to items in an image (e.g. "Point to the monkey before you point to the tortoise and the cat"). The standardised scores for these tasks were used for correlations and inclusion in mixed models.

4.3.2.3.4 *DCCS*

The Dimensional Change Card Sort (DCCS) task (Zelazo, 2006) was used to test children's cognitive flexibility. In this task, there was a set of cards showing blue bunnies and red boats. Two further cards were put above two trays in front of the child: one showing a red bunny and one showing a blue boat. Children were then asked to sort the cards. The first set of sorting was by colour (so all blue cards should go in the tray with the blue image above it). Half-way through the cards, the instructions changed and children were asked to sort the remainder of the cards by shape (so all boat cards would now go in the tray with the boat above it). Children were given one point for each card correctly placed in a tray. Analysis is conducted both on the pre-switch measure and post-switch measure.

4.3.2.4 Connectives comprehension task

4.3.2.4.1 *Audio*

Five sentence sets were created to start. Each set contained four sentences, one of each sub-type: *Because* Content, *Because* Speech-Act*, If* Content and *If* Speech-Act. To create each set, Content *because*- and *if*-sentences were created where similar semantic relationships were expressed. These sentences expressed a physical causal or conditional relationship (e.g. water spilling resulting in/about to result in a chair getting wet). Speech-Act sentences were then created by using the same semantic elements contained in the Content sentence (e.g. a chair getting wet being a reason to issue a command that water is no longer spilled). Given that context is sometimes necessary to determine the pragmatic type of these sentences (Sweetser, 1990; Zufferey, 2010), the Speech-Act sentences were constructed so that a Content interpretation was as unlikely as possible.

For example, in *No spilling the water, because the chair is getting all wet*, the use of the imperative form makes a Content interpretation unlikely (Sweetser, 1990).

To ensure that the sentences most closely represented what children were more likely to hear, the way that the Speech-Act sentences were constructed from the Content sentences differed for the two connectives. Specifically, as a real-world effect was deemed a more natural justification for an illocutionary act than a real-world cause (e.g. "No spilling the water because the chair is getting wet" was deemed more natural than "No getting the chair wet because you are spilling water"), the illocutionary act in *Because* Speech-Act sentences was taken from the semantic information in the subordinate clause of the Content sentence. For the *if*-sentences, the reverse was true. *If* Speech-Acts can relate to given information, where the subordinate clause refers to information that is understood in the discourse (Sweetser, 1990). As such, for *If* Speech-Acts, the sentences sounded more natural when the subordinate clause was based on the subordinate clause of the Content sentence (i.e. "Watch the chair doesn't get wet, if you are spilling that water" was deemed more natural than "Watch you aren't spilling the water, if you are getting the chair wet"). Sentence length was controlled across each sentence pair within a set, so that the two *because*-sentences were equal in length and the two *if*-sentences were equal in length. Sentence length for all pairs ranged from 10 to 14 words (M = 11.8, SD = 1.3).

Once the first five sets of sentences were created, an additional group of five sets were created based on the first group of five sets. Structurally, each set of sentences in the latter group mirrored a set in the former group, with only semantic information changed. For example, one set of sentences in the first group referred to eggs breaking because/if the child was kicking a basket, whereas the corresponding set in the second group referred to bottles breaking because/if the child was kicking a box. By doing this, it meant that when the sentences within a set were later divided across lists, each sentence in List 1 had a match in List 2 that varied in semantic elements, but expressed a similar causal/conditional relationship in a sentence of matching length.

In addition to the main task items, three warm up items and four fillers were created. The first warm up item was a simple sentence (*You are standing outside)* and the following

two were complex sentences connected by temporal connectives, so that children became familiar with sentence length/complex structure, but were able to warm up without hearing *because* or *if.* Like the first warm up, all four fillers consisted of simple sentences. These were designed to refocus any children who might be bored if they were struggling with the task, as well to provide a metric by which we could evaluate engagement. The audio for all test, warm up and filler items was recorded in Audacity v 2.3.0 [17] (Audacity Team, 2018) by a native speaker of British English using natural prosody to reflect natural input patterns as closely as possible.

Once the 40 test (comprising of 10 sets of four sentences), warm up and filler sentences were created, the stimuli lists were created. Each list contained five of each type of test sentence (i.e. 5 *Because* Content, 5 *Because* Speech-Act, 5 *If* Content, 5 *If* Speech-Act), plus all three warm ups and four fillers. The Content and Speech-Act pair for each connective within a set were separated across two lists so that, for each set, the *Because* Content and *If* Speech-Act went to one list, while the *Because* Speech-Act and *If* Content went to the other. This ensured that there was no repetition of semantic elements within one connective or one pragmatic type, nor exact repetition of any images in any list. Four orders (a-d) were then created, so that each list had four separate orderings (List 1a-d and List 2a-d). Within each list, sentences were presented in five blocks of four sentences, separated by a filler. Restrictions on pseudo-randomisation were that one connective would never appear more than twice in a row within one block and each block had to contain at least one sentence from both pragmatic types. Lists 1a and 2a are given in Appendix 1.

4.3.2.4.2 *Images*

Images were designed to accompany the sentences. The images for *Because* Content and *Because* Speech-Act within a set were the same, reflecting events that had already taken place, and the images for *If* Content and *If* Speech-Act within a set were the same, reflecting events just about to take place. The target image reflected the causal or conditional relationship expressed in the sentence; the distractor image reflected the

[17] Audacity® software is copyright © 1999-2019 Audacity Team.
The name Audacity® is a registered trademark of Dominic Mazzoni.

same semantic elements, but without the causal or conditional relationship connecting them.

Figure 4.2: Sample target (top) and distractor (bottom) images corresponding with *Because* Content sentence "The branches are breaking off because you are climbing up" and *Because* Speech-Act sentence "That's enough of that climbing, because the branches are breaking".

4.3.2.4.3 *Procedure*

Stimuli were presented to participants on an ASUS Zenbook UX330U, using PsychoPy (Peirce, 2009) version 1.84.4. The laptop was converted to a touchscreen using an AirBar (https://air.bar/). For children, a piece of white cardboard with cut-outs of two red hands was placed over the keyboard of the laptop and children were asked to keep their hands on the red hands until the end of the sentences. Participants were told they would see two pictures on the screen and that, in both pictures, there will be a child. They were then told that they would also hear the mother of the child in the pictures say a sentence and the participant's role in the game was to point to the picture that matched with what the mother said.

Participants were randomly allocated to one of the eight ordered lists, with distribution across lists being as equal as possible. Regardless of the test list to which they were allocated, all participants first saw the three warms ups in the same order: the simple sentence, then the complex sentence connected by *before* in a main-subordinate order and finally the complex sentence connected by *after* in a subordinate-main order. After the warm up items, the main task began. Images were presented so that one was at the top of the screen and one was at the bottom. This was chosen over a left/right display to maximise the size of the pictures, which had been designed in landscape. After hearing

the sentence, participants indicated their choice by touching the screen. Location was counterbalanced so that, within each list, half of the correct answers for each pragmatic type and each connective appeared on the top. Accuracy and response time data was recorded. Subsequent trials proceeded automatically after registering the participant's response.

4.4 Results

Analysis was done using R software (R Core Team, 2018) version 3.5.1 Feather Spray. Exclusion criteria are outlined below, followed by an explanation of the analysis strategy. Results from the additional executive function and language tasks are first presented before the accuracy and response time results for the main task (connectives comprehension).

4.4.1 Exclusions

4.4.1.1 Failure to answer warm ups/fillers correctly

The first warm up and all fillers were simple sentences, which children should understand without difficulty. We therefore used these as a measure of whether children were engaged in the task. The data from children who failed at least three of five of these sentences were excluded (N=2 three-year-olds).

4.4.1.2 Responses before the end of the audio stimuli

Although children were asked to keep their hands on the red cardboard hands until after the sentence ended, occasionally they responded earlier. As such, any responses which were recorded prior to 0.3 seconds after the end of the stimuli were removed (based on De Ruiter et al., 2018). This did not result in any removals of adult responses, but 38 responses from the children's data were removed. No individual child's full dataset was removed.

4.4.1.3 Failure to pass the Speech-Act causality test

As the understanding of Speech-Act causality was deemed critical to being able to perform the task, data from children who answered two or more of the four Speech-Act causality task items incorrectly were excluded. For three-year-olds, mean accuracy on this task was 3.5 out of 4 (SD = 0.7); for five-year-olds, 3.9 out of 4 (SD = 0.3). Due to performance on this task, data from an additional three three-year-olds were excluded. Additionally, one child did not do any of the additional language/executive function tasks,

meaning we could not assess their ability to perform this task. As such, their data were also excluded. Table 4.1 provides a Pass/Fail summary on this test for the two age groups.

Table 4.1: Summary of scores on Speech-Act causality task

Number incorrect	Age 3	Age 5
0	24 (61.5%)	45 (90%)
1	12 (30.8%)	5 (10%)
2	2 (5.1%)	0
3	1 (2.6%)	0
4	0	0

After all exclusions (n = 138 responses) based on the three conditions presented above, there were 2082 responses (Three-year-olds: a total of 699 responses from 36 participants; Five-year-olds: a total of 983 responses from 50 participants; Adults: a total of 400 responses from 20 participants).

4.4.2 Analysis strategy

First, the results for the additional executive function and language tasks will be presented. For these, correlations with accuracy and response time on the main task were first determined. Tasks showing strong correlation with accuracy or response time were later tested to see if they improved the fit of the accuracy and response time models for the main task. Correlations with both accuracy and response times were done using Bayesian correlations using the BayesMed package (Nuijten, Wetzels, Matzke, Dolan, & Wagenmakers, 2015) in R (R Core Team, 2018). The evidence for Bayesian correlations is interpreted via a BayesFactor (Jeffreys, 1961 as cited in Wetzels et al. 2011), for which Wetzsels et al. (2011, p. 293) offer an adapted table. As BayesFactors are reported in this paper for both correlations and Bayesian t-tests (which were run using the BayesFactor package; Morey & Rouder, 2014), tables in this paper reporting BayesFactors will report the corresponding interpretation from Wetzels et al. (2011) alongside the BayesFactor number.

For the main task, Bayesian linear mixed models were used (see e.g. Granlund et al., 2019; Nicenboim, Vasishth, Engelmann, & Suckow, 2018 for discussion of suitability of Bayesian models over frequentist models in language research). In a paper promoting the practice of running exploratory analyses before confirmatory/hypothesis-driven research, Nicenboim et al. (2018) argue a key benefit of Bayesian analyses in comparison to

frequentist methods are that they "allow us to quantify our uncertainty about the parameter of interest, given the data at hand. Contrast this with the frequentist 95% confidence interval, which depends on the properties of data that we did not collect" (p. 1078). Thus, this approach was deemed particularly useful to the present study, which serves as an initial exploration of the patterns associated with comprehension of Speech-Act sentences. That is, given the lack of clear a priori predictions, a Bayesian approach was deemed more suitable for exploring patterns in the present dataset, which as Nicenboim et al. (2018) suggest, can then be used to inform future confirmatory studies.

The models were run in R (R Core Team, 2018) using the *brms* package (Bürkner, 2018), which concurrently runs RStan (Stan Development Team, 2018). We used the default (uninformative) priors for all models. Using the same approach as Granlund et al. (2019) and Engelmann et al. (2019), maximal models were run with maximal random effects structure, as this reduces Type I statistical errors (Barr, Levy, Scheepers, & Tily, 2014). The random effects structure for all models had random intercepts for item and participant and random slopes for the interaction between Pragmatic Type and Connective for participants.

As the adults did not do the additional executive function and language tasks and it was planned that the scores from these tasks that correlated with accuracy and response time would be added into the children's models, the adults' and children's models were run separately. This also allowed us to ensure that the maximal structure best reflected differences between adult and child behaviour. To ensure the maximal structure was best suited to each group and task, certain additional factors related to the design of the study were included in the random effects structure of a null model and compared against a null model without them (using the Leave One Out (LOO) cross-validation method in *brms* (Bürkner, 2019)) to determine if they improved the model. These factors were location of the image (top/bottom) [18], the order of the image relative to its semantic pair in a list, the keyword (term identifying each semantic set, e.g. Water spilling) and list number (e.g. List

[18] Target items were counterbalanced for location as equally as possible (half of all correct for each connective were on the top, as were half of all correct for each pragmatic type) within each list. However, as there were five of each sub-type (e.g. If Content) for each list, this could not be fully counterbalanced for location. As such, this was included as a possible slope to control for variation resulting from preferences by any individual participants.

1a). As they were found to improve model fit when tested against a null structure, the children's accuracy model had an additional random slope by participant for location of the image (top or bottom), both the children's and adults' response time models had an additional random slope by participants for item order relative to its semantic pair in a list and the adults' response time had an additional intercept for keywords.

The predictors in the maximal models were the within-subject factors (Pragmatic Type = Content, Speech-Act; Connective = *Because*, *If*) and one between-subject factor for children (Age = Three, Five). The maximal model included all predictors (centred) and all two-way and three-way interactions. For response time models, the response time variable (the dependent variable) was log-transformed. Additionally, there were some additional factors which could potentially impact the models, so were entered as controls. These were Trial Order and Gender. With regard to the decision to include a control for Gender, as some studies have reported differences in boys' and girls' functional use of connectives (e.g. Kyratzis et al., 2010), we were not certain whether differences in accuracy or response time would emerge as a result of gender-based patterns. Therefore, although we made no a priori predictions about Gender and it was not a focus of the study, we wanted to ensure that any gender-based patterns of performance would not impact the overall results. As such, it was decided that Gender would be included in a model where it would act as a control to see if this yielded a better model fit. Thus, the original decision to include Gender in the model was not related to a specific hypothesis, but in an attempt to control for any additional variance that it may contribute to the model (over and above what could be explained by the predictors of Connective, Pragmatic Type and Age). A further discussion of hypothesis driven research versus exploratory research can be found in section 6.2. Once the maximal model was run, these additional factors were tested individually against the maximal model using LOO cross-validation method in *brms* (Bürkner, 2019). Where an additional predictor resulted in a better fit, the item was retained. The same process was also followed to see if the scores from the additional executive function and language tasks which correlated with accuracy improved the accuracy model (as will be shown in section 4.4.3, no scores from the additional tasks correlated with response times).

For all Bayesian models, mean, upper and lower 95% credible intervals and Probability (P) will be reported. It is important to note that the P reported in Bayesian models is different from the .05 threshold in frequentist statistics. Within a Bayesian framework, the P

> can be interpreted literally as the probability of the true effect being smaller/greater than zero, given the data. Thus, P here is fundamentally different from the p-value in the sense of null hypothesis significance testing (in NHST, the p-value is the probability of an effect of at least the observed magnitude, given that the null hypothesis is true) (Engelmann et al., 2019, p. 40).

We have interpreted the evidence for an effect using the P in the same way as Engelmann et al. (2019) [19]:

- No evidence: P values at or around .5
- Weak evidence: P values starting at approximately .85 and up to .9499
- Strong evidence: P values at .95 or above and/or credible intervals that do not cross zero.

4.4.3 Language and executive function tasks

Table 4.2 summarises the executive function and language task scores for each age group.

Table 4.2: Summary of children's performance on the additional executive function and language tasks

Task	Three-year-olds				Five-year-olds			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Accuracy Digit Span Forwards	4.5	1.7	0	9	6.1	1.8	3	11
Accuracy Digit Span Backwards	0	0	0	0	1.3	1.4	0	4
CELF Sentence Structure (standardised scores)	9.6	3.0	4	17	8.7	3.2	3	15
CELF Linguistic Concepts (standardised scores)	10.1	2.4	5	16	9.2	3.1	3	16
DCCS pre-switch	5.8	0.7	2	6	6	0.1	5	6
DCCS post-switch	3.3	2.9	0	6	5.3	1.8	0	6

Correlations for Digit Span, Linguistic Concepts, Sentence Structure and DCCS scores with both accuracy and response time are reported in Table 4.3, with BayesFactor interpretation using labels in Wetzels et al. (2011).

[19] P values were calculated from the models using a function script in R (R Core Team, 2018) similar to the ones used in Engelmann et al. (2019) and Granlund et al. (2019)

Table 4.3: Digit Span, CELF Linguistic Concepts, CELF Sentence Structure and DCCS score correlation with accuracy and response time using BayesFactors interpretation labels from Wetzels et al. (2011) (collapsed across children's age groups)

Task	Correlation with Accuracy			Correlation with Response Time		
	R	Bayes Factor	Interpretation	R	Bayes Factor	Interpretation
Digit Span Forward	**.24**	**1.20**	**Anecdotal evidence for H_A**	.02	.09	Strong evidence for H_0
Digit Span Backwards	**.27**	**2.13**	**Anecdotal evidence for H_A**	-.20	.47	Anecdotal evidence for H_0
CELF Linguistic Concepts	.10	.13	Substantial evidence for H_0	.00	.09	Strong evidence for H_0
CELF Sentence Structure	.20	.52	Anecdotal evidence for H_0	.06	.10	Substantial evidence for H_0
DCCS Pre-switch	.06	.10	Substantial evidence for H_0	.17	.30	Substantial evidence for H_0
DCCS Post-switch	.16	.27	Substantial evidence for H_0	-.11	.14	Substantial evidence for H_0

The only additional tasks which showed any evidence of correlating with accuracy were the Digit Span memory tasks. There was no evidence that any of the tasks correlated with response time.

4.4.4 Connectives comprehension

4.4.4.1 Accuracy

Overall, the 3-year-olds' mean accuracy was 63.7% (SD = .48); the 5-year-olds' 76.2% (SD = .43), and the adults' 99.5% (sd = .07) (see Figure 4.3).

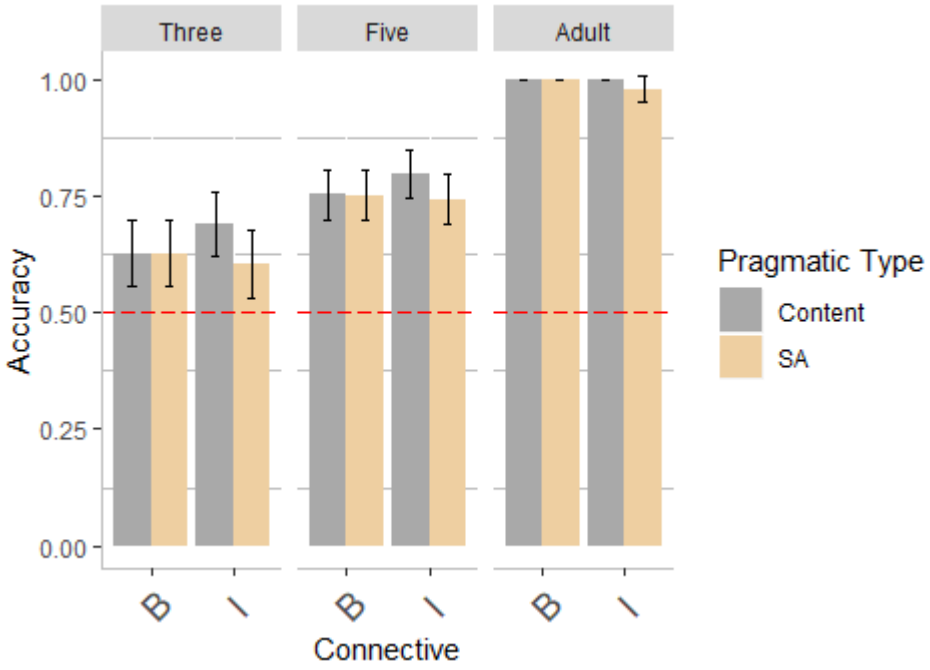

Figure 4.3: Connectives comprehension accuracy by age group per condition.

4.4.4.1.1 *Children's accuracy models*

The Bayesian output for the children's maximal model is in Table 4.4. The model shows only a strong effect of age (Five-year-olds were more accurate than three-year-olds).

Table 4.4: Summary output for maximal model of children's accuracy

Comparison	Mean	Lower	Upper	P(b<0)||P(b>0)
Intercept	1.4656	0.8943	2.0643	1.0000
b_cAge2	**-0.7369**	**-1.3298**	**-0.1836**	**0.9950**
b_cPragType2	-0.0473	-0.8457	0.7143	0.5400
b_cConn2	0.2389	-0.5219	0.9968	0.7385
b_cPragType2.cConn2	-0.3000	-1.364	0.786	0.7172
b_cAge2.cPragType2	-0.1281	-0.8272	0.5669	0.6465
b_cAge2.cConn2	-0.0608	-0.7681	0.679	0.5668
b_cAge2.cPragType2.cConn2	0.1722	-0.8614	1.2049	0.6335

While Trial Order or score on either direction of the Digit Span task did not improve the children's model, there was some evidence that Gender did predict accuracy when it was added to the maximal model. That is, using the LOO function in *brms* (Bürkner, 2019), the model with Gender appeared to be better than the model without (elpd_diff = -1.0), but the standard error was bigger than the elpd_difference (se = 1.2). As such, we cannot conclude either way if the model with Gender is a better fit. Running a summary of the model with a main effect of Gender, however, showed strong evidence that Gender did predict accuracy (mean: -0.3338, lower credible interval: -0.7346, upper credible interval: 0.0552, P = 0.9518) and, specifically, that the boys (coded as Males in the dataset) performed worse than girls, overall. Although we made no explicit predictions about the role of Gender in the comprehension of causal and conditional connectives, given its apparent contribution, for exploratory purposes we included the two and three-way interactions between Gender and main predictors from the study design (Age, Pragmatic Type and Connective) in the maximal model (see Table 4.5).

Table 4.5: Summary output for children's maximal model including Gender

Comparison	Mean	Lower	Upper	P(b<0)||P(b>0)
Intercept	1.2373	0.51	2.0072	0.9990
b_cGender2	0.3997	-0.4029	1.171	0.8348
b_cAge2	-0.0983	-0.9783	0.7887	0.5928
b_cPragType2	0.0878	-0.8391	0.9998	0.5772
b_cConn2	**0.8468**	**-0.0754**	**1.772**	**0.9630**
b_cPragType2.cConn2	**-0.7878**	**-2.071**	**0.5102**	**0.8830**
b_cAge2.cPragType2	-0.1657	-1.0769	0.753	0.6380
b_cAge2.cConn2	-0.3688	-1.3115	0.5714	0.7722
b_cGender2.cPragType2	-0.1964	-1.0793	0.6754	0.6730

b_cGender2.cConn2	**-0.9824**	**-1.8474**	**-0.1066**	**0.9850**
b_cGender2.cAge2	**-1.1154**	**-2.2605**	**-2e-04**	**0.9750**
b_cAge2.cPragType2.cConn2	0.1864	-0.8614	1.2229	0.6405
b_cGender2.cAge2.cConn2	0.4940	-0.5204	1.5169	0.8205
b_cGender2.cAge2.cPragType2	0.0419	-1.0242	1.1225	0.5262
b_cGender2.cPragType2.cConn2	**0.8101**	**-0.257**	**1.8371**	**0.9288**

This shows:

- Strong evidence of effects of Connective, and two-way interactions between Gender and Connective and Gender and Age;
- Weaker evidence of an interaction between Pragmatic Type and Connective and a three-way interaction of Gender, Pragmatic Type and Connective.

With regard to the main effect of connective, accuracy was higher for *If* than *Because,* overall. To explore the Gender by Age interaction (the only two-way interaction not included in the three-way-interaction), the main dataset was subsetted by Gender and models (with maximal random effects structure) with main effects of Age, Connective and Pragmatic Type and two-way interactions between these predictors were run for both the girls' and boys' datasets. While the boys' model showed a main effect of Age (mean: -1.2865, lower credible interval: -2.0653, upper credible interval: -0.5427, P = 0.9995), showing that three-year-old boys performed worse than five-year-old boys, there was no evidence of a main effect of Age in the girls' model (mean: -0.2608, lower credible interval: -1.0639, upper credible interval: 0.5825, P = 0.7300).

To explore the three-way-interaction between Connective, Pragmatic Type and Gender, a contrast was then run using the emmeans package (Lenth, 2019) to allow us to investigate this interaction more fully without subsetting the data any further. Here, strength for an effect is shown via 95% Highest Posterior Density Intervals (HPDs). These are credible intervals which show "the distribution by specifying an interval that spans most of the distribution, say 95% of it, such that every point inside the interval has higher credibility than any point outside the interval" (Kruschke, 2015, p. 87). The contrast showed that although the upper and lower HPDs for all comparisons cross zero, it only crossed marginally for the girls' *If* Content-Speech-Act contrast and Content *because – if* contrast (see Table 4.6 and Figure 4.4). This provides some weak evidence that girls were best with *if* Content, while there were no differences in accuracy for any other sentence types for either group.

Table 4.6: Summary (using emmeans, Lenth, 2019) of contrasts in of Gender, Pragmatic Type and Connective interaction in maximal model

Group	Contrast	Estimate	Lower HPD	Upper HPD
Girls	Because Content – SA	-0.007	-0.805	0.839
Girls	**If Content – SA**	**0.692**	**-0.157**	**1.558**
Boys	Because Content – SA	0.171	-0.546	0.992
Boys	If Content – SA	0.055	-0.716	0.835
Girls	**Content Because – If**	**-0.6639**	**-1.516**	**0.155**
Girls	Speech-Act Because – If	0.0315	-0.798	0.873
Boys	Content Because – If	0.0734	-0.705	0.824
Boys	Speech-Act Because – If	-0.0428	-0.821	0.747

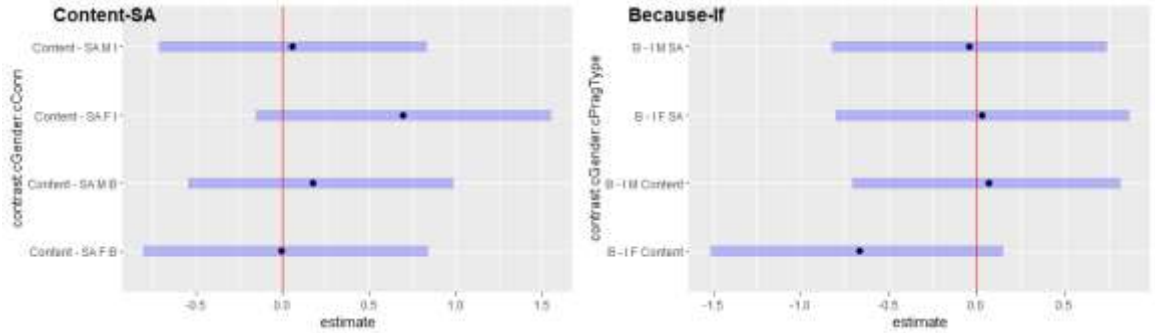

Figure 4.4: Plots showing emmeans contrast (Lenth, 2019) for differences between Content and Speech-Act for both Boys (M) and Girls (F) by Connective (B, I) (Left) and between Because and If for both Boys (M) and Girls (F) by Pragmatic Type (SA, Content).

In summary, when Gender was not considered, only Age predicted accuracy. However, the inclusion of Gender into the model reveals some interesting patterns. This model shows:

- While three-year-old boys perform worse than five-year-old boys, three-year-old girls' performance is similar to five-year-old girls (see Figure 4.5)
- There was weak evidence that girls were most accurate with *if* Content sentences, while there was no evidence that the boys' accuracy differed for any sentence type, overall (see Figure 4.6).

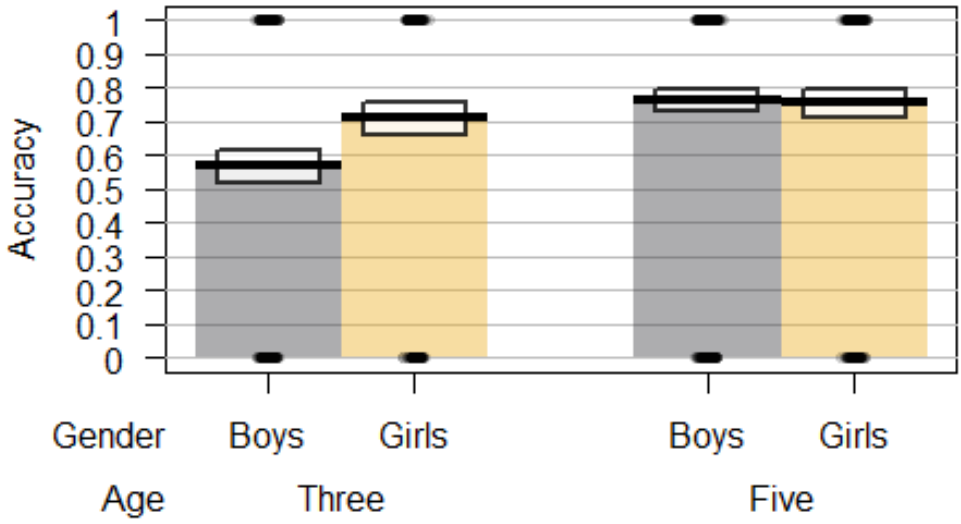

Figure 4.5: Pirate plot (Phillips, 2016) showing accuracy of three- and five-year-olds by gender.

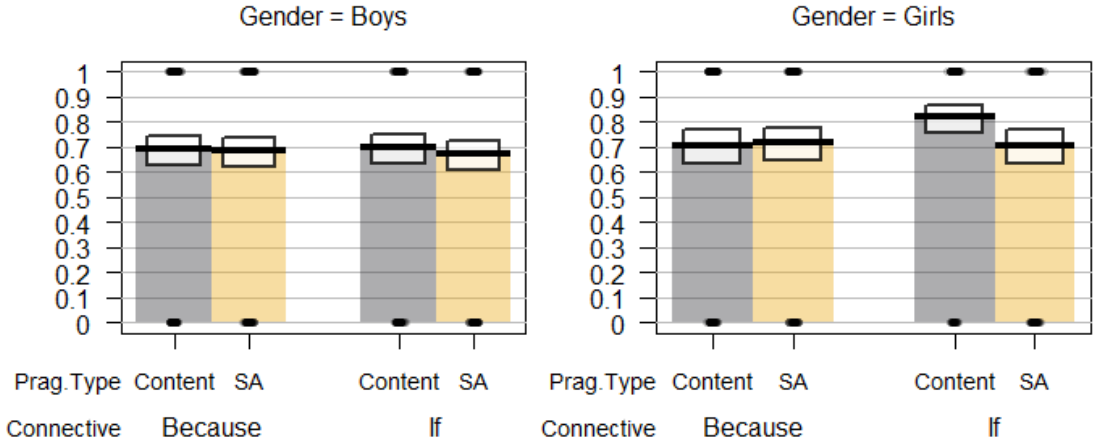

Figure 4.6: Pirate plot (Phillips, 2016) showing sentence type accuracy by gender.

4.4.4.1.2 *Children's accuracy compared to chance*

To clearly compare how the overall accuracy differed for each group on each sentence type, Bayesian t-tests were run comparing accuracy on each sentence type to chance. Table 4.7 provides a summary of overall accuracy for each sentence type for each group (based on age and gender), the output of the Bayesian t-test comparing accuracy to chance, and an interpretation of the Bayes Factors for each group.

Table 4.7: Bayes Factor t-test output and interpretation (based on labels in Wetzels et al. (2011)

Group	% Correct	Bayes Factor	Interpretation
3 Males Because Content	57	0.6	Anecdotal evidence for H_O
3 Males Because SA	56	0.4	Anecdotal evidence for H_O

3 Males If Content	59	1	Anecdotal evidence for H_A
3 Males If SA	56	.5	Anecdotal evidence for H_O
3 Females Because Content	70	**135.8**	**Decisive evidence for H_A**
3 Females Because SA	71	**255.2**	**Decisive evidence for H_A**
3 Females If Content	80	**1000218**	**Decisive evidence for H_A**
3 Females If SA	65	**11.6**	**Strong evidence for H_A**
5 Males Because Content	77	**514606386**	**Decisive evidence for H_A**
5 Males Because SA	77	**337891374**	**Decisive evidence for H_A**
5 Males If Content	77	**369544841**	**Decisive evidence for H_A**
5 Males If SA	74	**4781388**	**Decisive evidence for H_A**
5 Females Because Content	72	**6699.7**	**Decisive evidence for H_A**
5 Females Because SA	72	**4105**	**Decisive evidence for H_A**
5 Females If Content	84	**7833062997**	**Decisive evidence for H_A**
5 Females If SA	75	**39700.8**	**Decisive evidence for H_A**

These results reinforce the difference between three-year-old boys and girls: while there is only anecdotal evidence that three-year-old boys perform above chance on one sentence type (*If* Content), there is decisive evidence or strong evidence that all other groups perform above chance on all sentence types. Finally, it provides some more support to the finding that, while girls' performance is highest on *If* Content, the boys' performance is more stable across all sentence types.

4.4.4.1.3 *Adult's accuracy*

As adults performed at ceiling (only a total of two items were answered incorrectly in all of the adults' responses), none of the fixed effects were predictors of the adults' accuracy.

4.4.4.2 *Response Time*

As trial time was calculated from the start of the trial, a response time measure was calculated by subtracting the length of the audio for an item from a participant's total response time for that item. Response time analyses include only correct answers (n = 1207 for the children; n = 398 for the adults). Figure 4.7 shows the log-transformed response time data for the three age groups. The average response time for three-year-olds was 3.9 (SD =3.0) seconds; for five-year-olds 2.9 seconds (SD =3. 2), and for adults, 1.6 seconds (SD = 0.8).

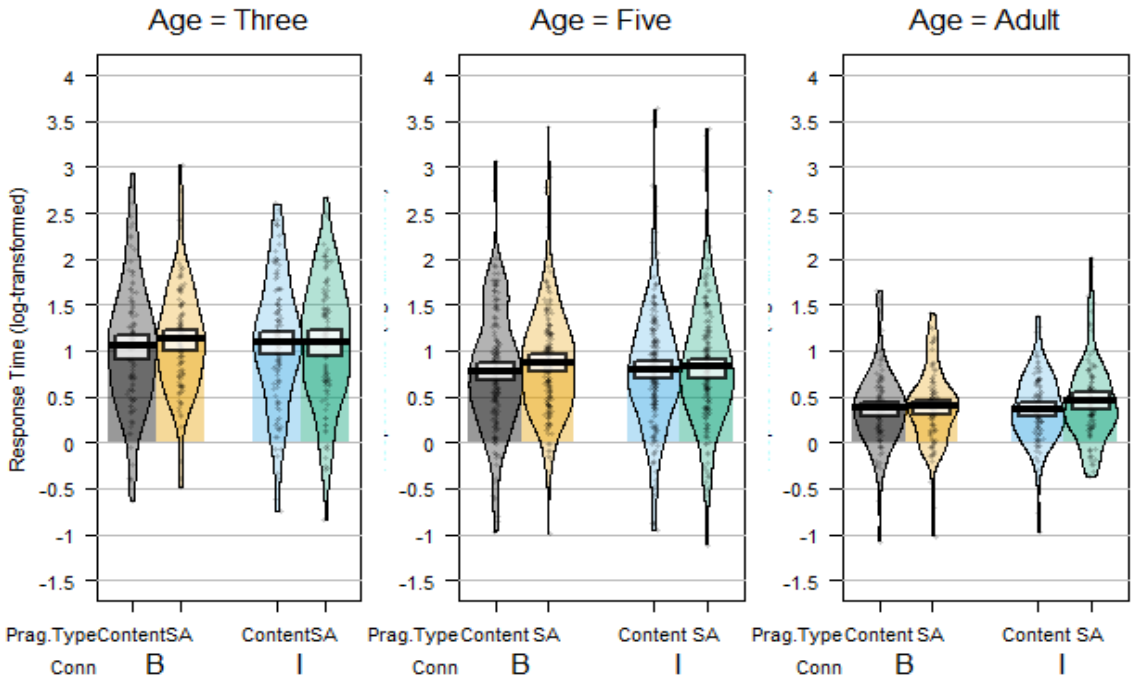

Figure 4.7: Pirate plot (Phillips, 2016) showing response time patterns (log-transformed) for each age group by pragmatic type and connective.

4.4.4.3 *Children's response time models*

Using the same approach as with accuracy, maximal models were run for the response time data separately for adults and children (see Table 4.8 for children's data). While Gender did not improve model fit, Trial Order did and was included in the response time model for the children (see Table 4.8). This model shows strong evidence of a main effect of Age (five-year-olds were faster) and some slightly weaker evidence of main effect of Pragmatic Type (children were faster with Content). There was also some weak evidence of a two-way interaction for Connective and Pragmatic Type.

Table 4.8: Maximal model output for children's response times

Comparison	Mean	Lower	Upper	P(b<0)||P(b>0)
Intercept	0.7703	0.6153	0.9306	1.0000
b_scaleTrialNo	-0.0819	-0.1168	-0.0471	1.0000

b_cAge2	**0.3002**	**0.0774**	**0.52**	**0.9968**
b_cPragType2	**0.0921**	**-0.0525**	**0.2324**	**0.9010**
b_cConn2	0.0542	-0.091	0.1941	0.7827
b_cPragType2.cConn2	**-0.1140**	**-0.313**	**0.0901**	**0.8675**
b_cAge2.cPragType2	-0.0264	-0.2003	0.1427	0.6152
b_cAge2.cConn2	-0.0204	-0.1902	0.1521	0.6005
b_cAge2.cPragType2.cConn2	0.0366	-0.2045	0.2853	0.6088

To investigate the two-way interaction between Pragmatic Type and Connective, the dataset was split by connective and maximal models were run for the two datasets. While there was no reliable evidence for Pragmatic Type in the *If* data (mean:-0.0248, lower credible interval:-0.1649, upper credible interval: 0.1197, P = 0.6355), the *Because* data showed weak evidence of an effect of Pragmatic Type (mean: 0.0900, lower credible interval: -0.0602, upper credible interval: 0.234, P = 0.8920). To determine how *Because* Content and Speech-Act compared to *If* Content and Speech-Act respectively, the main dataset was then subsetted by Pragmatic Type and models were run. There was no evidence of a main effect of Connective in the Content model (mean: 0.0412, lower credible interval: -0.1367, upper credible interval: 0.2226, P = 0.6728), but the Speech-Act model showed some weak evidence that children were faster with *If* (mean: -0.0766, lower credible interval: -0.2068, upper credible interval: 0.0547, P = 0.8820). Thus, we have some weak evidence that children were slower on *Because* Speech-Act compared to both *If* Speech-Act and *Because* Content, but that there were no differences between the two *If* sentences or the two Content sentences.

4.4.4.4 Adults response time models

For adults, like the children, Gender did not improve the response time model, but the Trial Order did and, as such, was retained in the model (see Table 4.9 for adults' maximal model). This model shows some weak evidence the adults responded more quickly to Content sentences.

Table 4.9: Maximal model output for adults' response times

Comparison	Mean	Lower	Upper	P(b<0)||P(b>0)
Intercept	0.3488	0.1803	0.5238	1.0000
b_scaleTrialNo	-0.1299	-0.159	-0.1017	1.0000
b_cPragType2	**0.0470**	**-0.0351**	**0.1331**	**0.8758**
b_cConn2	0.0339	-0.0488	0.1167	0.7998
b_cPragType2.cConn2	-0.0252	-0.1683	0.1184	0.6360

In summary, there was some evidence that both adults and children were faster at Content, but that children were slowest at *Because* Speech-Act, specifically. Thus, we have some evidence of the influence of cognitive complexity, where response times to Content sentences were faster, overall. Furthermore, for children, there also seems to be an inverse relationship between input and response time for *Because* Speech-Act sentences.

4.5 Discussion

This study aimed to provide some insight into the factors that impact children's acquisition of the different pragmatic relationships expressed by the connectives *because* and *if* (as proposed by Sweetser, 1990). From a cognitive complexity perspective (e.g. Zufferey, 2010), Content sentences should be easier than Speech-Act because the latter require more complex metacommunicative skills. By contrast, based on frequency patterns in the input, we would expect Speech-Act to be easiest for *because* and Content to be easiest for *if* (e.g. De Ruiter et al., in press). To test these predictions, this study compared accuracy and response time data for three-year-olds, five-year-olds and adults, who were asked to match *because*- and *if*-sentences expressing different pragmatic relationships (Content, Speech-Act) to pictures on a touch-screen laptop. We also investigated correlations between performance on this task and various other executive function and language tasks.

The data showed some weak evidence that *if* Content sentences were easiest, but that this pattern was primarily influenced by the girls, who performed better on the task overall at an earlier age. With regard to response times, there was weak evidence that both children and adults were faster with Content sentences than Speech-Act, but that the children were slowest with *because* Speech-Act, overall. These data show that children's comprehension of these sentences is impacted by pragmatic function, although the patterns associated with this change with gender, connective, age and measure. However, it is important to note that, except for the three-year-old boys, all groups performed above chance on all sentence types. This shows that the majority of children in this study had at least a general understanding of all of the sentence types, although some relationships were easier for them to understand than others. In general, the data here supports Zufferey's (2010) hypothesis that, although Speech-Act is more complex

than Content, children have the requisite metacommunication skills for acquisition of this pragmatic type by age three. In the sections that follow, we first discuss these patterns in regard to the predictions from both accounts, then offer a discussion on more general, gender and developmental patterns associated with acquisition of the different pragmatic relationships.

With regard to the relationship between the additional executive function/language tasks and the measures for connectives comprehension, no tasks correlated with response time and only the digit span tasks had anecdotal correlation with accuracy. When the digit span tasks were included into the accuracy model, however, these did not improve model fit. This suggests that while there was some evidence that children with better short-term memory performed better on the task, these patterns were not consistent enough for this measure to be a reliable predictor of accuracy.

4.5.1 Evidence for an interaction between cognitive complexity and input

Overall, there was little evidence that cognitive complexity impacted comprehension on its own. As noted in the predictions, in line with Zufferey (2010, see also Sanders, 2005), if cognitive complexity strongly predicts accuracy, children should be better with Content sentences with both connectives. However, despite the weak evidence that *if* Content sentences were easiest, this was not the case for *because*, where there were no differences in accuracy between the Content and Speech-Act sentences. Therefore, if cognitive complexity does impact acquisition, its effects are not consistent across both connectives. However, we cannot argue that overall input frequency patterns consistently predict accuracy on these sentences, either. If input frequency did predict accuracy, in line with findings and arguments in De Ruiter et al. (in press), we would have expected higher accuracy with Speech-Act for *because* and Content with *if*. Like the cognitive complexity prediction, the data support the input prediction only for *if*.

Thus, neither frequency nor cognitive complexity seems to reliably predict accuracy on their own, but children (girls, in particular) had the highest rates of accuracy on the sentence type where these predictions overlap. This suggests a relationship between the two factors. That is, with *because*, the Speech-Act type is most frequent (De Ruiter et al., in press), but the Content type is the least cognitively complex (Sanders, 2005; Zufferey,

2010). Thus, for *because,* it seems that the two factors are in conflict and neither pragmatic type has an advantage. With *if*, however, the cognitively simplest sentence type (Sanders, 2005; Zufferey, 2010) is also the most frequent (*if* Content) (De Ruiter et al., in press). This overlap appears to be advantageous for acquisition. This interaction between input frequency and cognitive simplicity is not unlike patterns found elsewhere. For example, with regard to their finding that children performed best on *before*-sentences which appeared in a main-subordinate ordering, De Ruiter et al. (2018) suggested this might be because these sentences were not only structurally easier to process, but also had a form-meaning mapping that was more consistent in the input.

However, in interpreting the response time data, we may have evidence that comprehension is more strongly influenced by a factor we had not considered. With response times, there was weak evidence that children were slowest with *because* Speech-Act sentences. This suggests an unexpected and inverse relationship between response time and input: while high input frequency in combination with lesser cognitive complexity results in higher accuracy (*if* Content), high input frequency in combination with higher cognitive complexity results in the slowest response times (*because* Speech-Act). Thus, if cognitive complexity and input frequency interact for accuracy, they do not seem to do so for response times. Moreover, in comparing the two Speech-Act sentences (and thus controlling for cognitive complexity), there was some weak evidence that response times were slower when input frequency was higher. This leaves us with the unlikely idea that, while input frequency plays some role in helping children understand these sentences (in combination with cognitive complexity), it actually impedes children's processing of them. However, in exploring an account of how these sentences may be processed, as well as very specific usage patterns in input, we offer an alternative explanation for these results, which we discuss in the following section.

4.5.2 The unexpected role of input on acquisition of Content and Speech-Act sentences

In an eye-tracking study with adults, Traxler, Bybee and Pickering (1997) argued in favour of an incremental account for adults' processing of complex causal sentences. According to Traxler et al. (1997) in this type of processing, expectations are established about the

causal relationship between the two clauses before the second clause ends, due to gradual processing of the sentence as it unfolds. While we do not know if children process complex *because*- and *if*-sentences this way, it seems plausible that they do, given evidence that children process simpler transitive sentences in an incremental and predictive manner (e.g. Borovsky et al., 2012). From this perspective, our data are consistent with the possibility that input patterns are at least partially responsible for the slightly delayed response times children have with *because* Speech-Act.

Although children regularly hear *because* Speech-Act sentences, they most frequently hear them alongside illocutionary acts which encourage an immediate behavioural response: Commands (Lemen et al., submitted). For example, if a mother says to her child "No more chocolate, because you've already had cake today", the child may focus on the directive in the main clause, rather than what is generally argued to be an added explanation/justification for it (i.e. the subordinate clause) (see Veneziano, 2001 for evidence that children learn to ignore their mothers' justifications of oppositional illocutionary acts; see e.g. Diessel & Hetterle, 2011; Ford, 1993; Kyratzis et al., 1990; Sweetser, 1990 for arguments that *because* justifies illocutionary acts that have already been performed). Therefore, children may learn that the *because*-clause is not critical to the interpretation of the illocutionary act, itself, and is actually rather separate (i.e. what Quirk, Greenbaum, Leech & Svartvik, 1985, p. 1070, call "disjuncts" which they argue have a more "peripheral" status). Given that children have been shown to prioritise action responses to directives (Shatz, 1978), the tendency for *because*-clauses to co-occur with commands, in particular, may impact how children learn to process these kinds of sentences.

By contrast, although the *if* Speech-Act sentences also have an illocutionary act in the main clause, Sweetser (1990) explains that, in *if* Speech-Acts the performance of the illocutionary act is considered to be contingent on the conditions in the subordinate clause (see also Haegeman, 1984; Van der Auwera, 1986; Van Dijk, 1979; Warchał, 2010). In this way, the command in the main clause of a sentence like "No more chocolate, if you've already had cake today", should only apply if the subordinate clause is true. As such, to properly understand the illocutionary act and how it applies to them, children

may learn from naturalistic speech that it is more important to interpret the main and subordinate clauses together in *if* Speech-Acts than *because* Speech-Acts.

Thus, despite the overall higher input frequency of *because* Speech-Act sentences, children may have less experience interpreting the two clauses together than in *if* Speech-Act sentences as a result of how these kinds of sentences are used in their input. To interpret overall sentence meaning in the connectives comprehension task, children would have had to integrate the two fully-processed clauses in *because* Speech Act sentences (more in line with Millis & Just, 1994), which could have incurred a slight processing delay relative to the other sentence types. Should this be true, it would mean that processing of these sentences is impacted by input – although by more specific usage patterns in the input, rather than the overall distribution of pragmatic types alone.

Given this possibility, we cannot rule this out as an explanation for the accuracy results. That is, although we suggested in section 4.5.1. that the higher accuracy with *if* Content was due to an interaction between cognitive complexity and input patterns, it is possible that children had some difficulty responding to *because* Speech-Act sentences because they are less used to relying on the connective to interpret a causal meaning between the clauses in these sentences. Thus, these specific usage patterns could be responsible for children's difficulty with *because* Speech-Act in comparison to *if* Content, rather than the fact that the latter is less complex. That is, if *because* Content and *if* Speech-Act are both low frequency and *because* Speech-Act relationships are not regularly interpreted in terms of a relationship between the two clauses, *if* Content then becomes the only true high-frequency sentence type. In this case, the higher accuracy with *if* Content can be primarily explained in terms of input patterns – although two different types of input patterns. While this argument provides an interesting account of the role of input on language acquisition and also offers a single explanation for the accuracy and response time patterns, it is currently based only on overall accuracy and response times for correct answers. To determine the extent to which more specific usage patterns influence expectations about connective meaning and function, more detailed information about how children process these sentences is required.

4.5.3 The relationship between gender, accuracy and development

The data also point to some specific gender and developmental patterns. First, while there was no difference in the overall accuracy between five-year-old boys and girls, three-year-old girls were far more accurate overall than three-year-old boys[20]. More specifically, three-year-old girls' performance was similar to that of the five-year-olds, while there was little reliable evidence that the three-year-old boys had above chance accuracy on any sentence type. Second, while there was weak evidence that children were better with *if* Content, overall, this appeared to be primarily based on the girls' data, while the boys had similar accuracy for all sentence types. In contrast to these gender differences in the accuracy data, however, there was no evidence of a gender difference in the response time data. Thus, there seems to be differences in the order in which boys and girls acquire these sentences, overall, but not how they process correct sentences (recall that response times are calculated solely on correct responses). It is possible that the lack of gender differences in the response time data is an effect of sample size, however: as the three-year-old boys had low accuracy, the response time data may be underpowered to pick up any gender differences, particularly if three- and five-year-old boys differed in their patterns.

The girls' preference for *if* Content seems to suggest that they first acquire greater competency on the sentence type which is easiest (either because it is most frequent or because it is high frequency-low complexity). The boys' equal, but slower, acquisition of all sentence types, by contrast, may mean they have a harder time establishing clear meaning for any single sentence type because of the noisiness of the form-function mapping in the input (which, as argued by Slobin, 1982 can complicate acquisition). However, once they are able to resolve this, they appear generally able to understand all sentence types equally, regardless of complexity or input patterns. Thus, for girls, the pragmatic variation seems to impact acquisition of these sentences longer than boys, even though they begin to acquire them earlier.

[20] While it is possible that the accuracy difference between three-year-old girls and boys is primarily due to differences in general language ability, we think this is not entirely the case, as there was no strong evidence that the additional language tasks correlated with accuracy. Furthermore, when the scores from the executive function tasks that were most closely correlated with accuracy (i.e. Digit Span tasks) and the two CELF language tasks were included in the model, the gender differences remained.

4.5.4 The relationship between pragmatic variation and overall acquisition of *because* and *if*

As noted in sections 4.2.1. and 4.2.2, many studies have found that children have a particularly difficult time understanding the connectives *because* and *if* (e.g. De Ruiter et al., 2018; Emerson, 1979, 1980; Emerson & Gekoski, 1980). However, although the data here provides some evidence that comprehension is impacted by pragmatic variation, the children in the present study generally performed well, overall. However, there is a key difference between this study and many of those reporting much later acquisition of these connectives (e.g. De Ruiter et al., 2018; Emerson, 1979, 1980; Emerson & Gekoski, 1980): the study here did not require children to rely on the ordering meaning inherent in these connectives to interpret reversible sentences. That is, in studies such as those by De Ruiter (De Ruiter et al., 2020, 2018) and Emerson (1979, 1980; Emerson & Gekoski, 1980), children needed to differentiate between sentences like "*He misses the bus, because he rides his old bike"* and "*Because he misses the bus, he rides his old bike"* (De Ruiter et al., 2020, 2018) or "*Woodstock fell out of his nest because he was jumping up and down"* and "*Woodstock was jumping up and down because he fell out of his nest"* (Emerson & Gekoski, 1980). In the present study, participants did not need to differentiate between images based on event ordering (i.e. the image either depicted the causal/conditional relationship or it did not). That said, there is not a clear consensus about the extent to which the ordering relationship is responsible for children's difficulty with these connectives. For example, while De Ruiter et al. (2018) showed that, even at age five, when an understanding of ordering was required, children only performed around chance on reversible *because*- and *if*-sentences expressing physical (Content) causality/conditionality (see also Emerson, 1979, 1980; Emerson & Gekoski, 1980), findings by Johnston and Welsh (2000) and French (1988) provide some evidence that children do understand ordering relationships with causal connectives, so long as they relate to events which are familiar (e.g. bedtime, Johnston & Welsh, 2000; eggs cracking, French, 1988). Taken together, then, these studies provide support for the idea that that children's comprehension of connectives at this age is relatively fragile, restricted to certain contexts and methodologies (e.g. De Ruiter et al., 2018; Donaldson, 1986; Emerson & Gekoski, 1980; French, 1988; Peterson & McCabe, 1985). The present study provides further evidence for this idea, showing that pre-school-aged children can

understand causal/conditional relationships (even the more cognitively complex Speech-Act relationships and those which are infrequent in the input), when the task does not require them to interpret meaning on the basis of the ordering relationship (see related arguments in Donaldson, 1986).

It is worth noting that the presence of pragmatic variation in speech may play at least some small role in children's difficulty with the ordering relationship, however. This is because the different pragmatic types are bound by somewhat different ordering rules. For example, as argued by Pander Maat and Degand (2001; Degand & Pander Maat, 2003) for causal sentences[21], in Speech-Act sentences, the ordering is more simultaneous (i.e. the causal relationship is between two clauses which occur at the same time in the given discourse). By contrast, the same authors (2001, 2003) show that in Content sentences (in particular, those they call "non-volitional"), the causal relationship is between "objective phenomena (in the real world)" (Pander Maat & Degand, 2001, p. 216) and, therefore, have a set ordering based on how that event actually occurred (i.e. the cause occurs prior to, or at the same time as, the effect). As such, children likely need to learn the differences in how the ordering relationship applies to the different pragmatic types, meaning it is not an entirely reliable relationship to learn (see also Donaldson, 1986 for related evidence and discussion for causals, specifically).

4.6 Conclusion

This study presents evidence that pragmatic variation impacts children's ability to interpret *because*- and *if*-sentences, although this changes with connective and measure. Furthermore, it provides some initial evidence that this pragmatic variation may impact boys and girls differently, resulting in differences in when they acquire the different sentence types. However, it raises some additional questions about how children process these sentences, and whether these differences can be explained by children's expectations about how to interpret these connectives, which may be informed by very specific patterns in naturalistic speech.

[21] Although there are differences in their models, Pander Maat and Degand's (2001; Degand & Pander Maat, 2003) "non-volitional" and "volitional" have overlap with Sweetser's (1990) Content, while their two epistemic and speech-act categories align with Sweetser's (1990) Epistemic and Speech-Act categories.

In terms of the influence of input and cognitive complexity, we found little evidence in favour of cognitive complexity, alone. Rather, if cognitive complexity of the different pragmatic types does impact acquisition, it does so in combination with input. However, an alternative explanation suggests that input is actually the primary predictor for both accuracy and response time, although the input patterns that influence comprehension include both overall distributional frequency and specific usage patterns associated with different sentence types. Thus, it appears that overall distributional frequency does impact comprehension of these connectives, although more research is needed to determine whether this interacts more with cognitive complexity or specific functional uses of the connectives.

It is important to note, however, that these findings are based on a comparison between only two pragmatic types, meaning the cognitive skills tested here relate only to earlier-acquired metacommunicative skills, not the more advanced metacognitive skills required for Epistemic relationships (Zufferey, 2010). In order to fully test the theory put forth from a cognitive complexity account (e.g. Sanders, 2005; Zufferey, 2010), a study would need to include all three pragmatic relationships. In light of this and the potential impact of specific usage patterns in input, we are currently investigating children's expectations and processing of all three kinds of pragmatic relationships with these connectives via a mixed measure approach, including eye-tracking. Through this, we may gain a more complete picture of children's understanding and processing of these connectives, as well as more information about the relationship between input, production and comprehension of complex language.

4.7 References

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4.8 Appendices

4.8.1 Appendix 4.1: Stimuli Lists 1a and 2a

Table 4.10: List 1a

Number	Sentence	Connective	Type
20	Try not to get the trousers dirty if you are splashing mud around	I	SA
13	The eggs are cracking because you are kicking the basket	B	Content
19	Your hands are going to get very messy if your ice lolly drips	I	Content
1	The chair is getting wet because you are spilling the water	B	Content
FILLER			
2	No spraying the hose because the handbag is getting all wet	B	SA
12	Don't break the branches if you are going to keep climbing	I	SA
7	The blocks are going to fall down if you shake the table	I	Content
18	Don’t let your ice lolly drip because your hands are getting messy	B	SA
FILLER			
16	Those eggs better not crack if you are kicking that basket	I	SA
17	The trousers are getting dirty because you are splashing in the mud	B	Content
4	Watch the chair doesn't get wet if you are spilling that water	I	SA
6	No more shaking the table because the blocks are falling	B	SA
FILLER			
5	The books are falling because you are shaking the bookshelf	B	Content
3	The handbag is going to get wet if you spray the hose	I	Content
10	That’s enough of that jumping because the bed is breaking	B	SA
14	Stop kicking at the box because the bottles are smashing	B	SA
FILLER			
15	The bottles are going to smash if you kick the box	I	Content
9	The branches are breaking off because you are climbing up	B	Content
11	The bed is going to break if you jump too much	I	Content
8	Be careful the books don’t fall if you are shaking that bookshelf	I	SA

Table 4.11: List 2a

Number	Sentence	Connective	Type
40	Try not to get your hands messy if your ice lolly is dripping	I	SA
33	The bottles are smashing because you are kicking the box	B	Content

39	The trousers are going to get very dirty if you splash mud around	I	Content
21	The handbag is getting wet because you are spraying the hose	B	Content
FILLER			
22	No spilling the water because the chair is getting all wet	B	SA
32	Don't break the bed, if you are going to keep jumping	I	SA
27	The books are going to fall down if you shake the bookshelf	I	Content
38	Don't splash in the mud because the trousers are getting all dirty	B	SA
FILLER			
36	Those bottles better not smash if you are kicking that box	I	SA
37	Your hands are getting so messy because your ice lolly is dripping	B	Content
24	Watch the handbag isn't getting wet if you are spraying that hose	I	SA
26	No more shaking the bookshelf because the books are falling	B	SA
FILLER			
25	The blocks are falling because you are shaking the table	B	Content
23	The chair is going to get wet if you spill the water	I	Content
30	That's enough of that climbing because the branches are breaking	B	SA
34	Stop kicking at the basket because the eggs are cracking	B	SA
FILLER			
35	The eggs are going to crack if you kick the basket	I	Content
29	The bed is breaking because you are jumping so much	B	Content
31	The branches are going to break off if you climb up	I	Content
28	Be careful the blocks don't fall if you are shaking that table	I	SA

4.8.2 Appendix 4.2: Children's maximal model for accuracy, with Gender and Sentence Structure, Linguistic Concepts and Digit Span scores

Table 4.12: Children's maximal model for accuracy, with Gender and Sentence Structure, Linguistic Concepts and Digit Span scores

	comparison	mean	lower	upper	P(b<0)||P(b>0)
1	Intercept	1.1757	0.4185	1.9365	0.9988
2	b_scaleSentence_Structure_stand	0.2259	-0.0298	0.484	0.9620
3	b_scaleDigit_Span_F	0.0866	-0.1432	0.3178	0.7688
4	b_scaleDigit_Span_B	0.0122	-0.2504	0.2776	0.5352
5	b_scaleLinguistic_Concepts_stand	0.0552	-0.2192	0.3331	0.6587
6	b_cGender2	0.5482	-0.2349	1.3639	0.9140
7	b_cAge2	-0.0249	-1.0027	0.9084	0.5160
8	b_cPragType2	0.0735	-0.8375	1.0323	0.5628
9	b_cConn2	0.8286	-0.1267	1.7885	0.9565

10	b_cPragType2.cConn2	-0.7641	-2.0305	0.5484	0.8785
11	b_cAge2.cPragType2	-0.1388	-1.0897	0.7876	0.6158
12	b_cAge2.cConn2	-0.3634	-1.3323	0.6179	0.7678
13	b_cGender2.cPragType2	-0.1967	-1.0744	0.6485	0.6680
14	b_cGender2.cConn2	-0.9838	-1.8653	-0.116	0.9868
15	b_cGender2.cAge2	-1.2773	-2.4108	-0.1785	0.9878
16	b_cAge2.cPragType2.cConn2	0.1712	-0.843	1.2362	0.6220
17	b_cGender2.cAge2.cConn2	0.5038	-0.5637	1.56	0.8220
18	b_cGender2.cAge2.cPragType2	0.0146	-1.0272	1.0562	0.4980
19	b_cGender2.cPragType2.cConn2	0.8146	-0.2261	1.8299	0.9338

5 Children's expectations of the functional meaning of *because* and *if*: Evidence from eye-tracking, accuracy and response time measures

This chapter addresses the third research question of this thesis: (a) Do children have a preferred pragmatic function for either *because* or *if*?; and (b) Can this be explained in terms of patterns in naturalistic speech and/or cognitive complexity?

The study in Chapter 5 is in preparation for submission to a journal for publication. The author and title information for draft in preparation are:

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5.1 Abstract

Children's difficulty with understanding the adverbial connectives *because* and *if* has long been noted in experimental studies. What is often overlooked is the fact that these connectives express three different pragmatic functions (Content, Epistemic, Speech-Act; Sweetser, 1990), although comprehension is primarily tested using only Content sentences. Yet, children hear and produce all three pragmatic types in naturalistic speech, with Speech-Act being particularly frequent, especially for *because* (De Ruiter et al., in press). However, in addition to input frequency, the pragmatic types also differ in their cognitive complexity (e.g. Zufferey, 2010) and specific usage patterns (Lemen et al., submitted), but existing research does not provide clear evidence as to which, if any, of these factors best explains the order in which different pragmatic meanings are acquired. To address this, this study used eye-tracking data, alongside accuracy and response time measures, to better understand children's processing and interpretation of these pragmatic meanings. Using a forced-choice picture selection task, 92 three- to five-year-olds and 22 adults identified images completing *because* and *if*-sentences heard in a discourse context. Results showed that children's understanding is first built upon the Content meaning, but this occurs later for *if* than *because*. Additionally, while experience with the other pragmatic types makes five-year-olds less confident in predicting pragmatic meaning with *because*, they appear to rely on a general understanding of conditional meaning signalled by *if* to interpret less well-understood pragmatic types with this connective at the same age. These results suggest that pragmatic acquisition is influenced by all three factors, but that the influence of these differs with age and connective.

5.2 Introduction

There have been a number of studies over the past 50 (or so) years which have attempted to explain children's acquisition of the adverbial connectives *because* and *if* (e.g. Amidon, 1976; Bowerman, 1986; Corrigan, 1975; De Ruiter et al., in press, 2018, 2020; Diessel, 2004; Donaldson, 1984, 1986; Emerson, 1979, 1980; Emerson & Gekoski, 1980; French, 1988; Homzie & Gravitt, 1977; Hood & Bloom, 1979; Johnston & Welsh, 2000; Kuhn & Phelps, 1976; Lemen et al., submitted, in prep..; A. E. McCabe et al., 1983; A. McCabe & Peterson, 1985, 1988; Peterson & McCabe, 1985; Reilly, 1986). However, while production studies have been relatively consistent in showing that *because* is first

produced around two-and-a-half, with *if* following a few months later (e.g. Bloom et al., 1980; Braunwald, 1985; De Ruiter et al., in press; Diessel, 2004; Reilly, 1986) and that children are fairly competent in their use of these connectives (e.g. Donaldson, 1984, 1986; Hood & Bloom, 1979; A. E. McCabe et al., 1983; A. McCabe & Peterson, 1985), the results from comprehension studies are much more varied, with little clear consensus about when children can understand these connectives or the factors primarily responsible for any difficulty (e.g. compare Emerson, 1979; Emerson & Gekoski, 1980; and French, 1988). Yet despite differing conclusions from some of these studies, when taken together, many provide evidence that these connectives are especially difficult for young children (e.g. De Ruiter et al., 2018; Emerson, 1979, 1980; Emerson & Gekoski, 1980; Kuhn & Phelps, 1976), particularly in comparison to a.) the relatively young age at which they first produce them (e.g. Bloom et al., 1980; Braunwald, 1985; De Ruiter et al., in press; Diessel, 2004; Reilly, 1986), b.) the high frequency with which they hear them in naturalistic speech (De Ruiter et al., in press; Diessel, 2004) and c.) the younger age at which they seem to understand less frequently heard and produced adverbial connectives (e.g. before; De Ruiter et al., in press., 2018, 2020).

The existing research has primarily focused on the ability to interpret the semantic meaning these connectives express, while little is known about children's understanding of their different pragmatic meanings (see related arguments raised by Donaldson, 1986 for causals). Yet, given that children's production of these connectives appears to be strongly influenced by pragmatics (De Ruiter et al., in press; Kyratzis et al., 1990; Lemen et al., submitted), it is possible that young children have a better understanding of *how* to use these connectives, rather than what they actually mean (i.e. their understanding may be more strongly related to a pragmatic meaning, instead of a semantic one). For example, their use of *because* may be more strongly related to a pragmatic function of supporting "control acts", rather than a clear understanding of *because*'s semantic meaning of explaining a cause-effect relationship (Kyratzis et al., 1990). This seems plausible, given that children seem to understand that language can be used for specific functional purposes before they necessarily understand what certain words mean or regularly produce them (e.g. see Matthews, in prep.; Stephens & Matthews, 2014 for review and discussion). Moreover, studies have shown that, while children can use

function words like *no* for specific pragmatic purposes around their first birthday, the ability to demonstrate semantic understanding comes years later, with understanding of negation being impacted by pragmatic factors (see Reuter, Feiman & Snedeker, 2018 for review, results and discussion).

However, even if a pragmatic account can help explain children's acquisition of *because* and *if*, the associated developmental predictions are not necessarily straightforward. This is because these connectives can express multiple pragmatic functions (e.g. Haegeman, 1984; Kyratzis et al., 1990; Pander Maat & Degand, 2001; Redeker, 1990; Sanders, 2005; Sweetser, 1990; Van der Auwera, 1986; Van Dijk, 1979; Warchał, 2010; Zufferey et al., 2015). Unless children simultaneously acquire all pragmatic meanings, they likely learn whichever one is most "meaningful" (Slobin, 1985) first, but different approaches offer different predictions about which pragmatic type this is likely to be. For example, usage-based perspectives would expect a relationship between input/usage frequency and acquisition (e.g see De Ruiter & Theakston, 2017 for review/discussion). Although *because* and *if* express different pragmatic functions in the speech produced by, and to, English-speaking children, these functions vary in frequency (De Ruiter et al., in press; Kyratzis et al., 1990). Thus, this approach would predict that the most frequently occurring types would be the easiest. Alternatively, as the different pragmatic types also vary in terms of their complexity, cognitive complexity accounts predict that the cognitively simplest types should be the easiest (e.g. Sanders, 2005; Zufferey, 2010). Finally, a recent comprehension study suggested that a more detailed assessment of input patterns is needed to understand children's acquisition of connectives. Specifically, that the types of illocutionary acts with which some of these clauses regularly co-occur might impact children's comprehension of these connectives (Lemen et al., in prep.). Therefore, although it seems likely there is some relationship between pragmatic variation, input statistics and children's acquisition of these connectives, we do not know whether children have a preferred pragmatic function, nor which factors can best explain why one function might be preferred.

To address this, the present study used multiple measures (eye-tracking, accuracy, response time) to investigate children's (aged 3-5 years) ability to predict and interpret different pragmatic meanings expressed by *because* and *if*. This paper starts with a

summary of pragmatic patterns in children's *because*- and *if*-sentences, followed by an overview of the limited experimental literature in this area. In reviewing the patterns from the literature, we next present a framework for investigating children's understanding of the pragmatic meanings. The current study will then be summarised and discussed.

5.2.1 Functional patterns of *because* and *if* in child and child-directed speech

According to a model by Sweetser (1990) the connectives *because* and *if* can signal three different pragmatic relationships between the clauses they connect (see also e.g. Haegeman, 1984; Kyratzis et al., 1990; Pander Maat & Degand, 2001; Redeker, 1990; Van Dijk, 1979; Warchał, 2010; Zufferey et al., 2015 for related models). In Content relationships (e.g. *She eats the sandwich because/if she is hungry)*, the subordinate clause provides a cause/sufficient condition for a(n) state/event referenced in the main clause. In Speech-Act relationships (e.g. *This sandwich is for you, because/if you like peanut butter),* the subordinate clause provides support/conditions for a(n) speech/illocutionary[22] act (e.g. offer, request, command, etc.). In Epistemic relationships (*e.g. he does not like peanut butter because/if he didn't eat his sandwich),* the subordinate clause provides evidence in support of a conclusion.

Although children hear and produce all three pragmatic types for both connectives, they do not occur in speech with equal frequency (De Ruiter et al., in press; Kyratzis et al., 1990). Specifically, De Ruiter et al. (in press) analysed the speech of 14 English-speaking mother-child dyads (children aged between 2 – 5 years of age) and found that all speakers primarily produced Speech-Act relationships with *because* (see also Kyratzis et al., 1990), a finding that generally aligns with accounts of adults' usage of *because* (e.g. Diessel & Hetterle, 2011; Ford, 1993). With *if*, De Ruiter et al. (in press) found that mothers more consistently produced Content relationships, while children were more varied in their patterns. In a follow-up study using the same dataset, however, Lemen et al. (submitted) showed that the children's variation with *if* was largely explained by the presence of recurring *if* Speech-Act clauses (*if you like/want (to)*) in the children's speech. The

[22] Following Lemen et al. (submitted, in prep.), we will use the term "illocutionary act" to refer to the main clause of Speech-Act sentences (cf. Kyratzis et al., 1990; Sweetser, 1990 who use the term "speech act" for this) to avoid confusion with the name of the pragmatic category.

repetitiveness of these clauses suggested they likely did not express any true conditional relationship (see Sweetser, 1990 for related discussion in adult speech) and when these were removed from the data, children's pragmatic proportions had much less individual variation and favoured the Content function with *if,* overall. Thus, there is evidence that, although these connectives express different pragmatic relationships in speech, each connective seems to have a preferred function in child and child-directed speech (Speech-Act with *because* and Content with *if*).

From a usage-based perspective (e.g. Tomasello, 2001), based on overall frequency in input and production, we might expect that these input/production patterns mean children have an easier time understanding *because* Speech-Act and *if* Content sentences (De Ruiter et al., in press). However, despite the large body of work addressing the pragmatic functions of these connectives from a theoretical perspective (e.g. Haegeman, 1984; Pander Maat & Degand, 2001; Sanders, 2005; Sweetser, 1990; Van Dijk, 1979; Warchał, 2010), very little research has explored the role this might play in children's comprehension of *because* and *if*. Based on the two studies that have investigated this (Corrigan, 1975; Lemen et al., in prep.), there is some evidence that there are differences in when the different pragmatic types are acquired. However, as will be discussed in the following section, these studies offer different explanations for these findings.

5.2.2 Children's comprehension of *because* and *if*-sentences expressing different pragmatic relationships

Although no previous study (of which we are aware) has directly compared comprehension of all three pragmatic types, there is evidence that Content relationships are easier to understand than Epistemic, at least for *because*. Corrigan (1975) compared children's (aged 3 – 7 years) understanding of *because*-sentences expressing Affective, Physical and Concrete Logical causality (where the former two generally align with Sweetser's, 1990, Content and the latter with Sweetser's, 1990, Epistemic). She found that children had more correct responses to the sentences expressing Affective and Physical causality relationships (see also Zufferey et al., 2015 for similar cross-linguistic patterns; and Donaldson, 1986 for similar patterns based on a different pragmatic framework).

While a higher accuracy with Content in comparison to Epistemic aligns with a prediction based on overall frequency (see section 5.2.1.), Corrigan (1975) (in line with Piaget, e.g. Piaget & Inhelder, 1969) argued that young children's difficulty with Concrete Logical sentences could be explained developmentally, where performance on these sentences is related to reaching the concrete operational stage of development (around 6-7 years). The argument that there may be developmental differences in the acquisition of the pragmatic types has also been put forward in more recent literature. For example, Zufferey (2010) (see also discussion in Sanders, 2005) argued that Content sentences are the easiest, as interpretation of Speech-Act and Epistemic sentences require additional cognitive skills. Specifically, she argues Speech-Act sentences demand metacommunicative skills, while Epistemic sentences demand even later-acquired metacognitive skills (Zufferey, 2010). Zufferey (2010) also argues that, although Speech-Act sentences are more complex than Content, both express meaning explicitly (rather than implicitly like Epistemic). Thus, the difference between Content and Speech-Act is assumed to be less pronounced than between these two types and Epistemic, further reinforcing the level of difficulty associated with Epistemic sentences. The results of Corrigan (1975) are, therefore, predicted by both overall input/usage frequency (as reported in De Ruiter et al., in press; Kyratzis et al., 1990) and cognitive complexity (e.g. Zufferey, 2010) accounts, meaning the extent to which either factor influences accuracy remains unclear. Furthermore, without a comparison to Speech-Act, we know little about how the specific differences in cognitive complexity associated with this sentence type relate to comprehension, nor whether these patterns may be better explained by input frequency.

In an attempt to determine whether children's acquisition of these connectives is influenced by frequency and/or cognitive complexity, Lemen et al. (in prep.) compared children's (aged 3 and 5) comprehension of Content and Speech-Act *because*- and *if*-sentences. While we found differences across pragmatic types, the patterns changed with age, gender, connective and measure. Specifically, children were most accurate with *if* Content sentences (although, this pattern appeared to be primarily driven by data from girls, with boys acquiring the different pragmatic types simultaneously at a slightly older age). Thus, the accuracy data suggest an interaction between cognitive complexity and

input frequency– i.e. *if* Content is easiest because this is the sentence type where these factors overlap. However, taking the response time data into account, where children were slowest with the highly frequent (De Ruiter et al., in press) *because* Speech-Act sentences, we provided an alternative explanation. Specifically, we suggested (in line with Shatz', 1978 "action response" strategy; and evidence from Veneziano, 2001 that children begin to overlook their mothers' justifications to oppositional utterances) that the slower response times with *because* Speech-Act may be related to the fact that children most regularly encounter *because* Speech-Act sentences that require an immediate response (i.e. Commands, Lemen et al., submitted). Because of this, children may learn to focus on responding to the illocutionary act, itself, deprioritising the following *because*-clause and, as a result, have very limited experience with interpreting the two clauses of *because* Speech-Acts together as one unified sentence. Consequently, when asked to interpret overall sentence meaning in the study, children may have processed the two clauses separately and integrated them afterwards (e.g. Millis & Just, 1994) rather than gradually establishing meaning by interpreting the clauses together in an incremental way (in line with Traxler, Bybee & Pickering, 1997). We also argued that children's lower accuracy on *because* Speech-Act in comparison to *if* Content may reflect the influence of these specific input patterns (i.e. that children may not regularly interpret these utterances as unified sentences), not cognitive complexity. Thus, we suggested that children's ability to interpret these sentences may be primarily related to input patterns but at the level of both specific usages and overall distributional frequency.

However, as also pointed out in Lemen et al. (in prep.), to be able to confirm this hypothesis, more detailed information about processing is required. This highlights a limitation of relying solely on accuracy and response time data for sentence comprehension. That is, while these measures provide information about how children ultimately interpret sentence meaning and the time it takes to do so, they do not provide information about how children process the sentences in real-time or the specific time at which any processing differences occur.

5.2.3 Towards a framework for evaluating children's comprehension of the different pragmatic meanings of *because* and *if*

In summary, we have outlined three possible factors which may influence children's pragmatic understanding of these connectives:

1. differences in overall input/usage frequency (De Ruiter et al., in press; Kyratzis et al., 1990; Lemen et al., submitted);
2. differences in cognitive complexity (e.g. Sanders, 2005; Zufferey, 2010; Zufferey et al., 2015);
3. differences in patterns associated with how the pragmatic types are used in naturalistic speech (Lemen et al., in prep.).

However, existing research does not give us a clear idea as to which factor (or combination of factors) can best explain why children may have an easier time with some pragmatic meanings than others. That is, while Corrigan (1975) showed that children were more accurate with Content sentences with *because,* it is not clear whether this is due to differences in cognitive complexity or overall input frequency; while Lemen et al. (in prep.) showed that children were most accurate overall with *if* Content, it remains unclear as to whether this is due to an interaction between cognitive complexity and input frequency or an interaction between specific usage patterns and input frequency.

Furthermore, although Lemen et al. (submitted) showed that *because* and *if* are both associated with specific functional patterns, the impact of these patterns on acquisition may differ for the two connectives. For example, while we showed *because* Speech-Act often co-occurred with commands in input, we found *if* had stronger associations with politeness (a pattern also found in more theoretical accounts; e.g. Sweetser, 1990; Van der Auwera, 1986). Given the arguable salience of commands, alongside the fact that *because* Speech-Act is heard/produced far more frequently (De Ruiter et al., in press.; Kyratzis et al., 1990), it is possible that these patterns influence acquisition more for *because* than *if.* However, without a clear baseline[23] for how children process these

[23] Although Traxler et al. (1997) show that adults process complex causal sentences incrementally and Borovsky et al. (2012) show that children process transitive sentences incrementally, we are not aware of any studies showing how preschool-aged children process these kinds of complex adverbial *because*- and *if*-sentences, specifically.

sentences in the first place, it is difficult to say with certainty where any processing delays – or advantages – exist within these sentences, let alone how they can be explained.

To help resolve these issues, a predictive looking paradigm will be helpful. Through this, we can see how children's predictions about meaning change as the sentence unfolds (e.g. Borovsky et al., 2012, 2014; Gambi, Pickering & Rabagliati, 2016; Mani & Huettig, 2012), allowing us to gather information about how and when processing might differ across the different sentences types. For example, if, as Lemen et al. (in prep.) suggest, children do process the clauses in *because* Speech-Act sentences separately, they may make predictions about the speaker's meaning after hearing the illocutionary act, rather than utilising the connective to interpret overall sentence meaning. Alternatively, if children are unfamiliar or have difficulty with a particular pragmatic meaning, it seems unlikely that they will be able to reliably predict the cause or condition at all. Therefore, through predictive looking, we can investigate how children's processing changes based on the pragmatic function of the connective, as well as gain some information about which factors are most likely to contribute to any differences. Yet, simply because a child takes longer to process a meaning online, does not mean they cannot do so – and for this, accuracy and response time measures can provide information about children's overall ability to understand the pragmatic meanings. As such, by interpreting online measures alongside accuracy and response time we may gain more complete information about children's processing, interpretation and understanding of sentences containing these connectives. This is the focus of the present study.

5.3 Present study

5.3.1 Aims

The present study used predictive looking, accuracy (i.e. the ability to accurately predict the causal/conditional meaning) and response time (i.e. the time taken to accurately predict the causal/conditional meaning) measures to determine the extent to which children's understanding of the adverbial connectives, *because* and *if,* is primarily built around a particular pragmatic meaning and, if so, why this may be. Through an investigation of these patterns, we hoped to gain more insight into the extent to which this kind of pragmatic variation may impact children's acquisition of these connectives, as well as a better understanding of the factors influencing children's pragmatic

understanding. With regard to specific hypotheses, the existing literature does not provide enough information about children's processing and comprehension of these connectives in the speech of others to allow us to make informed predictions about the directions of the patterns we might find. That is, although we have identified three factors which may impact comprehension (i.e. overall input frequency, cognitive complexity, specific usage patterns), based on existing literature, we do not have a clear idea as to which one has the strongest influence, nor how they might interact. As such, this study is primarily exploratory, which through the use of multiple measures (accuracy, response time and looking behaviour), aims to determine a. whether children have a preferred pragmatic function for these connectives and b. whether any preferences can be explained by differences in overall input frequency, cognitive complexity or specific usage patterns associated with the different pragmatic types.

5.3.2 Methods

5.3.2.1 Participants

92 monolingual English-speaking children were recruited and tested either at the University of Manchester Child Study Centre or at their school/nursery. To provide a comparison at different developmental points, there were two age groups for the children: three-year-olds (n = 45, 3;00:08 – 3;10:27, M = 3;06, SD = 3.09) and five-year-olds (n = 47, 4;06:17 – 5;06:26, M = 5;02; SD = 3.43). To ensure that the stimuli was being interpreted in the way that it was intended 22 monolingual, English-speaking university students were also tested. None of the participants had any known language or developmental delays.

5.3.2.2 Language and executive function tasks

In line with De Ruiter et al. (2018) and Lemen et al. (in prep.), to control for factors which could possibly confound results (i.e. executive function and general language skills), measures of language, inferencing skill, memory and Speech-Act causality understanding were taken. As in these earlier studies, the scores from these tasks were first tested to see if they correlated with accuracy and response times; those that did were tested as controls in the models, only being retained when they improved model fit. In total, these additional tasks lasted approximately 10 minutes. These tasks were always done at the end of the session; thus their inclusion did not impact the data collected for the

connectives comprehension task. The details of these tasks are summarised below. Adults did not perform the additional tasks.

5.3.2.2.1 *Speech-Act Causality*

To assess children's ability to understand that speakers' utterances can be linked to particular situations, children were asked to match an utterance to one of two images in a series. Images were presented on laminated paper and the experimenter asked the child to point to the picture that would make a parent or teacher say a particular phrase (e.g. children saw picture of a girl who is crying and throwing her toys around and a picture of a girl who has just built a tower of blocks and were asked which one would make their parent/teacher say "Well done!"). This task consisted of four trials.

Figure 5.1: Example images from Speech-Act causality task. On seeing this set of images, children were asked to point to the picture that would make a parent/teacher say *Well done!*

5.3.2.2.2 *Digit Span*

A digit span test (adapted from Wechsler, 2014) was used to assess children's short term memory. Children were asked to try to repeat numbers that the experimenter said. Number sequences were first presented in forward order, in sets of two. Children provided a response to the first sequence in a set before they heard the second sequence. Provided they correctly repeated at least one of the sequences in a set, they would advance to the next set, where the sequences were one number longer. On providing incorrect answers to both sequences in a set, the task began again, but this time children were asked to repeat number sequences backwards (e.g. responding 8-3 when the experimenter said 3-8). The task ended when children were unable to correctly repeat either sequence in a set in reverse order. For both forward and backward sequences, the shortest sequences were two digits long. There were eight sequence lengths for forward and seven for backward. One point was given for every individual sequence a child correctly repeated, meaning that children could score a maximum of

two points for every sequence length (maximum total score forward = 16 points; maximum total score backward = 14 points).

5.3.2.2.3 *Receptive language*

The Sentence Structure sub-test from the Clinical Evaluation of Language Fundamentals®-Preschool-2 (CELF) (Wiig et al., 2004) was used to assess children's receptive language skills. For each trial in this task, children were shown images in a book and they had to choose the image that matched a sentence that the experimenter read. The task starts with simple sentences and progresses to complex constructions.

5.3.2.2.4 *Inferencing task*

To fully understand the stories in the connectives comprehension task, some inferencing skills were required. To provide a measure of children's ability to draw such inferences, a task assessing children's global and local inferencing skills was designed based on Freed and Cain (2016) and Language and Reading Research Consortium (LARRC) and Muijselaar (2012). In this task, children heard four short stories, such as *Kevin woke up very hungry. He could smell the breakfast his mother was cooking in the kitchen. Kevin picked out some jeans and a sweatshirt. After he got dressed, he went to the kitchen to go eat.* Children were then asked one local (e.g. What was Kevin wearing when he went to the kitchen to eat?) and one global (e.g. What time of day was it?) inferencing skill question for each story. Local and global inferencing scores were calculated separately.

5.3.2.3 Eye-tracking Task (Connectives comprehension)

5.3.2.3.1 *Design*

The aim of this study was to explore whether children have expectations about how *because* and *if* typically function. To test this, a task was designed where children had to predict how a sentence would end by selecting the image that completed a *because* or *if*-sentence. Via this design, we were able to see how their abilities (i.e. the ability to accurately predict the cause/condition and the time taken to make that prediction) and online processing (i.e. predictive looking) and differed across sentence types, as well as how these measures relate to one another. To provide the most complete picture of how children's expectations change with pragmatic type, all three pragmatic types in Sweetser's (1990) model were included (Content, Speech-Act, Epistemic).

Eye-tracking data was analysed during the time when the connective was spoken and also during the subsequent subordinate clause. The connective window allowed us to examine patterns in children's online processing of the connective, itself . That is, given evidence that children process sentences incrementally (e.g. Borovsky et al., 2012) and evidence that adults do this for complex causal sentences, specifically (Traxler et al., 1997), it allowed us to compare how processing differed across pragmatic types when hearing the connective. In particular, it allowed us to compare if children make predictions on hearing these connectives and how the patterns associated with this differ. The subordinate clauses, which were effectively the "answer", were included so that we could gain some measure as to children's confidence in their responses and how this varied across pragmatic types. That is, although participants had already selected their response by the time they heard the subordinate clause, if a participant was absolutely certain that their response was the correct one, we hypothesised that there would be little need to look to the distractor to confirm this. However, as confidence in that response decreased, we expected that participants would be more likely to look to the distractor while hearing the subordinate clause to ensure that the distractor image was not a better match for the unfolding clause than the one they had selected.

5.3.2.3.2 *Audio and images*

For all sentence types, short stories about four characters (Charlie, Sophie, Henry and Daisy) were created. In contrast to Lemen et al. (in prep.), we used stories instead of isolated sentences to best ensure children understood the speaker's intention (see Sweetser, 1990; Zufferey, 2010, for discussion of the role of context on clarifying the type of pragmatic relationship being expressed). As utterances in naturalistic speech are typically interpreted in the context of a discourse and not in isolation, we also expected this would make the conditions for interpreting these sentences increasingly natural. Due to differences in the types of *because* and *if* Speech-Act sentences children normally hear (e.g. where *because* is normally heard alongside directives and *if* has stronger associations with politeness; Lemen et al., submitted), the illocutionary acts used alongside the Speech-Act sentences differed to best reflect patterns in the input as much as possible. This allowed us to focus on how children's acquisition is impacted by the specific input patterns they hear most frequently. As such, the illocutionary acts in the *because* Speech-

Act sentences in the present study were commands/instructions about behaviour (e.g. 'Settle down a little bit'), while the *if* Speech-Act sentences primarily related to politeness via permission or an offer (e.g. 'Here is a nice blanket'). All stories were 28 – 33 words (M = 30.5, SD = 1.4), with the main clause of each test sentence consisting of five words.

To test the three different pragmatic types for two connectives, different stories had to be constructed for each condition. This meant we could create stories that most clearly presented the different pragmatic types and use scenarios that children were likely to recognise. However, it also means there is a higher degree of variation between the stimuli for the different sentence types than would be ideal under the most controlled conditions. Without careful consideration to this, caution would need to be applied when interpreting the results to ensure that patterns were based on general trends associated with the different connective functions, rather than effects of individual test items. For example, semantic differences may lead to differences in results if children have varying levels of understanding of the types of causal/conditional situations depicted. To address this, all efforts were made to try to have the scenarios focus on the same four general semantic aspects, which we expected children to be familiar with: heat/temperature, wetness/water, feeling tired/unwell, cleanliness/routine/order. (Figure 5.2 shows a visual depiction of a Because Content sentence; examples of image sets for the other sentence types are found in Appendix 5.1). Furthermore, this was accounted for in the statistical analysis, where (as is discussed in the Detailed Analysis Strategy in Appendix 5.2) the use of maximal random effect structures for models was expected to yield a more conservative result (Barr et al., 2014). Additionally, as the models contained random intercepts for item, the difference in individual stories on the overall results is expected to be minimal.

The first sentence in each story provided information relevant to the cause/condition (Content, Speech-Act or Epistemic) that the participant would be asked to interpret. The second sentence provided related information, but also served to temporally separate the first sentence from the appearance of the target and distractor images at the start of third sentence. The third sentence always began "[Character's name]'s mum says:" and was then followed by the main clause and connective of the test sentence. The subordinate clauses described the cause/condition for the event (Content sentences),

illocutionary act (Speech-Act sentences) or conclusion (Epistemic sentences) based on the information given in the first sentence of the story. All test item stories are provided in Appendix 5.1.

Five warm up and three filler stories were also constructed. These followed the same format, but the sentences were coordinated with *and* rather than *because* or *if,* meaning participants did not have to interpret a causal/conditional relationship. By following the same format for warm up and test items, we were able to provide feedback to participants during the warm up to make sure they understood the task, but without contributing to their understanding of *because* or *if*. Warm ups always occurred in the same order, although participants only heard the final two if they had difficulty with the first three. All participants heard the same three fillers, which were fully randomised along with the rest of the test items in the main task. A native speaker of British English recorded all audio items using natural prosody in Audacity v 2.3.0 [24] (Audacity Team, 2018).

For each story, an image set was designed, containing a target and distractor image (see example in Figure 5.2, section 5.3.2.3.4). The target images reflected the most likely cause/condition based on the information given in the first sentence of the story, thus matching the subordinate clause. The distractor images depicted a situation that could also be interpreted as a cause/condition given the main clause of the test sentence, but that did not fit with the information given in the story. This was designed to ensure children were relying on the information in the story to make their decision, rather than making up their own causes/conditions.

All items were presented in a left-right visual display, with a gap in the centre to provide a clear distinction between the two images. Image order (left-right) was counterbalanced, so that the target images appeared on the left for half of each sentence type. Two stimuli lists existed, but as trial order was randomised for each participant, the only difference

[24] Audacity® software is copyright © 1999-2019 Audacity Team.
The name Audacity® is a registered trademark of Dominic Mazzoni.

between the lists was that the target images appearing on the left in list one appeared on the right in list two. Participants were allocated as equally as possible across the two lists.

5.3.2.3.3 *Eye-tracking equipment and set up*

SR Research Experiment Builder was used to build and run the connectives comprehension task via an EyeLink Portable Duo (SR Research, Mississauga, Ontario, Canada). The display computer was a Lenovo Thinkpad L470 and the host computer was a Lenovo Thinkpad T470. Participants sat at a table or desk with the display laptop in front of them. The eye-tracking camera, adjusted to the height of participants, sat on the keyboard to the display laptop. Participants wore stickers on their foreheads so that the eye-tracker could locate the participant's head and determine its position. The host laptop, on which the experimenter controlled the programme, faced away from participants so that they would not be distracted by it. A three-point calibration was done prior to the warm ups. The eye-tracker recorded eye position every two milliseconds at 500 Hz.

In addition to looking behaviour, we also collected accuracy and response time data. The participants' responses for these measures were recorded via a Microsoft Sidewinder game controller. To select the image on the left side of the screen, participants pressed a button at the top left of the controller; to select the image on the right side of the screen, participants pressed a button at the top right of the controller. The controllers did not become active until after the connective was spoken in the audio, so responses were only recorded from that point onwards.

5.3.2.3.4 *Procedure*

Prior to the start of any of the tasks, all participants were given a full explanation of how to play the game and had the opportunity to ask any questions. Once any questions were answered, they were asked to confirm whether they were happy to participate in the task[25]. After calibration of the eye-tracker, the warm up trials began. All participants heard the same first three warm ups and were given feedback after their responses. Children who had difficulty with the warms ups were given another two warms ups with

[25] Testing did not proceed for anyone who did not confirm verbal assent. Additionally, written consent was provided by adult participants, head teachers and caregivers prior to testing, in line with the approved ethics procedure. This study was approved by the University of Manchester's University Research Ethics Committee, Ref: 2019-5773-9339. "Do children make predictions about meaning in complex sentences?"

feedback, to best ensure they understood how the game worked. For all items, participants first saw a smiley face on the screen, which remained on the screen during the first two sentences of every story. This ensured that participants did not see the images while hearing the first sentence, where information relating to the cause/condition was expressed. As the first sentence contained the important information about the cause/condition, participants were asked a question about that sentence after hearing it to make sure they had both heard and understood it (e.g. "What did Charlie do?"). If participants were unable to answer this or got it wrong, the correct information was then repeated by the experimenter to ensure the participants knew and understood this information before the trial progressed. The target and distractor images appeared onscreen at the onset of "[Character's name]'s mum said:" and remained there until the end of the trial. After hearing the main clause and connective from the test sentence, participants were asked to select the image that matched with how they thought the mother's sentence would end. Participants were able to take as long as they wanted to respond, but the subordinate clause only played after they made their response. After the end of the subordinate clause, the trial proceeded automatically to the next. Figure 5.2 shows a visual depiction of the procedure.

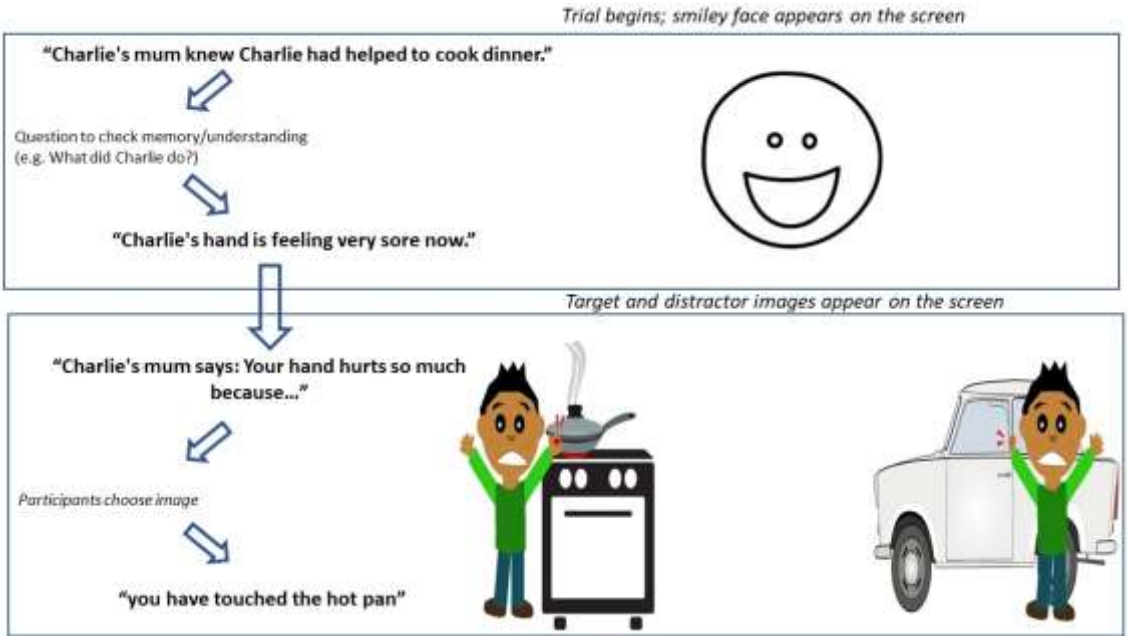

Figure 5.2. Visual depiction of the study design. Participants saw a smiley face while hearing the first two sentences of the story. At the start of the third sentence, the target and distractor images appeared. After hearing the main clause of the test sentence (e.g. Your hand hurts so much) and connective (*because/if*), participants had

to select the image that they thought matched with how the sentence would end. Once they selected the image, they heard the subordinate clause.

5.4 Results

5.4.1 Analysis strategy

This section provides an overview of the analysis strategy. More specific details about how the data was analysed is in appendix 5.2. The results for the additional executive function and language tasks are presented first, as any tasks that correlated with accuracy and response time were compared against maximal mixed effects models to see if they improved model fit. After a summary of these scores, the eye-tracking data are presented, followed by accuracy and then response time results.

For all measures (looking behaviour, accuracy and response time), Bayesian mixed models (see e.g. Granlund et al., 2019; Nicenboim et al., 2018 for discussion of suitability of Bayesian models over frequentist models in language research) were run with the *brms* package (Bürkner, 2018) (which runs RStan (Stan Development Team, 2018) concurrently). For looking behaviour, window analyses in *eyetrackingR* (Dink & Ferguson, 2015) were run on correct responses for both the connective and the subordinate clause. For the accuracy and response times models, there were two within-subject factors (Pragmatic Type = Content, Speech-Act, Epistemic; Connective = Because, If), with one between-subject factor for children (Age = Three, Five). All predictors were centred and maximal models included all predictors, as well as all two-way and three-way interactions. Additionally, to control for Trial Order and Gender, as well as the scores from the executive function and language tasks, these factors were individually compared against the maximal model using the Leave One Out (LOO) cross-validation method in *brms* (Bürkner, 2019). These items were only retained when they resulted in a better fit of the model. Treatment contrasts were used for binary predictors (Age, Connective) and sum contrasts for Pragmatic Type, which has three levels, thus the output of the model for each predictor shows a comparison to the mean, rather than one reference level.

Both window analyses and response time models were run only on items for which children gave correct responses to give us the clearest measure of any differences between types, without the additional confound of differences due to differences in accuracy. To be able to provide the clearest idea of looking behaviour, window analyses

were run individually for each age group and connective. For accuracy and response time models, the children's data were analysed together, but due to the possible relationship between executive function/language tasks (which the adults did not do) and accuracy and response time scores, adults and children's models were run separately.

Mean, upper and lower 95% credible intervals and Probability (P) will be reported for Bayesian models. In line with Engelmann et al. (2019) and Lemen et al. (in prep.), P values in this paper are interpreted as follows:

- P values close to .5 = no evidence for an effect;
- P values starting around .85 and up to .9499 = weak evidence for an effect; and
- credible intervals that do not cross zero and/or P values at .95 or above = strong evidence for an effect.

Additionally, for comparisons using emmeans (Lenth, 2019), Highest Posterior Density (HPD) intervals are cited in place of standard credibility intervals. The two are similar, but HPD "summarizes the distribution by specifying an interval that spans most of the distribution, say 95% of it, such that every point inside the interval has higher credibility than any point outside the interval" (Kruschke, 2015, p. 87). Here, we have strong evidence for an effect when the contrasts do not cross zero.

5.4.2 Exclusions

5.4.2.1 Fillers

As the fillers were relatively easy, we expected all children to be able to answer them without difficulty. However, they did require an understanding of how to perform the task (i.e. that children needed to interpret the test sentences in the context of the story they had heard). As such, if children failed two of the three fillers, we interpreted this as meaning they did not understand how to perform the task in general, and their data should be excluded. While no five-year-olds got more than one filler wrong, five three-year-olds responded incorrectly to two of the three.

5.4.2.2 Trackloss and response times

For the window analyses, an overall trackloss threshold was set on the datasets at .7 (i.e. any trials where overall trackloss was greater than 70% were removed from the looking behaviour analyses). After the looking behaviour windows were set, the data was cleaned for trackloss a second time, this time at a .5 threshold, removing any remaining trials with trackloss above 50% within the specified window. Table 5.1 shows a summary of trackloss removals, where the second column (full data) shows the number of trials removed after

the first trackloss removal (i.e. based on the full trial for each participant) and the subsequent columns show the trials removed after the second track loss removal for each looking window.

Table 5.1: Summary of total trials and those removed from windows analyses due to trackloss

			Because		If	
Age	**Trials prior to cleaning**	**Full data**	**Connective**	**Subordinate**	**Connective**	**Subordinate**
Three	505	226	33	69	30	73
Five	694	157	65	88	56	66
Adult	473	29	4	2	3	2

There were three trials in the three-year-olds' data which, due to technical failure, resulted in response times of over 60 seconds. These were removed from the data.

5.4.3 Language and executive function task scores

A summary of the scores for each age group on the Digit Span, Sentence Structure, Speech-Act causality and Inferencing tasks are in Table 5.2.

Table 5.2: Summary of children's performance on executive function/language tasks

Task	Three-year-olds				Five-year-olds			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Speech-Act causality	3.2	0.9	1	4	3.8	0.5	2	4
Digit Span Forwards	5.1	1.8	2	10	6	1.8	2	11
Digit Span Backwards	0.1	0.3	0	2	1.7	1.1	0	4
CELF Sentence Structure (standardised scores)	8.2	3.5	2	16	9.8	2.6	6	15
Inferencing (Global)	1.7	1.1	0	4	3.1	1.1	0	4
Inferencing (Local)	1.4	0.9	0	3	2.4	1.1	0	4

Bayesian correlations with accuracy and response time were then run (using BayesMed package; Nuijten, Wetzels, Matzke, Dolan, & Wagenmakers, 2015) for the scores of each task. Backwards Digit Span and both Inferencing tasks correlated with both measures, while there was anecdotal evidence Speech-Act causality also correlated with response times. Table 5.3 shows the correlations for all tasks.

Table 5.3: Correlations and Bayes Factors (rounded to nearest hundredth) between Speech-Act causality, Digit Span, CELF Sentence Structure and Inferencing task scores

and accuracy and response time, along with BayesFactors interpretation labels as cited in Wetzels et al. (2011) (collapsed across children's age groups)

Task	Correlation with Accuracy			Correlation with Response Time		
	R	Bayes Factor	Interpretation	R	Bayes Factor	Interpretation
Speech-Act causality	.2	.2	Substantial evidence for H_0	**-.2**	**1.4**	**Anecdotal evidence for H_A**
Digit Span Forward	.2	.6	Anecdotal evidence for H_0	-.2	.5	Anecdotal evidence for H_0
Digit Span Backwards	**.3**	**3.6**	**Substantial evidence for H_A**	**-.5**	**136708.3**	**Decisive evidence for H_A**
CELF Sentence Structure	.2	.6	Anecdotal evidence for H_0	-.2	.5	Anecdotal evidence for H_0
Inferencing (Global)	**.3**	**13.8**	**Strong evidence for H_A**	**-.4**	**33.1**	**Very strong evidence for H_A**
Inferencing (Local	**.4**	**32.2**	**Very strong evidence for H_A**	**-.3**	**10.6**	**Strong evidence for H_A**

5.4.4 Connectives comprehension

5.4.4.1 Looking behaviour

5.4.4.1.1 *Three-year-olds' connective*

First, we present the eye-tracking data. Here, participants' looking behaviour was examined to determine whether proportional looks to target images within the specific time window (i.e. either while the connective or subordinate clause was spoken) varied based on the pragmatic function of the connective. The data is presented for each age group separately (three-year-olds, five-year-olds, then adults). For each age group, the connective window analysis is first, followed by the subordinate clause window analysis.

Figure 5.3 shows the three-year-olds' looking behaviour when the connective was spoken. For *because*, in relation to the mean, there were more looks to target for Content (weak evidence, mean: 1.2801, lower credible interval: -0.5226, upper credible interval: 3.0144, P = 0.9170), fewer for Epistemic (strong evidence, mean: -1.6230, lower credible interval: -3.5906, upper credible interval: 0.3757, P = 0.9538), but no reliable difference for Speech-Act (mean: 0.3554, lower credible interval: -1.4656, upper credible interval: 2.2024, P = 0.6565).

For *if*, in relation to the mean, there were more looks to target for Epistemic (moderate evidence, mean: 2.1441, lower credible interval: -0.5409, upper credible interval: 4.8755, P = 0.9405), fewer for Speech-Act (weak evidence, mean: -1.6581, lower credible interval:

-4.4383, upper credible interval: 1.1678, P = 0.8852), with no reliable difference for Content (mean: -0.4439, lower credible interval: -3.2895, upper credible interval: 2.2484, P = 0.6318).

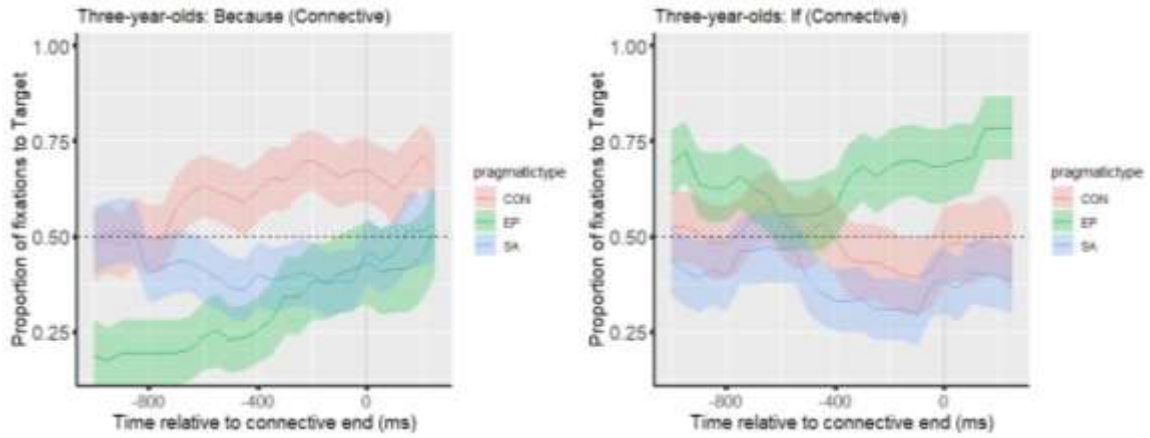

Figure 5.3: Plot of three-year-old's looking behaviour when hearing connectives, showing more looks to target for *because* Content and *if* Epistemic and fewer looks to target for *because* Epistemic and *if* Speech-Act.

5.4.4.1.2 *Three-year-olds' subordinate clause*

Figure 5.4 visualises three-year-olds' looking behaviour immediately prior to/during the subordinate clause of the sentences. For *because*, in relation to the mean, there were no reliable differences between the pragmatic types (Content – mean: 0.6037, lower credible interval: -1.3883, upper credible interval: 2.489, P = 0.7418; Epistemic – mean: 0.1771, lower credible interval: -1.9256, upper credible interval: 2.2342, P = 0.5725; Speech-Act – mean: -0.8187, lower credible interval: -2.6482, upper credible interval: 1.058, P = 0.8202).

For *if*, in relation to the mean, there were more looks to target for Speech-Act (weak evidence, mean: 1.5127, lower credible interval: -1.1443, upper credible interval: 4.1348, P = 0.8835), but there were no reliable differences for the other two pragmatic types (Content: mean: -1.1331, lower credible interval: -3.6234, upper credible interval: 1.7784, P = 0.8263; Epistemic: mean: -0.4434, lower credible interval: -3.5083, upper credible interval: 2.2066, P = 0.6257).

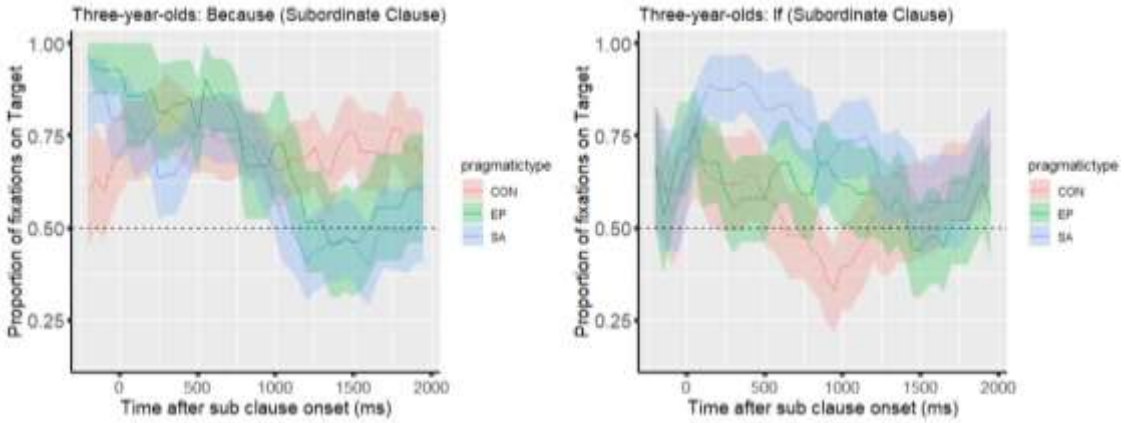

Figure 5.4: Plot of three-year-old's looking behaviour at subordinate clauses, showing more looks to target for *if* Speech-Act, with no differences between any of the other pragmatic types for either connective.

5.4.4.1.3 *Five-year-olds' connective*

Figure 5.5 shows the five-year-olds' connective looking behaviour. In relation to the mean, the *because* data showed more looks to target for Speech-Act (strong evidence, mean: 1.2956, lower credible interval: 0.1571, upper credible interval: 2.4394, P = 0.9862), fewer for Epistemic (strong evidence, mean: -1.1721, lower credible interval: -2.2433, upper credible interval: -0.0854, P = 0.9812), with no difference for Content (mean: -0.1053, lower credible interval: -1.2441, upper credible interval: 1.0156, P = 0.5695).

With *if*, in comparison to the mean, there were more looks to target for Content (strong evidence, mean: 1.5894, lower credible interval: -0.2769, upper credible interval: 3.3316, P = 0.9552), fewer for Epistemic (weak evidence, mean: -1.0625, lower credible interval: -2.7758, upper credible interval: 0.7606, P = 0.8965), with no reliable evidence of a difference for Speech-Act (mean: -0.4967, lower credible interval: -2.2758, upper credible interval: 1.3452, P = 0.7450).

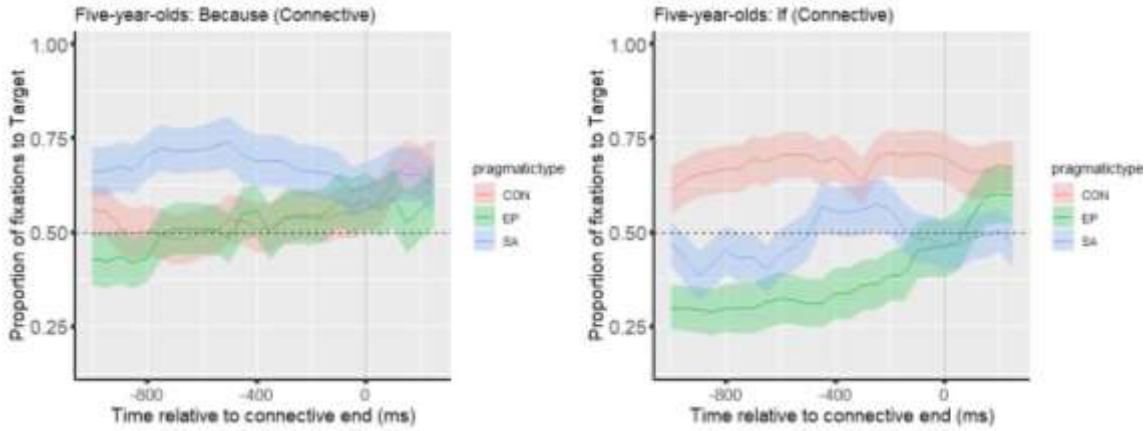

Figure 5.5: Plot of five-year-old's looking behaviour when hearing connective, showing that looks to target for *because* Speech-Act and *if* Content were above the mean, while looks to Epistemic were below the mean for both connectives.

5.4.4.1.4 *Five-year-olds' subordinate clause*

Figure 5.6 visualises five-year-olds' subordinate clause looking behaviour. There was no reliable evidence for any differences between the pragmatic types for either connective. *Because*, Content – mean: 0.4416, lower credible interval: -0.6102, upper credible interval: 1.3972, P = 0.8212; Epistemic – mean: 0.0350, lower credible interval: -1.0032, upper credible interval: 1.1068, P = 0.5242; Speech-Act – mean: -0.4823, lower credible interval: -1.4803, upper credible interval: 0.577, P = 0.8352.

If: Content- mean:-0.2248, lower credible interval: -1.1728, upper credible interval: 0.7194, P = 0.6955; Epistemic- mean: 0.1469, lower credible interval: -0.8205, upper credible interval: 1.1043, P = 0.6248; Speech-Act: mean: 0.0799, lower credible interval: -0.8517, upper credible interval: 1.0355, P = 0.5692.

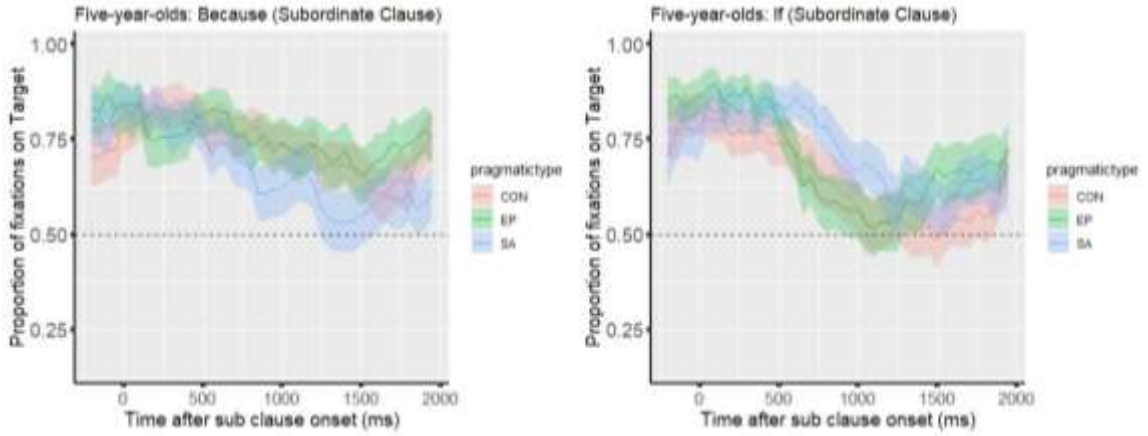

Figure 5.6: Plot of five-year-old's looking behaviour at subordinate clauses, showing no differences between the mean and any sentence type for either connective.

5.4.4.1.5 *Adults' connective*

Figure 5.7 shows adults' connective looking behaviour. For *because*, in relation to the mean, there was no reliable evidence of a difference for any sentence type (Content – mean: 0.6318, lower credible interval: -1.1122, upper credible interval: 2.3797, P = 0.7732; Epistemic – mean: -0.4831, lower credible interval: -2.2167, upper credible interval: 1.3028, P = 0.7240; Speech-Act – mean: -0.1570, lower credible interval: -2.004, upper credible interval: 1.6322, P = 0.5810).

For *if,* there were more looks to target for Content (strong evidence, mean: 1.0354, lower credible interval: 0.11, upper credible interval: 2.0215, P = 0.9852), fewer for Epistemic (weak evidence, mean: -0.5061, lower credible interval: -1.5207, upper credible interval: 0.5067, P = 0.8590) and Speech-Act (weak evidence, mean: -0.5360, lower credible interval: -1.5121, upper credible interval: 0.4303, P = 0.8772).

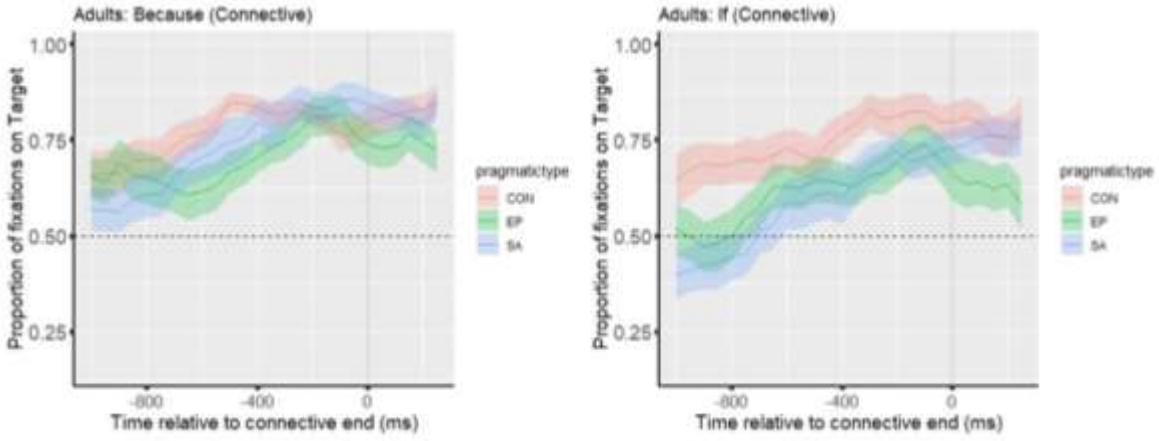

Figure 5.7: Plot of adults' looking behaviour at connectives, showing more looks to target for *if* Content, fewer for *if* Speech-Act and Epistemic and no differences for any of the *because* sentences.

5.4.4.1.6 *Adults' subordinate clause*

Figure 5.8 plots adults' subordinate clause looking behaviour. For *because*, in relation to the mean, there were more looks to target for Content (weak evidence, mean: 0.5619, lower credible interval: -0.4065, upper credible interval: 1.4953, P = 0.9002), but no evidence of a difference between the other pragmatic types and the mean (Epistemic – mean: -0.2298, lower credible interval: -1.3597, upper credible interval: 0.9329, P = 0.6660; Speech-Act – mean: -0.3152, lower credible interval: -1.3944, upper credible interval: 0.8085, P = 0.7250).

For *if* there were more looks to target for Content (strong evidence, mean: 1.1349, lower credible interval: 0.3286, upper credible interval: 1.9266, P = 0.9950), and fewer for both Speech-Act (strong evidence, mean: -0.6727, lower credible interval: -1.4398, upper credible interval: 0.1227, P = 0.957) and Epistemic (weak evidence, mean: -0.4631, lower credible interval: -1.3012, upper credible interval: 0.354, P = 0.8812).

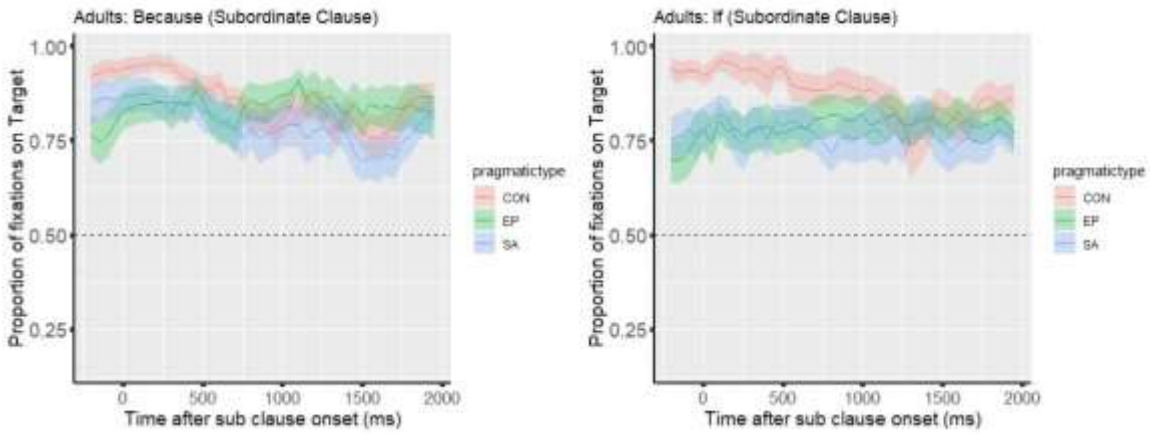

Figure 5.8: Plot of adults' looking behaviour during the subordinate clauses, showing more looks to target for *because* and *if* Content and fewer for *if* Epistemic and Speech-Act.

A summary of the looking behaviour patterns can be found in section 5.4.5.

5.4.4.2 Accuracy

5.4.4.2.1 *Children's accuracy models*

Next, we investigated accuracy on all sentence types to determine whether the participants' ability to respond accurately changed with Age, Connective, Pragmatic Type or a combination of any of those factors. We first present the children's results, followed by the adults' in section 5.4.4.2.2. Across all items, the accuracy for three-year-olds was 54.2% (SD = .5) and the accuracy for five-year-olds was 63.7% (SD = .5). Figure 5.9 shows a comparison of the children's mean accuracy by connective and pragmatic type.

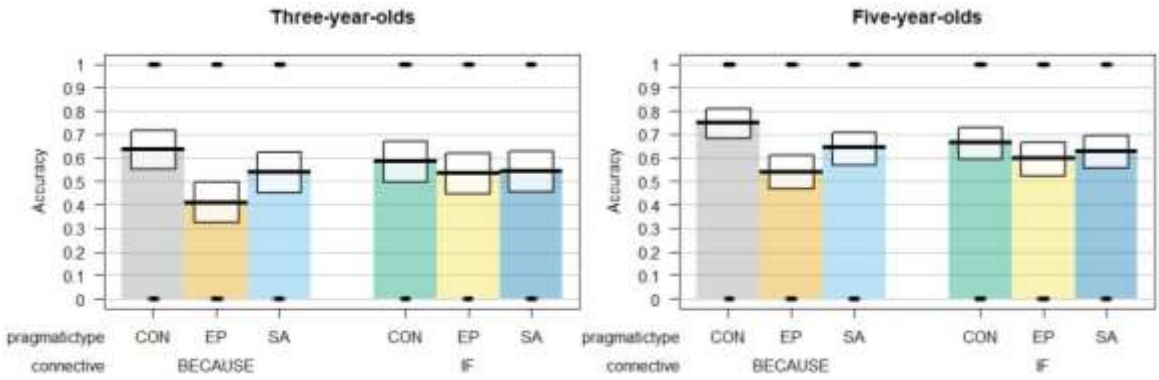

Figure 5.9: Pirateplots (Phillips, 2016) of Three-year-old and Five-year-old accuracy by Connective and Pragmatic Type

While the Backwards Digit Span, although it correlated with accuracy, did not improve the model, both the Global and Local inferencing scores did. Neither Trial Order nor Gender improved the children's accuracy model. The maximal model for the children's accuracy data is summarised in Table 5.4. This model shows strong evidence that five-year-olds were more accurate than three-year-olds and also strong evidence that children's accuracy on Content sentences was above the mean, with slightly weaker evidence that accuracy for Epistemic was below the mean. There was also weak evidence of a two-way-interaction between Age and Connective, and between Pragmatic Type (Content) and Connective.

Table 5.4: Output of Bayesian maximal model for children's accuracy

Comparison	Mean	Lower	Upper	P(b<0)||P(b>0)
Intercept	0.6824	0.1468	1.233	0.9925
Inferencing_Global	**0.0815**	**-0.0564**	**0.2177**	**0.8748**
Inferencing_Local	**0.1146**	**-0.0238**	**0.247**	**0.9545**
Age3	**-0.4009**	**-0.7718**	**-0.044**	**0.9862**
Content	**0.6989**	**-0.0612**	**1.5206**	**0.9638**
Epistemic	**-0.6191**	**-1.4039**	**0.1436**	**0.9468**
SpeechAct	-0.0846	-0.8723	0.6918	0.5808
connective_If	-0.1755	-0.9296	0.567	0.6815
Age3.Content	-0.1153	-0.591	0.349	0.6760
Age3.Epistemic	-0.0002	-0.4194	0.4225	0.5075
Age3.SpeechAct	0.1210	-0.3044	0.5531	0.7085
Age3.connective_If	**0.2566**	**-0.1678**	**0.676**	**0.8802**
Content.connective_If	**-0.5435**	**-1.6836**	**0.5801**	**0.8448**
Epistemic.connective_If	0.4873	-0.6511	1.5807	0.8165
SpeechAct.connective_If	0.0445	-1.0628	1.2014	0.5282
Age3.Content.connective_If	0.0802	-0.5358	0.7105	0.5923
Age3.Epistemic.connective_If	0.0703	-0.528	0.6451	0.5950
Age3.SpeechAct.connective_If	-0.1373	-0.73	0.4452	0.6720

Due to the presence of a three-way-interaction in the model which may make an emmeans comparison unreliable, to further explore the Age by Connective interaction and the Pragmatic Type (Content) by Connective interaction, the dataset was split by connective and models were run on both of the smaller datasets. While there was no evidence for either of these effects in the *if* model (Age: mean: -0.1499, lower credible interval: -0.5058, upper credible interval: 0.2263, P = 0.7935; Content: (mean: 0.1822, lower credible interval: -0.3749, upper credible interval: 0.7568, P = 0.7640), there was evidence for both in the *because* model (Age: strong evidence, mean: -0.4105, lower credible interval: -0.8261, upper credible interval: -0.0064, P = 0.9765; Content: weak evidence, mean: 0.7528, lower credible interval: -0.3877, upper credible interval: 2.0029, P = 0.9125). Additionally, although there was only anecdotal evidence for an interaction between Epistemic and the Connectives in the main model, there was some evidence that children's accuracy with *because* Epistemic was below the mean (weak evidence, mean: -0.6116, lower credible interval: -1.7292, upper credible interval: 0.5001, P = 0.8840) while there was no evidence the accuracy for *If* Epistemic was different from the mean (mean: -0.1531, lower credible interval: -0.7295, upper credible interval: 0.4379, P = 0.7225). This suggests that five-year-olds were better than three-year-olds with *because* but not *if* and that children were better with *because* Content and worse with *because* Epistemic, while their performance was more consistent with *if*.

5.4.4.2.2 *Children's accuracy in comparison to chance*

As the children's accuracy on many of the sentence types appeared to be close to 50%, comparisons to chance were run to provide some additional information about accuracy on each pragmatic type at each age. Overall, this showed that three-year-olds were above chance on *because* Content and *if* Content (although the evidence was only anecdotal for the latter) and that five-year-olds were above chance for all pragmatic types except *because* Epistemic. A full summary of the comparison to chance can be found in Appendix 5.3.

5.4.4.2.3 *Adults' accuracy models*

Across all items, the accuracy for adults was 89.6% (SD = .31) (see Figure 5.10).

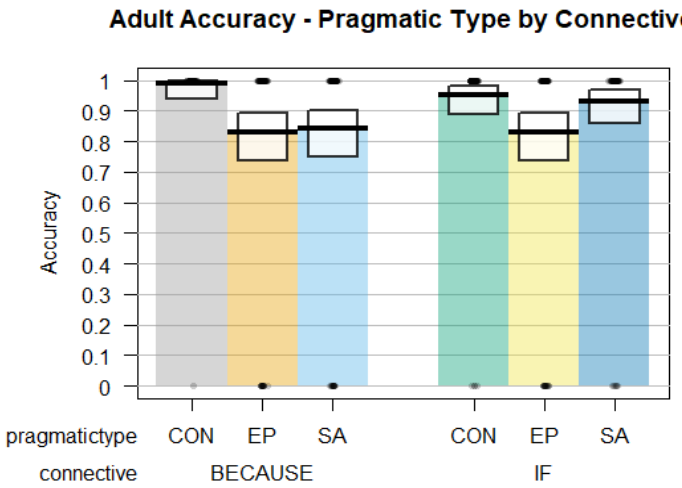

Figure 5.10: Pirateplot (Phillips, 2016) of adults' accuracy by Connective and Pragmatic Type

While Gender did not improve the model, there was strong evidence of an effect of ordering. The model (summarised in Table 5.5) shows some evidence that adults were more accurate with Content, but less accurate with Epistemic, with some additional evidence of an interaction between Connective and Content.

Table 5.5: Output of Bayesian maximal model for adults' accuracy

Comparison	Mean	Lower	Upper	P(b<0)||P(b>0)
Intercept	5.9012	2.6688	10.9474	0.9990
Order	**0.8480**	**0.3648**	**1.443**	**1.0000**
connective_If	0.8376	-4.1901	6.4739	0.6372
Content	**3.8166**	**-1.2863**	**10.4989**	**0.9392**
Epistemic	**-2.6491**	**-8.3792**	**1.5626**	**0.8962**
SpeechAct	-1.1922	-6.0112	3.5976	0.7205
connective_If.Content	**-4.5901**	**-13.4647**	**2.299**	**0.9120**
connective_If.Epistemic	0.8535	-5.9021	8.0966	0.6048
connective_If.SpeechAct	3.1649	-3.4479	11.8161	0.8382

To explore the two-way interaction between Pragmatic Type and Content, a contrast was run in emmeans (Lenth, 2019) for the Pragmatic Type by Connective interaction (see Table 5.6). This showed that, although all contrasts crossed zero, the *because* Content-Epistemic contrast crossed marginally compared to the *if* Content-Epistemic contrast. Additionally, even though a large proportion of the *because* Content-Speech-Act contrast crossed zero, it did so less than *if* Content-Speech-Act. Therefore, although (based on the relationship between the contrasts and zero) there is no strong evidence for any contrasts, this helps explain the two-way-interaction in the main model, where the patterns associated with adult's performance on Content compared to the mean differed

for the two connectives (i.e. although there was only anecdotal evidence that adults were better with *because* Content in comparison to *because* Epistemic and Speech-Act, there was more evidence that adults were better with the Content relationships with *because* than there was for *if*).

A summary of the accuracy patterns can be found in section 5.4.5.

Table 5.6: Output of emmeans (Lenth, 2019) contrasts with Tukey adjustment for the Pragmatic Type by Connective contrast in the adults' accuracy model

contrast	estimate	lower. HPD	upper. HPD	Estimate	lower. HPD	upper. HPD
Because				**If**		
CON – EP	5.87	-1.92	16.87	1.10	-7.46	8.80
CON – SA	4.62	-4.52	14.92	-2.77	-13.78	5.55
EP – SA	-1.22	-10.72	5.99	-3.88	-14.18	4.61

5.4.4.3 Response times

5.4.4.3.1 *Children's response times*

Finally, we investigated whether participants' response times (for correct responses) changed with Age, Connective, Pragmatic Type or a combination of any of those factors. As with accuracy, we first present the children's data; the adult's results follow in section 5.4.4.3.2.The average response time on correct answers was 8.49 seconds (SD = 4.8) for three-year-olds and 4.39 seconds (SD = 4.1) for five-year-olds (Figure 5.11 summarises the means for each sentence type for the two age groups).

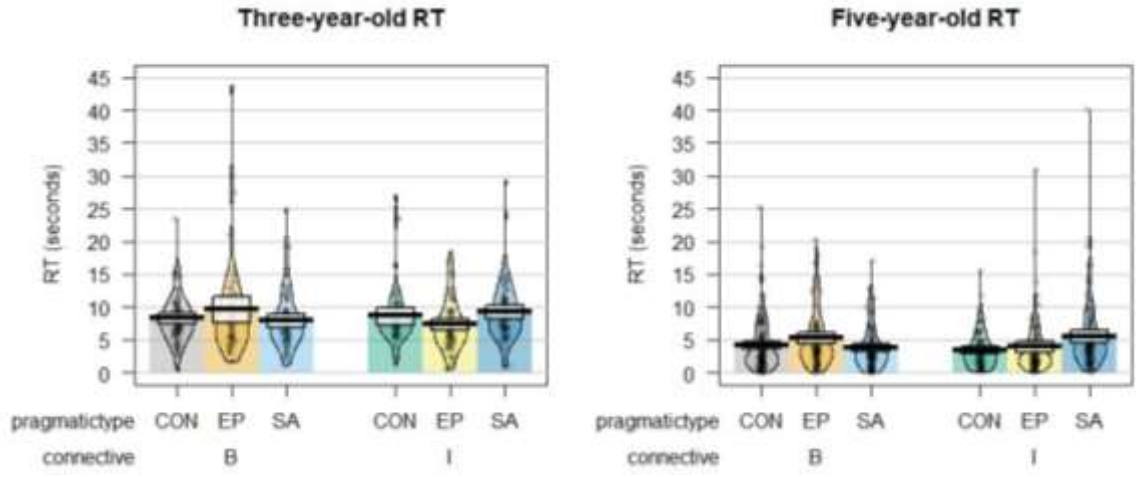

Figure 5.11: Pirate plots (Phillips, 2016) comparing three- and five-year-olds' response times for the different pragmatic types for each connective

While Gender did not improve model fit for children's response times, both Trial Order and Backwards Digit Span did and were added to the model. There was no evidence that

any of the other executive function tasks that correlated with response time improved the model fit. The output for the children's accuracy model is in Table 5.7. This model shows main effects of Age (five-year-olds were faster) and Pragmatic Type (moderate evidence that Epistemic response times were slower than the mean; very weak evidence that Speech-Act response times were faster than the mean), two-way-interactions between Age and Connective, Age and Pragmatic Type (Epistemic, Speech-Act) and Connective and Pragmatic Type (all pragmatic types) and three-way-interactions between Age, Connective and Pragmatic Type (all pragmatic types).

Table 5.7: Output of Bayesian maximal model for children's response time

Comparison	Mean	Lower	Upper	P(b<0)||P(b>0)
Intercept	16.3312	15.1364	17.5585	1.0000
Backwards Digit Span	**-0.5376**	**-1.3617**	**0.2487**	**0.9160**
Order	**-1.0561**	**-1.2844**	**-0.8325**	**1.0000**
Age3	**4.1385**	**2.527**	**5.7906**	**1.0000**
Content	-0.3272	-1.6508	1.0229	0.6998
Epistemic	**0.9906**	**-0.3491**	**2.3625**	**0.9282**
Speech-Act	**-0.6412**	**-1.9325**	**0.677**	**0.8498**
Connective_If	-0.0280	-1.4246	1.3179	0.5175
Age3.Content	0.2699	-0.6051	1.1702	0.7175
Age3.Epistemic	**-0.5545**	**-1.5428**	**0.4364**	**0.8645**
Age3.Speech-Act	0.3006	-0.5842	1.1626	0.7485
Age3. Connective_If	-0.0449	-1.0251	0.9216	0.5320
Connective_If.Content	-0.9065	-2.9028	1.0576	0.8365
Connective_If.Epistemic	**-1.3743**	**-3.2943**	**0.5526**	**0.9248**
Connective_If.Speech-Act	**2.2503**	**0.3742**	**4.0458**	**0.9885**
Age3. Connective_If.Content	**0.8397**	**-0.5379**	**2.1959**	**0.8872**
Age3. Connective_If.Epistemic	0.3144	-1.0756	1.7398	0.6720
Age. Connective_If.Speech-Act	**-1.1432**	**-2.4507**	**0.1453**	**0.9552**

To fully explore the three-way-interactions and determine how the relationships between the pragmatic types differ with age for each connective, contrasts were run using emmeans (Lenth, 2019). This shows that there was little difference in response time for the different pragmatic types for the three-year-olds' sentences. In comparison, there was strong evidence that the five-year-olds were faster with *If* Content than Speech-Act (as the contrasts did not cross zero), with some weak evidence that they were faster with *If* Epistemic than Speech-Act (as the contrasts only crossed zero very marginally) (see Table 5.8).

Table 5.8: Output of emmeans (Lenth, 2019) comparisons for Pragmatic Type | Age contrasts for each connective

	Three-year-olds					
	Because			If		
contrast	**estimate**	**lower .HPD**	**upper. HPD**	**estimate**	**lower. HPD**	**upper. HPD**
CON - EP	-0.512	-3.035	1.845	0.496	-1.991	3.162
CON - SA	0.339	-1.966	2.782	-0.850	-3.287	1.889
EP - SA	0.832	-1.601	3.268	-1.391	-3.829	1.028
	Five-year-olds					
	Because			If		
contrast	**estimate**	**lower .HPD**	**upper. HPD**	**estimate**	**lower. HPD**	**upper. HPD**
CON – EP	-1.339	-3.645	1.024	-0.830	-3.279	1.597
CON - SA	0.339	-1.918	2.542	**-2.854**	**-5.164**	**-0.218**
EP - SA	1.656	-0.728	3.976	**-2.021**	**-4.179**	**0.309**

Thus, for children's response times, three-year-olds have relatively stable performance across all pragmatic types for both connectives, while five-year-olds are slower to respond to *if* Speech-Act in comparison to *if* Content and Epistemic.

5.4.4.3.2 *Adults' response times*

The average response time for adults on correct answers was .9 seconds (SD = .84) (Figure 5.12 shows the means for each sentence type).

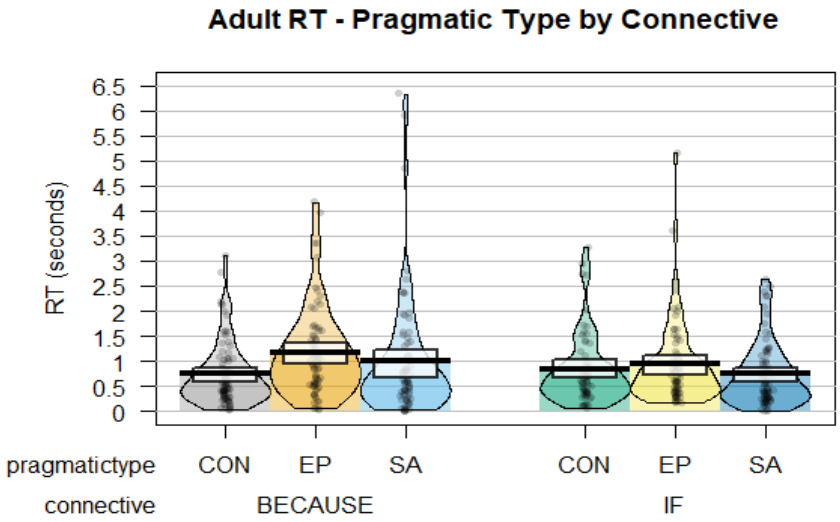

Figure 5.12 : Pirate plots (Phillips, 2016) comparing adults' response times for the different pragmatic types for each connective

The adults' response time data shows strong evidence that adults were faster with Content and slower with Epistemic, as well as slightly weaker evidence for an interaction between Connective and Content (see Table 5.9).

Table 5.9: Output of adults' response time model

Comparison	Mean	Lower	Upper	P(b<0)||P(b>0)
Intercept	5.5149	5.2301	5.8038	1.0000
Order	**-0.3160**	**-0.4305**	**-0.1985**	**1.0000**
Connective_If	-0.1195	-0.4869	0.228	0.7430
Content	**-0.3527**	**-0.6899**	**-0.0092**	**0.9780**
Epistemic	**0.4476**	**0.0953**	**0.7872**	**0.9925**
Speech-Act	-0.0912	-0.4588	0.281	0.6995
Connective_If.Content	**0.3549**	**-0.164**	**0.864**	**0.9198**
Connective_If.Epistemic	-0.1856	-0.6769	0.3155	0.7765
Connective_If.Speech-Act	-0.1767	-0.7082	0.3269	0.7560

To investigate the two-way-interaction between Connective and Content, a contrast was run using emmeans (Lenth, 2019). The output of this is in Table 5.10. As the contrasts for *because* Content-Epistemic do not cross zero, we have strong evidence that adults were faster with Content than Epistemic with *because*, but not for *if.* Additionally, as the contrasts cross only marginally, it shows some weak evidence that adults were slower with Epistemic in comparison to Speech-Act for *because*, although there was only anecdotal evidence for *if*.

Table 5.10: Emmeans contrast (Lenth, 2019) showing the relationship between the different pragmatic types by connective in the adults' response time model

	Because			If		
contrast	**estimate**	**lower .HPD**	**upper. HPD**	**estimate**	**lower. HPD**	**upper. HPD**
CON – EP	**-0.802**	**-1.4004**	**-0.212**	-0.256	-0.9100	0.410
CON – SA	-0.255	-0.8497	0.345	0.262	-0.3982	0.930
EP - SA	**0.544**	**-0.0322**	**1.208**	**0.526**	**-0.1445**	**1.121**

5.4.5 Eye-tracking, accuracy and response time summary

Table 5.11 provides a summary of the eye tracking data, followed by a summary of the accuracy and response time results for all age groups.

Table 5.11: Summary of looks to target image patterns for each age group

	Because		If	
	Connective	**Subordinate clause**	**Connective**	**Subordinate clause**
Three-year-olds	More looks for Content; fewer for Epistemic	No differences	More looks for Epistemic; fewer for Speech-Act	More looks for Speech-Act
Five-year-olds	More looks for Speech-Act, fewer for Epistemic	No differences	More looks for Content, fewer for Epistemic	No differences
Adults	No differences	More looks for Content	More looks for Content; fewer for Epistemic, Speech-Act	More looks for Content; fewer for Epistemic, Speech-Act

- Accuracy: Both adults and children were more accurate with Content, overall. For children, there was weak evidence that accuracy was higher with *because* Content and lower with *because* Epistemic, while there were little differences across pragmatic types with *if*. Furthermore, five-year-olds had higher accuracy than three-year-olds with *because*, but not *if*.
- Response times: Three-year-olds' were relatively stable across all sentences, although the average response time was over 8 seconds, which is almost twice the average response time for five-year-olds. With *because*, five-year-olds' response times were relatively consistent, but with *if*, they were slowest with Speech-Act. Adults were slowest with Epistemic, overall, with strong evidence they were slower with *because* Epistemic in comparison to *because* Content.

5.5 Discussion

While very few studies have investigated children's understanding of the pragmatic meanings (Content, Epistemic and Speech-Act; Sweetser, 1990) expressed by the adverbial connectives *because* and *if*, there is evidence that some pragmatic relationships are easier to understand (Corrigan, 1975; Lemen et al., in prep.), although it is not entirely clear why. That is, based solely on differences in cognitive complexity, Content should be easiest and Epistemic most difficult (e.g. Sanders, 2005; Zufferey, 2010), but based on input frequency, Speech-Act should be easiest for *because,* Content easiest for *if* and Epistemic the most difficult for both (De Ruiter et al., in press). There is also some

evidence that specific usage patterns in naturalistic speech (Lemen et al., submitted) may lead children to process *because* Speech-Act sentences differently (Lemen et al., in prep.). However, of the two studies that have investigated English-speaking children's comprehension of either of these connectives on the basis of pragmatic meaning, neither compared all three pragmatic types, nor does either provide any detailed information about online processing. This means we are not able to fully understand how acquisition is impacted by this kind of pragmatic variation.

To address this, the present study used multiple measures (accuracy, response time and eye-tracking) to investigate children's processing and understanding of all three pragmatic meanings expressed by these connectives (as described by Sweetser, 1990). Furthermore, we also tested a range of other executive function and language skills to determine how they relate to accuracy and response time. The results showed that, overall, children were more accurate with *because* Content, but slower with *if* Speech-Act (five-year-olds, in particular), while looking behaviour changed with age, pragmatic type and connective. Additionally, while backwards digit span and inferencing task scores all correlated with both accuracy and response time, only the scores from the inferencing task improved the fit of the accuracy model and only backwards digit span improved the fit of the response time model. In the discussion that follows, we first consider the evidence for whether children first acquire one pragmatic type and whether this can be explained by cognitive complexity, input frequency and specific usage patterns. Next, we relate these findings to the results from previous research, before discussing the role of inferencing skills and memory on the present task.

5.5.1 Is one pragmatic meaning easiest to acquire?

5.5.1.1 Because

At three, children's understanding of *because* appears to be primarily built around a Content function. They were most accurate with this pragmatic type and it was the only type on which their accuracy was reliably above chance. They also looked more to target when they heard *because* expressing a Content relationship. Additionally, although there was no reliable evidence of a difference in looking patterns during the subordinate clause at any age with *because*, in the three-year-old's data, this appears to be because of noise in the data, rather than any consistent patterns. This noise is likely due to the large

number of trials removed for trackloss, which means individual patterns had a higher influence on the overall results. While the three-year-olds' looks to target during the subordinate clause for Content generally remained around .7, looks to Speech-Act and Epistemic ranged from close to ceiling to below chance. This suggests, albeit anecdotally, that three-year-olds were more consistently confident in their responses to Content than the other two pragmatic types.

However, further investigation of the data shows that the higher accuracy with *because* Content was largely due to the fact that children were worse overall with *because* Epistemic (recall in the present study, differences in pragmatic type indicate a difference to the mean, rather than a comparison between any two pragmatic types). In comparison to Speech-Act, specifically, there is only anecdotal evidence that either three-year-olds (mean: -0.5686, lower credible interval: -1.9283, upper credible interval: 0.7722, P = 0.8078) or five-year-olds (mean:-0.6735, lower credibility interval: -2.4975, upper credible interval: 1.0579, P = 0.7855) were more accurate with Content. This means that their understanding of *because* Speech-Act is not far behind their understanding of *because* Content. This generally aligns with Zufferey's (2010) picture of acquisition based on cognitive complexity, where Speech-Act is not much more difficult than Content, but Epistemic is much more difficult than both. In the case of five-year-olds, however, their understanding of Speech-Act is becoming more consistent (64%), whereas in three-year-olds, this understanding is still only emerging, not yet reliably above chance (54%).

A rather different pattern emerges by age five, however. While five-year-olds' looks to both Content and Epistemic target images during the connective were around chance, their looks to target for Speech-Act were above the mean. This drop in predictive looks to Content between age three and five suggests that, at age five, children had lost confidence that *because* would express a Content meaning; instead, they have stronger expectations around a Speech-Act meaning. However, this eye-tracking data reveals some further important patterns: although five-year-olds looked more to target for Speech-Act immediately following the main clause, these looks had declined by the end of the connective window, while their looks to target for Content had begun to increase (compared to the beginning of the connective). This provides support for Lemen et al.'s (in prep.) hypothesis that children prioritise the command in the main clause of these

sentences. Specifically, the data suggests that five-year-olds often made predictions about meaning based only on the command in the main clause. On realising that they needed to interpret that command in relation to a *because*-clause, their confidence in their prediction decreased and they had to re-adjust to interpret it in relation to a causal meaning. Meanwhile, their confidence in Content meanings increased.

Thus, when considered altogether, the data here shows that Content is the most stable pragmatic meaning for both age groups with *because*. However, five-year-olds do not predict this meaning early in the same way that three-year-olds do. Rather, at five, children do not know what pragmatic type to expect during online processing of the connective. Yet, based on the increased accuracy on all pragmatic types, it seems five-year-olds are developing a better understanding of all three different pragmatic meanings, overall. In particular, although the five-year-olds did not expect to interpret *because* in relation to a command in the Speech-Act sentences, that their accuracy on this sentence type was well above chance suggests they were relatively capable at overcoming these initial expectations. This considerable level of competency at five likely results from the high frequency with which this connective in heard in naturalistic speech (e.g. De Ruiter et al., in press; Diessel, 2004). Of course, at five, children have had more experience interpreting the different pragmatic meanings than they have at three. Additionally, although the data here show that children do not expect to interpret *because* with a command, this is not necessarily the case for all illocutionary acts co-occurring with *because* in Speech-Act form. It is possible that other sorts of illocutionary acts (e.g. those that are more speaker-focused than commands, such as issuing praise or permission) encourage less of a focus on the illocutionary act, itself. In this case, children may be more likely to process these with the *because*-clause, rather than responding solely on the basis of the illocutionary act and overlooking the connective. Some evidence for this comes from the children's processing of the more listener-focused *if* Speech-Act illocutionary acts in the present study, where children did not make predictions during the illocutionary act, itself. Given that Speech-Act is the most frequently produced pragmatic type (De Ruiter et al., in press; Kyratzis et al., 1990) and children hear a range of illocutionary acts with it (Lemen et al., submitted), it seems possible that, if children process *because*-clauses differently with different illocutionary acts, this variety in input

may eventually contribute to a relatively flexible understanding of this pragmatic type, overall. However, as commands are the most frequent type of *because* Speech-Act, a reliable understanding of the Speech-Act relationship may not emerge until later, once children have had more experience with *because* alongside a wider range of illocutionary acts.

This, then, makes the influence of cognitive complexity difficult to untangle from the influence of input, particularly for three-year-olds. That is, it is not clear whether the three-year-olds' expectations were based more strongly around the Content relationship because it is the only pragmatic meaning they consistently interpret with *because* (as suggested by Lemen et al., in prep.) or because it is less cognitively complex (as suggested by Zufferey, 2010). However, the data suggests that, by age five, children's processing and understanding is strongly impacted by specific patterns in the input. While more data on comprehension of these connectives alongside other illocutionary acts is needed, it seems unlikely that patterns in the input, which appear to have a strong influence on the five-year-olds' processing and interpretation of these sentences, would have no impact at age three. Additionally, although the three-year-old's *because* data aligns with a cognitive complexity account, as will be shown in section 5.5.1.2, these patterns were not consistent across the two connectives. This provides further evidence that the data here can best be explained by input specific to the different sentence types, rather than a level of complexity relevant to each level of pragmatic meaning.

5.5.1.2 Factors influencing acquisition of if

As discussed in section 5.5.1.1, with *because,* three-year-olds were more reliable with Content, indicating that they had at least a baseline preference for one pragmatic type with *because*. With *if* they had no such preference and, in fact, looked more to the pragmatic type that should be most difficult (i.e. least frequent; De Ruiter et al., in press; most complex, Sanders, 2005; Zufferey, 2010). One explanation is that rather than looking to *if* Epistemic more because they were better at predicting it, actually they were worse. That is, it is possible that with Content and Speech-Act, children had some understanding of these pragmatic meanings and so, during the connective, they looked between the pictures to determine meaning. However, if they had absolutely no idea what a speaker meant in producing an *if* Epistemic meaning, they may have been more likely to just

choose an image and look at it, deciding that is the one they liked best. Given that the looking time data only shows correct responses, it would make sense that if they adopted this strategy, they would have a high proportion of looks to target on correct answers.

By age five, children looked more to target for Content during the connective window. Here, we have some strong evidence that five-year-olds expect a Content meaning with *if*, although there were no differences in their accuracy with the different pragmatic meanings. Interestingly, five-year-olds were more likely to make predictions for *if* Content prior to hearing the connective, which was not a pattern in the five-year-old's *because* Content sentences (although it was a pattern in the adults' *if* Content and all of their *because* sentences, as well as the five-year-olds *because* Speech-Act). It is possible that children used heuristic cues in the main clause (e.g. reference to future tense via *will*) to interpret the type of sentence in the context of the given discourse, allowing them to have a slight advantage at predicting an *if* Content meaning. If this is the case, it would speak to children's abilities to use cues from a sentence to interpret connective meaning, a skill which Flores d'Arcais (1984) says is only available to children who already have some understanding of the meaning of a given function word.

Five-year-olds were also slower with *if* Speech-Act, overall. While based on input frequency and cognitive complexity, we would expect Speech-Act response times to be slower than Content, this seems unexpected in comparison to Epistemic. However, as argued in regard to the three-year-olds' eye-tracking data, this might reflect a difficulty with *if* Epistemic. If children are not confident about how to interpret these, they may be more likely to guess quickly. By contrast, if (whether based on cognitive complexity or input frequency) children have a harder time with *if* Speech-Act compared to Content, but have some understanding of them, they may spend more time trying to figure them out.

Why, then, do they not have lower rates of accuracy on *if* Epistemic? It is possible that this is due to how meaning is constructed for *if* Epistemic and Speech-Act relationships, particularly in comparison to *because*. In *if* Speech-Act and Epistemic, the subordinate clause relates the conditions for the illocutionary act/conclusions (Sweetser, 1990; Van der Auwera, 1986; Van Dijk, 1979), while in *because* Speech-Act and Epistemic, the

subordinate clause explains an illocutionary act/conclusion that has been performed/drawn (e.g. Diessel & Hetterle, 2011; Ford, 1993; Sweetser, 1990). Thus, as suggested by Lemen et al. (in prep.), children may learn that *if* is more critical to sentence meaning than *because.* Although their understanding of *if* Speech-Act and Epistemic meanings may not be as secure as for *if* Content, they may have a sufficient idea of how to interpret *if*, and an appreciation of the necessity of doing so, to decipher a general meaning for these sentence types (see Donaldson, 1986 for arguments on children's ability to use a general understanding of connectives to interpret utterance meaning). This would mean that, compared to *because*, children have a more consistent idea of *how* to interpret an *if*-sentence, even if they do not have a robust understanding of the pragmatic meaning, itself. Anecdotally, the five-year-olds' *if*-subordinate clause eye-tracking data seems to support this: although they have no differences between the pragmatic types, their looking behaviour shows a dramatic drop in looks to target at about 500 ms after the start of the subordinate clause, before rising again slightly. The same pattern does not appear (at least in such a pronounced manner) for any pragmatic type with *because.* This suggests that, for all pragmatic meanings – even ones they appear to understand well – they are more likely to second guess with *if* than *because*.

These results indicate that input patterns impact the connectives differently. Unlike *because*, where an understanding of Content emerges early, children seem to take longer to establish an understanding based on *if* Content. As noted by De Ruiter et al. (in press), this is possibly due to factors in the input such as noise in the form-meaning mapping (e.g. *if* can express counterfactual, hypothetical and simple semantic meanings; see de Ruiter et al., in press, for patterns in child-directed speech) and lower overall input frequency (although frequent in comparison to adverbial connectives like *before* and *after, if* is less frequent than *because;* De Ruiter et al., in press; Diessel, 2004).

Therefore, while we cannot rule out the fact that cognitive complexity plays some role in children's comprehension of *if,* at three, it seems plausible that children will not have heard enough consistent input of *if* in any pragmatic form to reliably understand differences in pragmatic meaning expressed (see Ambridge et al., 2015 for review/discussion of how "type" consistency supports learning). This is somewhat supported anecdotally by lower accuracy and fewer looks to target for *if* Content than

because Content at age three. It is also supported by corpus data, which show that, despite more frequent input (De Ruiter et al., in press) of the least cognitively complex type, Content (Sanders, 2005; Zufferey, 2010), *if* appears later and less-frequently in children's speech than *because* (Bloom et al., 1980; Braunwald, 1985; De Ruiter et al., in press; Diessel, 2004), and contains a high proportion of idiomatic phrases (Lemen et al., submitted). Once they do establish an understanding of *if* Content, however, they appear to use this understanding, in combination with an awareness of the relevance of *if* to overall sentence meaning, to interpret the other pragmatic relationships. Thus, while more varied patterns in input and lower overall frequency seem to delay children's pragmatic understanding of *if,* broader functional patterns in input provide children with a tool to interpret overall sentence meaning for all pragmatic types at a later age.

5.5.2 Comparison to previous literature and limitations of the present study

In terms of the relationship to previous literature, higher accuracy with *because* Content aligns with the findings reported by Corrigan (1975), who found that children were more accurate on sentences which expressed Content relationships (which she called "Physical Causality" and "Affective Causality") earlier than those expressing Epistemic relationships (which she called "Concrete Logical Causality"). However, the patterns reported in the present study seem to contradict the findings from Lemen et al. (in prep.), where children (girls, especially) were more accurate with *if* Content, with no differences in accuracy between the pragmatic types for *because*.

We suspect the difference in patterns may be largely explained by the design of the two tasks. In Lemen et al.'s (in prep.) study, participants had to identify the correct picture after hearing a full sentence; in the present task, interpretation was focused on the connective, which had to be interpreted in the context of information given earlier in the trial. In the former task, even if children did not have a fully robust understanding of a connective's pragmatic meaning, so long as they had a general idea of what *because* or *if* meant, they may have been able to use cues from the overall sentence and images to interpret meaning (see Donaldson, 1984; Emerson & Gekoski, 1980 for related arguments). If, as argued above, this is a strategy children use more with *if,* it may explain why performance was better for *if* Content in Lemen et al. (in prep.).

There are also some potential limitations of the present study which should be addressed. It is possible that looks to target were influenced by the fact that participants heard semantically related information to the cause/condition in the first sentence of the story (e.g. hearing that Charlie had helped to cook dinner/seeing the picture of the oven). However, given the full design of the study, the age group of the participants and the patterns in the data, we do not think this occurred. That is, although the information in the first sentence does relate more to the target than the distractor image, participants then heard a second sentence, which was semantically related to both images (e.g. Charlie's hand hurting). In order for participants to choose the target based only on the information in the first sentence, they would not only have to know that that information is the information worth retaining at the expense of all other information, they would also have to hold it in their mind even after hearing the second sentence and the main clause. While we expect this is possible in older children or adults, this would seem to be a particularly advanced/complex strategy for pre-schoolers. This is supported by the accuracy and response time data, which suggest that children did not regularly have the cause/condition in their mind when hearing the connective (i.e. as indicated by lower overall accuracy and slower response times than would be expected if answers were primarily driven by semantic bias). Furthermore, the looking time data from the beginning of "[Character's mum] said:" through the rest of the main clause shows no evidence that participants consistently favoured the target image (Appendix 5.4 shows looking behaviour from the image onset, as well as additional looking behaviour after the connective).

Therefore, we do not expect the results of this study to be solely influenced by semantic information. However, this does mean that responses were likely influenced by an ability to recall information in the pre-amble and relate it to both the images shown and the information in target sentence (see discussion of the role of memory and inferencing skills on accuracy and response time in section 5.5.3). While we did account for these factors in our models (where they correlated with the dependent variable), it is possible that the complexity of the task design presents children's ability to understand these connectives and their associated pragmatic functions as less advanced than would be in naturalistic contexts. However, from the perspective of exploratory research, this study

provides some rather helpful support for the ideas put forth in Lemen et al. (in prep.) about the influence of specific usage patterns in the input on acquisition of connective function, with a design that focuses on pragmatic expectations of the connective, rather than understanding of the full complex sentence. To verify these findings, particularly in the spirit of open science, further studies, with specific hypotheses established based on the patterns presented here, should be run (see e.g. Munafò et al., 2017; Nicenboim et al., 2018).

5.5.3 Executive Function tasks

In the present study, performance on the inferencing task was a predictor of accuracy on the connectives comprehension task. This is not particularly surprising given there is a relationship – albeit one that differs across pragmatic types – between the pragmatic meanings and inferences/assumptions (e.g. Pander Maat & Degand, 2001; Sweetser, 1990; Zufferey, 2010). Additionally, a general level of inferencing skill was relevant to the task, overall, as children needed to use a certain level of pragmatic inferencing (i.e. one related to the context of the utterance; e.g. Grundy, 2014) to relate the information in the first sentence to the cause/condition they were interpreting.

Similarly, our data also showed a relationship between Backwards Digit Span score and children's response times. However, given that Forward Digit Span score did not correlate with response times, nor improve the model fit, it appears that it is not memory, in general, that relates to response times, but the ability to recall information in a reverse order. We expect this is because participants had to interpret the connective meaning in the context of the first event of the story. This required them to remember that sentence, and then link the main clause and connective back to that information to construct causal/conditional meaning. Children with good backwards recall appear to reconstruct these events faster. Interestingly, as there was no evidence that Backwards Digit Span predicted accuracy, it appears this is not a skill that predicts their ability to interpret connective meaning, just the speed at which this is done correctly. Although causes/conditions are not always overtly expressed in this same way in naturalistic discourse, given that we have argued above (in line with arguments presented by Donaldson, 1986; Emerson & Gekoski, 1980) that children use cues to help them interpret these connectives when they are having difficulty, strong backwards recall skills may also

support comprehension in naturalistic contexts. However, as this study did not directly test children's inferencing ability or backward recall on stories expressing different pragmatic meanings, more information is needed about the role these skills play in acquisition of these connectives. This should be an avenue for future research.

5.6 Conclusion

The use of mixed measures in this study provided new and detailed information about children's acquisition of the adverbial connectives, *because* and *if*, at two different stages of development. In particular, interpreting these measures together allowed for insight into how children process these connectives and how this processing relates to their overall interpretation of the pragmatic meanings these connectives express. This allowed us to present arguments based on broader evidence. Overall, the data here show that children's acquisition of connective function is impacted by complex factors, requiring children to be creative and adaptive in order to resolve meaning, particularly in lesser-heard sentence types.

More specifically, while children appear to acquire an understanding of both connectives based on the least cognitively complex meaning (Content; e.g. Sanders, 2005; Zufferey, 2010), this understanding develops earlier for *because* than *if*. While this seems to point toward the influence of cognitive complexity, there is evidence that this might be more related to usage patterns in the input for both connectives. While part of this evidence comes from the fact that the performance on the different pragmatic types differs across the connectives, which we would not expect based on complexity alone, more evidence comes from how the patterns change across the two age groups for each connective. Specifically, there is evidence that children prefer a Content function with *because* due to the tendency to prioritise the illocutionary act over the subordinate clause in the most frequently-heard type of *because* Speech-Act sentence (i.e. those co-occurring with commands). It is not until they have had more experience with *because* that they establish a more consistent understanding of how to interpret this pragmatic relationship, but the cost of this is that they no longer have expectations about how a speaker will use *because*. This lack of confidence may contribute to some of the difficulty children have when asked to interpret Content relationships in comprehension studies (e.g. De Ruiter et al., 2020, 2018; Emerson, 1979, 1980; Emerson & Gekoski, 1980). Similarly with *if,*

variation in input patterns may contribute to the fact that children do not develop expectations based on Content until age five, when they are also able to use cues in the sentence and a general understanding of how to interpret *if* to respond with above-chance accuracy on all pragmatic types. In both cases, the data here suggest that children are sensitive to specific patterns in the input and that, because of these patterns, children are faced with a number of challenges when trying to establish meaning for these adverbial connectives. In some cases, resolving these difficulties requires the employment of heuristic tools, such as relying on cues from the overall sentence to discern meaning; in others, it requires overcoming expectations established based on frequent patterns in naturalistic speech. Children's ability to do so at the age of five shows them as creative and flexible learners.

However, it is important to note here that the patterns for Speech-Act are based only on the most frequently heard illocutionary acts for each connective (as reported in Lemen et al., submitted). While this design was chosen to allow for the clearest idea about how the patterns in naturalistic speech influence acquisition, the patterns here relate to how children process only specific illocutionary acts for each connective, rather than providing a full account of how these sentences are processed. As such, future studies should consider exploring patterns in children's processing of these clauses in relation to different illocutionary acts to gain more insight into how children's acquisition of this pragmatic type develops in relation to lesser heard illocutionary acts, and better determine the influence of specific usage patterns on this process.

5.7 References

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5.8 Appendices

5.8.1 Appendix 5.1 – Audio stimuli list and additional sample images

Because			
Type	**Story**	**Beginning of Sentence**	**End of sentence**
SA	Charlie's mum saw that the sky has started to turn grey. Charlie is playing outside now. Charlie's mum says:	Time to come inside now because	it is going to rain soon
SA	Sophie's mum saw that Sophie has just taken a bath. Sophie is going to paint now. Sophie's mum says:	Be careful with the paint because	you will get yourself all messy again
SA	Henry's mum knew that something fun is happening later today. Henry is running around the house. Henry's mum says:	Settle down a little bit because	you will be too tired for the party
SA	Daisy's mum knew it is a very sunny summer day. Daisy is wearing her red jumper. Daisy's mum says:	Take off that jumper please because	you will get too hot and sweaty
CON	Sophie's mum knew Sophie had watered the garden earlier. Sophie sees her dress is very wet. Sophie's mum says:	Your dress is all wet because	you sprayed yourself with the hose
CON	Henry's mum saw Henry gardening this morning. Henry sees that his clothes are all dirty. Henry's mum says:	Your clothes are very dirty because	you were kneeling in the mud
CON	Daisy's mum saw Daisy playing football with friends earlier. Daisy is feeling very tired now. Daisy's mum says:	You are feeling so tired because	you were running around
CON	Charlie's mum knew Charlie had helped to cook dinner. Charlie's hand is feeling very sore now. Charlie's mum says:	Your hand hurts so much because	you have touched the hot pan
EP	Henry's mum hears the bathroom tap running. Henry has been told to get ready for dinner. Henry's mum says	Henry is about to eat because	he is washing his hands

EP	Daisy's mum sees Daisy going out the front door. Daisy had been feeling very poorly earlier. Daisy's mum says:	Daisy is feeling much better because	she is going to play in the garden
EP	Charlie's mum hears the fridge door open. Charlie has just been told to wake up. Charlie's mum says:	Charlie is out of bed because	he is making some breakfast
EP	Sophie's mum sees Sophie filling the kettle. Sophie has just come in from playing outside. Sophie's mum says:	Sophie is feeling very cold because	she is making herself some tea
	If		
Type	**Story**	**Beginning of Sentence**	**End of sentence**
SA	Henry's mum saw Henry was very sticky after lunch. Henry wants to leave the table. Henry's mum says:	I will find you soap if	you want to go and wash your hands
SA	Charlie's mum saw Charlie take a bite of very hot food. Charlie is looking very uncomfortable. Charlie's mum says:	Have some of my water if	you have burnt your tongue
SA	Daisy's mum knew Daisy had a very busy day. Daisy and her mum are visiting grandpa. Daisy's mum says:	Here is a nice blanket if	you are feeling tired
SA	Sophie's mum knew some laundry was left out in the rain yesterday. Sophie is getting dressed. Sophie's mum says:	Maybe wear a skirt today if	your trousers are still wet
CON	Charlie's mum saw Charlie spilled juice on his football jersey. Charlie has a big game tomorrow. Charlie's mum says:	Your jersey will look better if	you put it in the laundry
CON	Daisy's mum knew Daisy ran a cold bath and got herself in. Daisy is feeling chilly. Daisy's mum says:	You will feel much warmer if	you add more hot water
CON	Sophie's mum knew Sophie stayed up late all week. Sophie is slow at football practice today. Sophie's mum says:	You will be much faster if	you get a good night's sleep

CON	Henry's mum saw that the dog is thirsty. Henry wants to play with the dog. Henry's mum says:	The dog will be happier if	you give her some water
EP	Daisy's mum sees the bathroom light turn on. Daisy was told it is almost bedtime. Daisy's mum says:	Daisy is going to bed if	she is brushing her teeth
EP	Sophie's mum sees the freezer door open. Sophie was eating her dinner in the kitchen. Sophie's mum says:	Sophie is finished with dinner if	she is getting out the ice cream
EP	Henry's mum hears the front door open. Henry has been at school all day. Henry's mum says:	School is over for today if	Henry is back at home
EP	Charlie's mum hears some water running in the kitchen. Charlie has been asked to make a drink. Charlie's mum says:	Charlie is making some tea if	he is filling the kettle

Further sample images

Figure 5.13: Because Speech-Act sample image – "Henry's mum knew that something fun is happening later today. Henry is running around the house. Henry's mum says: Settle down a little bit because you will be too tired for the party"

Figure 5.14: Because Epistemic sample image – "Sophie's mum sees Sophie filling the kettle. Sophie has just come in from playing outside. Sophie's mum says: Sophie is feeling very cold because she is making herself some tea"

Figure 5.15: If Content sample image – "Charlie's mum saw Charlie spilled juice on his football jersey. Charlie has a big game tomorrow. Charlie's mum says: Your jersey will look better if you put it in the laundry"

Figure 5.16: If Speech-Act sample image – "Sophie's mum knew some laundry was left out in the rain yesterday. Sophie is getting dressed. Sophie's mum says: Maybe wear a skirt today if your trousers are still wet"

Figure 5.17 - If Epistemic sample image – "Charlie's mum hears some water running in the kitchen. Charlie has been asked to make a drink. Charlie's mum says: Charlie is making some tea if he is filling the kettle"

5.8.2 Appendix 5.2 – Detailed analysis strategy

R software (R Core Team, 2018) version 3.5.1 ("Feather Spray") was used to analyse the data. The BayesMed package (Nuijten, Wetzels, Matzke, Dolan, & Wagenmakers, 2015) was used to run Bayesian correlations. As the evidence for Bayesian correlations is interpreted via a BayesFactor (Jeffreys, 1961 as cited in Wetzels et al. 2011), where BayesFactors are reported in this paper, the corresponding interpretation (based on the adapted table in Wetzels et al. (2011, p. 293) will also be provided.

As the main clause and connective had been recorded together in one audio file (to ensure the prosody of the sentence was as natural as possible), the connective looking behaviour was taken from the last 1000 ms of this audio file, plus 300 ms after the connective ended, to include any processing differences immediately following the connective. The subordinate clause window was 200 ms before the onset of the subordinate clause audio file (which began when participants made their response via game controller) and went until 2000 ms after the onset (after which the critical information for all items had been spoken).

Due to an editing error, one *If* Content item had an additional 500 ms of silence at the end of the audio file where the connective was spoken. To address this, for the window analysis, the time window for this item was taken from -1500 ms to -200 ms (rather than -1000 to 300 ms, like the other items). This meant we could capture looking behaviour for that item at the same time (relative to when the connective was spoken) as the other

items. However, due to the impact this delay might have on response times for this item (where participants could not respond until the end of the audio file), this item was removed from response time analysis. The removal of this item had little impact on the output of the models, however, with no differences which impacted overall interpretation of the results.

For response times, log-transforming resulted in a left-skew (see Nicenboim & Vasishth, 2016 for discussion of log-transforming reaction time with Bayesian models), so to obtain a more normal distribution, the boxcox function in the MASS package (Venables & Ripley, 2002) was run to get the optimal lambda and models were then run with the response time variable adjusted to this. For the children, this was .34; for the adults, this was .22.

Models had a maximal random effects structure as this has been shown to limit Type I statistical errors (see Barr et al., 2014). As the window analysis models were split by Age and Connective, the only predictor in each model was Pragmatic Type and, as such, the random effect structure included only random intercepts for item and participants and a random slope for Pragmatic Type by participant; for accuracy and response time, models had random intercepts for item and participant and random slopes of Pragmatic Type by Connective for participants. As there are three levels for the Pragmatic Type variable (Content, Epistemic, Speech-Act), the final model for each analysis was run twice: once with Content as the reference level and once with Speech-Act as a reference level to determine the difference to mean for all pragmatic types. For efficiency, we have combined the outputs of the two tables into one.

To explore interactions in accuracy and response time models, emmeans (Lenth, 2019) was used when the interaction being explored was the most complex type of interaction in the model. That is, as emmeans (Lenth, 2019) issues a warning that these kinds of comparisons may be unreliable for two-way-interactions when three-way-interactions are also present in the model, these contrasts were only used for three-way-interactions (in models where they were present) and two-way-interactions in models where there were no three-way-interactions. Where there were two-way-interactions in models with three-way-interactions which warranted further investigation, this was done by splitting the

main dataset into subsets based on a predictor and running maximal models on each of the smaller datasets.

5.8.3 Appendix 5.3 – Children's accuracy compared to chance

Table 5.12: Children's accuracy compared to chance with BayesFactor (BF) interpretation based on Wetzels et al. (2011)

Group	Mean	BF	BF Interpretation
Threes Because Content	63.8%	**22.36**	**Strong evidence for H_A**
Threes Because Epistemic	40.8%	1.64	Anecdotal evidence for H_A
Threes Because Speech-Act	54.0%	0.32	Substantial evidence for H_0
Threes If Content	58.5%	1.21	Anecdotal evidence for H_A
Threes If Epistemic	53.6%	0.30	Substantial evidence for H_0
Threes If Speech-Act	54.4%	0.34	Anecdotal evidence for H_0
Fives Because Content	75.1%	**1969584530**	**Decisive evidence for H_A**
Fives Because Epistemic	53.8%	0.31	Substantial evidence for H_0
Fives Because Speech-Act	64.3%	**259.59**	**Decisive evidence for H_A**
Fives If Content	66.7%	**3979.06**	**Decisive evidence for H_A**
Fives If Epistemic	59.7%	**4.86**	**Substantial evidence for H_A**
Fives If Speech-Act	62.8%	**56.22**	**Very strong evidence for H_A**

5.8.4 Appendix 5.4 – Additional eye-tracking plots

Additional eye-tracking plots from image onset (also the start of "[Character's mum] said…") and after the connective offset are provided here. Note that due to differences in trackloss cleaning for the different looking windows, there is slight variation in the datasets used in these plots in comparison to the ones included in the results section. In particular, given the length of the main clause plots, the second trackloss cleaning at the .5 threshold was not done for these datasets, as this would likely remove too much data to result in meaningful plots. Additionally, the connective offset plot provides additional eye-tracking data after the connective, which may be helpful for gaining a better idea of children's ongoing processing after hearing the connective. However, as participants could respond any time after the connective offset, some responded very quickly, which means they would have heard the subordinate clause information earlier. For example, any who responded at 500 ms after the connective offset would have heard the start of the subordinate clause audio begin immediately after that. Therefore, to avoid including the eye-tracking data from participants as they were listening to the response, the data from anyone who responded prior to 1000 ms after the connective offset was removed when running the connective offset plots.

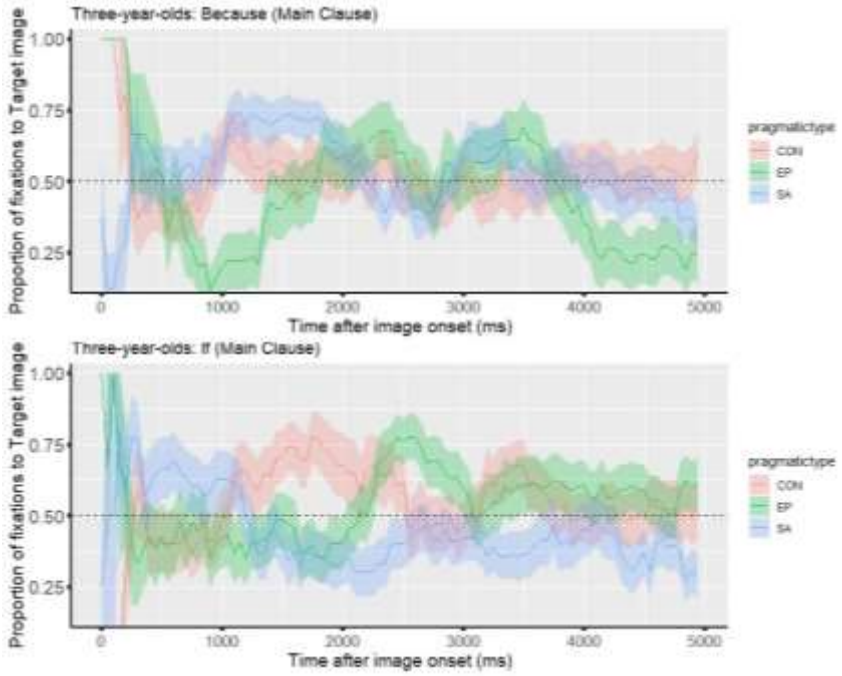

Figure 5.18: Three-year-olds' looking behaviour from image onset

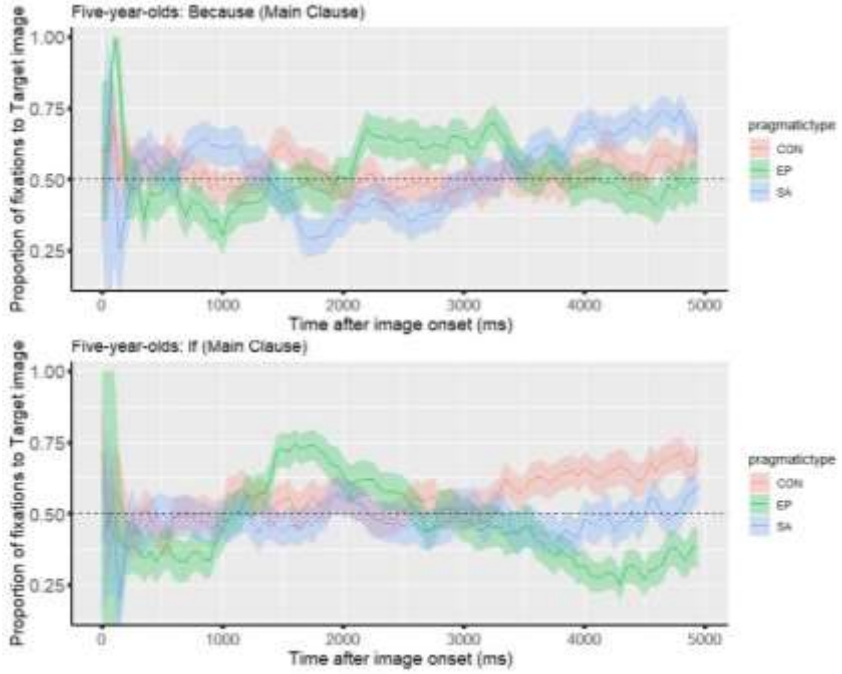

Figure 5.19: Five-year-olds' looking behaviour from image onset

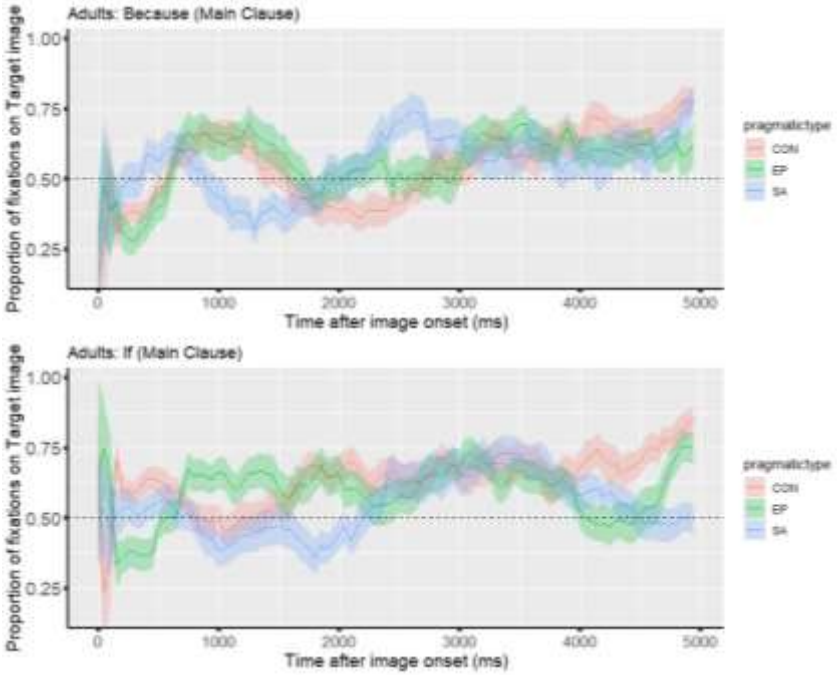

Figure 5.20: Adults' looking behaviour from image onset

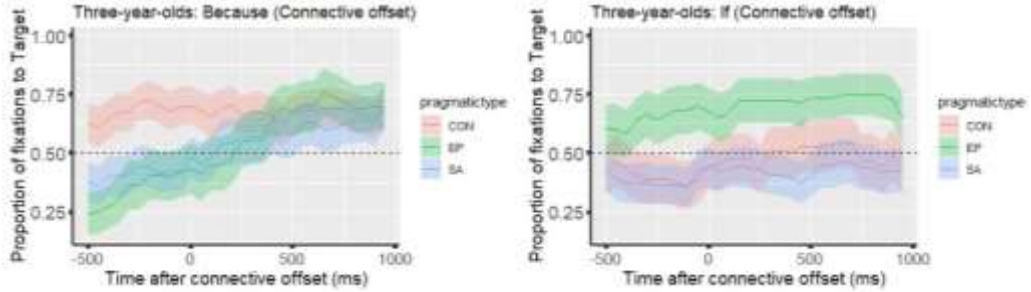

Figure 5.21: Three-year-olds' looking behaviour 500 ms before/1000 ms after connective offset

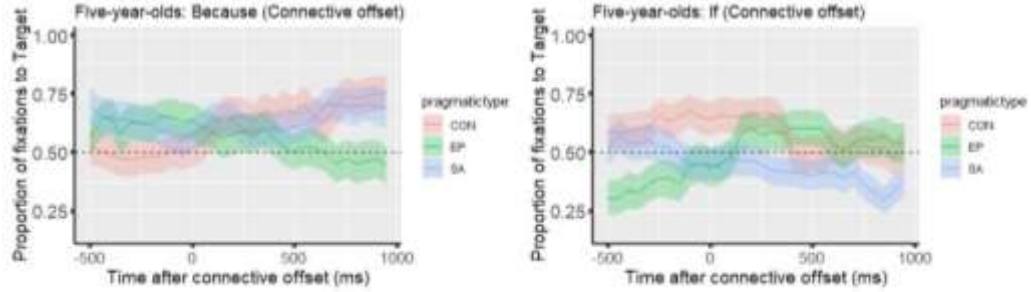

Figure 5.22: Five-year-olds' looking behaviour 500 ms before/1000 ms after connective offset

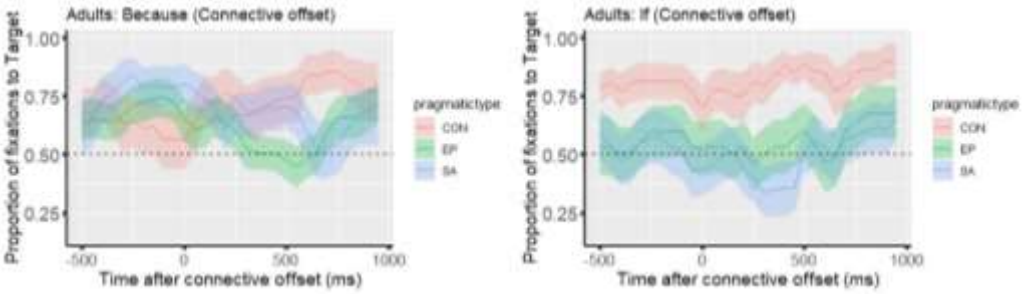

Figure 5.23: Adults' looking behaviour 500 ms before/1000 ms after connective offset

6 Discussion

6.1 Chapter overview

The chapter starts with an overview of the aims of this thesis, followed by a discussion of the primary research questions. For each research question, I will provide a summary of the aims and results of the study in which they were primarily addressed, before evaluating the efficacy of the study in addressing the research question. This chapter will also discuss the overall implications of this research in terms of what it can contribute to an understanding of children's pragmatic awareness, the acquisition of the adverbial connectives, *because* and *if*, and an evaluation of the usage-based (e.g. Tomasello, 2001) and cognitive complexity (e.g. Zufferey, 2010) accounts.

6.2 Research questions and motivation

Existing research on children's acquisition of the adverbial connectives *because* and *if* presents a rather inconsistent picture about the age at which children acquire these connectives and the factors which influence this. In particular, research from comprehension studies provides very different ages at which these connectives are said to be understood. For example, some studies (e.g. Amidon, 1976; French, 1988; Johnston & Welsh, 2000) suggest children understand these connectives by or around the time they are five, while others show that children do not understand them until a couple of years later (e.g. Kuhn & Phelps, 1976), with still others arguing that consistent understanding only occurs around age ten (e.g. Emerson, 1979; Emerson & Gekoski, 1980). Additionally, children have been shown to be very sensitive to methodological differences in these kinds of studies until relatively late in childhood (e.g. Donaldson, 1986; Emerson & Gekoski, 1980; French, 1988; Peterson & McCabe, 1985).

However, data on children's production of these connectives present a very different picture, showing not only that they are competent in their productions (e.g. Donaldson, 1986; Hood & Bloom, 1979; A. E. McCabe et al., 1983; A. McCabe & Peterson, 1985), but also that there are specific pragmatic factors which motivate their usage (De Ruiter et al., in press; Kyratzis et al., 1990). In particular, *because* and *if* express three different pragmatic functions, Content, Epistemic and Speech-Act (Sweetser, 1990) and children hear and use all three pragmatic functions with both connectives (De Ruiter et al., in press; Kyratzis et al., 1990). Yet, this fact is largely overlooked in comprehension studies,

which often focus instead on semantic factors, such as temporal ordering in only one pragmatic type (Content) (e.g. De Ruiter et al., 2018; Emerson & Gekoski, 1980; Peterson & McCabe, 1985; see Donaldson, 1986 for a review and critique).

It is possible, then, that the use of *because* and *if* for multiple pragmatic functions complicates acquisition of these connectives for young children (e.g. see Slobin, 1982 for evidence that items with multiple functions are harder to acquire), making them more difficult to understand in the speech of others than connectives which are more functionally consistent (e.g. *before*, *after*; see evidence and arguments in De Ruiter et al., in press). This seems particularly plausible when assessment of comprehension of these connectives is often based on children's understanding of the temporal ordering of the events in these sentences, which is not consistent in all three pragmatic types (Pander Maat & Degand, 2001; see also Donaldson, 1986 for related discussion and critique). Alternatively (or possibly, additionally), the Speech-Act type is particularly frequent in children's speech and the input they hear (De Ruiter et al., in press; Kyratzis et al., 1990) and may also be associated with further, very specific functions which make it particularly useful (e.g. a relationship with giving direction and/or neutralising contentious utterances in *because*, e.g. Diessel & Hetterle, 2011; Ford, 1993; Kyratzis et al., 1990; and a relationship with politeness in *if;* Brown & Levinson, 1987; Sweetser, 1990; Van der Auwera, 1986; Warchał, 2010). This means it is possible that children's understanding of how these connectives are used are based more around this pragmatic type (see discussions in De Ruiter et al., in press; Kyratzis et al., 1990).

Although they differ in places, both usage-based (e.g. Tomasello, 2001) and cognitive complexity (e.g. Sanders, 2005; Zufferey, 2010) accounts predict differences in the order of acquisition for the pragmatic types. More specifically, a usage-based account predicts that children's acquisition of the pragmatic types will be related to frequency patterns in speech. However, data from 14 English-speaking mother-child dyads reported in De Ruiter et al. (in press) do not provide consistent support that input frequency on its own predicts acquisition. As such, given that usage-based approaches also suggest that overall input frequency often interacts with other factors (e.g. Ambridge et al., 2015; Lieven, 2010), more data is needed to determine what these factors might be and how they relate to both production and comprehension. By contrast, from a cognitive complexity

perspective, Content should be the easiest pragmatic type to acquire, with Epistemic the most difficult and Speech-Act somewhere in between (Zufferey, 2010). However, this account does not make clear predictions on how the complexity differences between Content and Speech-Act will relate to children's comprehension of the different pragmatic types and the absence of data on comprehension of Speech-Act *because*- or *if*-sentences means there is little evidence to support or oppose this theory, particularly in contrast to a usage-based account.

As such, in order to determine how and why this type of pragmatic variation influences acquisition of these connectives, the research in this thesis aimed to address three primary research questions related to these issues.

Research question 1:

(a) Are there particular functional uses of *because* and *if* in Speech-Act sentences that might make them particularly salient for children?; and

(b) How do these relate to those they hear in input?

Research question 2:

(a) Is there a difference in children's ability to understand *because* and *if* in Content and Speech-Act sentences?; and

(b) Can this be explained in terms of patterns in naturalistic speech and/or cognitive complexity?

Research question 3:

(a) Do children have a preferred pragmatic function for either *because* or *if*?; and

(b) Can this be explained in terms of patterns in naturalistic speech and/or cognitive complexity?

In answering these questions, this thesis primarily aimed to investigate the extent to which children's difficulty with understanding *because* and *if* can be explained by the fact that these connectives perform different pragmatic functions. However, it also offered the opportunity to provide a better understanding of children's pragmatic sensitivity insofar as the pragmatic meaning of these connectives goes. Additionally, in investigating whether either cognitive complexity or input patterns impact children's comprehension, there was the opportunity to contribute to more information about both of these

accounts. Specifically, it allowed for more information about the differences in complexity between the pragmatic types in terms of how they relate to comprehension, as well as the identification of more specific patterns in speech that interact with frequency to impact acquisition. In considering the patterns associated with both of these accounts, there was also the opportunity to evaluate them in terms of their ability to explain children's acquisition of these connectives. In summary, then, this thesis aimed to determine how pragmatic patterns impact preschool-aged children's acquisition of the adverbial connectives *because* and *if*, and to investigate and evaluate the role of both cognitive complexity and input patterns on this acquisition process.

At this point I would like to offer a brief discussion on the exploratory approach taken in this thesis. Although for each study, I have summarised the primary predictions related to the cognitive complexity and usage-based accounts, drawing on specific patterns reported in generally related, existing literature (e.g. including those from Corrigan, 1975; De Ruiter et al., in press; Ford, 1993; Kyratzis et al., 1990; Sweetser, 1990; Zufferey, 2010) given the lack of existing data on children's pragmatic acquisition of *because* and *if*, and of Speech-Act sentences, in particular, I was unable to make definitive predictions about the most likely patterns or the direction these patterns would take. While, as Elliott, Cheruvelil, Montgomery and Soranno (2016) note, the "linear" hypothesis-driven approach, where defined predictions are tested and verified, has risen and fallen in popularity over the past 400 or so years, they also note that hypothesis-driven testing is "much less helpful for mapping out new areas of inquiry (e.g., the sequence of the human genome), identifying important relationships among many different variables, or studying complex systems" (p. 2). Rather, recent papers such as Elliott et al. (2016) and Nicenboim et al. (2018) call for a more integrated approach, where both exploratory testing and hypothesis/confirmatory testing both play an important role (see also Munafò et al., 2017). For example, Nicenboim et al. (2018), call for a two-stage approach, where exploratory analyses are conducted in the first phase, which then inform specific predictions that are then tested in a separate, confirmatory study. They argue that this allows for flexible evaluation of patterns in the first stage and also avoids potential causes of Type I error at the confirmatory stage (Nicenboim et al., 2018).

Thus, given the lack of existing research on English-speaking children's pragmatic acquisition of these connectives, the results presented in this thesis contribute to the first (exploratory) part of the process for this topic, rather than attempting to confirm any specific predictions based on previously established patterns. This means that, while the data here present some very useful patterns for a topic about which little had been previously known, in addition to the further exploratory studies I propose in the data chapters and discussion of this thesis, future research should also include confirmatory testing of specific predictions based on the patterns presented here, to contribute to a more "robust" (Munafò et al., 2017; Nicenboim et al., 2018) understanding of children's acquisition of these connectives and the factors influencing this. Moreover, while pre-registration is less critical for exploratory research (Munafò et al., 2017), further work on pragmatic acquisition of connectives should include testing these clearly-defined hypotheses in pre-registered studies. This is important, as Munafò et al. (2017) argue pre-registration of hypothesis-driven research helps to avoid both cognitive and publication bias in research and ensures researchers follow a prescribed design and analysis plan, thereby improving the potential for reproducible research. Thus, this has value from the perspective of open science, which has the important central tenets of transparency and accessibility of research (Munafò et al., 2017).

6.3 Addressing the research questions

6.3.1 Research question 1: (a) Are there particular functional uses of *because* and *if* Speech-Act sentences that might make them particularly salient for children; and (b) How do these relate to those they hear in input?

6.3.1.1 Study background and aims

When compared against patterns reported in corpus research (e.g. Bloom, Lahey, Hood, Lifter, & Fiess, 1980; Diessel, 2004), studies assessing children's comprehension of the adverbial connectives *because* and *if* (e.g. Emerson & Gekoski, 1980; De Ruiter, Theakston, Brandt, & Lieven, 2018) suggest a sizable gap between when children first produce them and when they understand them. However, it may be that this is a methodological issue more than a problem in children's ability (De Ruiter et al., in press; Donaldson, 1986; Kyratzis et al., 1990). That is, while corpus studies (De Ruiter et al., in press; Kyratzis et al., 1990) have shown that children hear and produce different pragmatic meanings with *because* and *if* (Content, Epistemic, Speech-Act, Sweetser,

1990), with the Speech-Act type occurring frequently in both input and production, comprehension studies have typically only tested children's understanding of Content (e.g. Amidon, 1976; De Ruiter et al., 2020, 2018; Emerson, 1979, 1980; Emerson & Gekoski, 1980; French, 1988; Johnston & Welsh, 2000; Kuhn & Phelps, 1976; Peterson & McCabe, 1985). More specifically, the limited data on comprehension of any other pragmatic type (e.g. Corrigan, 1975) included only a comparision between Content and the highly infrequent (De Ruiter et al., in press; Kyratzis et al., 1990) Epistemic. However, Speech-Act clauses relate to a causality constructed by the speaker, rather than one that is dependent on observed factual events (Pander Maat & Degand, 2001) and, based on patterns reported in corpus data on both adult (e.g. Diessel & Hetterle, 2011; Ford, 1993; Sweetser, 1990) and child (De Ruiter et al., in press; Kyratzis et al., 1990) speech, may have particular functional value. When considered alongside their input/usage frequency, this may mean that this pragmatic meaning is acquired first because it is the most "meaningful" (Slobin, 1985), "practical" (Kyratzis et al., 1990, p. 210) or "useful" (Evers-Vermeul & Sanders, 2011, p. 1647).

Alternatively, it is possible that the frequency observed for children's use of Speech-Act does not relate to any creative construction of causal/conditional relationships at all; it is possible that children simply reuse or repeat phrases they hear. That is, if these kinds of sentences are highly subjective (Pander Maat & Degand, 2001), they may be more likely to contain repetition in either content or form. This seems particularly plausible in the case of *if* Speech-Act, where even adults appear to use these clauses in an idiomatic way (Brown & Levinson, 1987; Sweetser, 1990; Van der Auwera, 1986). However, the existing data do not provide enough detail about Speech-Act sentences in child discourse to confidently draw conclusions about competency or functional patterns, particularly in association to input.

To address this, this study analysed longitudinal data from 14 English-speaking mother-child dyads (children aged between 2;06 – 4;11). *Because* and *if* Speech-Act sentences produced by all speakers were coded for both form (subordinate clause phrasing) and function (the illocutionary act for which the cause/conditions were given). In doing this, this study aimed to determine whether there were any regularities in either function or

form in the *because* and *if* Speech-Act sentences produced by, and to, English-speaking children which may help explain children's use of the Speech-Act function.

6.3.1.2 Results summary

The results showed different patterns for the two connectives. Children's *because* Speech-Act sentences were primarily explanations of Statements/Claims (38.2%), followed by Commands (27.1%), while their mothers' were predominately Commands (38.8%) followed by State/Claim (14.5%). There were significant differences in the children's and mothers' proportional production of both State/Claim (38.2% vs. 14.5%) and Disagrees (4.4% vs. 0.6%), with children producing both more frequently. There was no evidence that speakers from either group repeated any *because*-clause phrasing in any idiomatic or highly repetative way. Overall, the data for *because* showed that children abstract broad functional patterns from input and that *because* is primarly used to increase co-operation in a discourse (e.g. Ford & Mori, 1994; Orsolini, 1993; cf. Kyratzis et al., 1990).

In comparison, for both groups, Permission was the most frequently produced ilocutionary act with *if* Speech-Act (children: 39.8%; mothers: 19.9%). For children, this was followed by State/Claim (18.8%); for mothers, this was followed by Ask (16.6%). Children's *if*-sentences also closely resembled their mothers in form, containing a high proportion of recurring phrases which appear to be abstracted from input (*if you like/want (to)*). These accounted for 52.2% of children's *if* Speech-Acts and 23.0% for mothers'. Furthermore, when these idiomatic phrases were removed, the variation in children's proportions of *if* Content and Speech-Act (reported in De Ruiter et al., in press) was much reduced and children favoured the Content type, like their mothers. In general, the patterns with *if* aligned with the predictions in theoretical accounts and studies of adult's usage (Brown & Levinson, 1987; Sweetser, 1990; Van der Auwera, 1986; Warchał, 2010): it showed that children's *if* Speech-Act was associated with politeness.

6.3.1.3 Study implications

The results from this study provide a helpful foundation for an understanding of children's acquisition of the Speech-Act meaning. While the finding that children primarily use *because* in a co-operative manner aligns with arguments in Ford (1993) and Ford and Mori (1994) based on adults' use of *because* and also with Orsolini's (1993) arguments for

Italian children's use of *perché* (*because*), it is the first study to report this based on English-speaking children's data. Furthermore, it is in conflict with patterns reported in Kyratzis et al. (1990), who argued that children primarily used causal connectives for control. However, their study included both *because* and *so*, and as noted by Evers-Vermeul and Sanders (2011), used a coding scheme which only contained imperatives (indirect and direct), responses and questions in the Speech-Act category. For *if,* the presence of idiomatic forms helps explain the high degree of variation observed in Content and Speech-Act types in De Ruiter et al. (in press), as the removal of these sentences from the data yielded far lower standard deviations and better alignment with input. This highlights the importance of investigating usage patterns before making predictions about competency based on overall frequency accounts, alone (Shatz et al., 1983). Given the consistency of these patterns, then, this study provides some evidence that children's acquisition of these connectives may be impacted by their pragmatic function and the associated usage patterns. This provides a strong methodological justification for exploring children's comprehension of this pragmatic type, particularly in comparison to the Content type, to provide more information about how this pragmatic variation impacts acquisition of these connectives overall.

The study also provides evidence of the influence of input on children's production of these connectives. While this evidence appears to be stronger for the less-frequent *if* Speech-Act, a couple of caveats to this are necessary. First, it is possible that *if* is just more pragmatically limited. That is, it is possible that the explanation function of *because* Speech-Act extends equally well to both commands and statements/claims and it just happens that using it alongside commands better suits adult discourse priorities in child-directed speech. For example, Ryckebusch and Marcos (2004) found that the type of activity predicted the type of illocutionary act parents produced in conversation with their children. By contrast, children's speech – and their causal utterances, in particuar - have often been shown to be quite self-focused (e.g. Diessel, 2004; Hood & Bloom, 1979). As such, children may find *because* more useful for explaining their own ideas in conversation with their mothers than their mothers do with them. Additionally, the fact that they were speaking with their mothers may have increased the frequency with which they produced assertions overall, as Ryckebusch and Marcos (2004) found that the

parent's gender influenced illocutionary act patterns. In particular, they found that 1-2 year-olds were more likely to use directives with their fathers than their mothers overall, while the older children produced more assertions with their mothers. Conversely, for *if*, it is possible that the strength of its association with politeness (e.g. Sweetser, 1990) may mean that there is simply less variation in the illocutionary acts with which it regularly co-occurs, irrespective of the speaker. In this case, the evidence would suggest that children were equally competent in abstracting the broad functional usage for both connectives, rather than suggesting that the functional patterns for *if* were more strongly influenced by input.

Second, although the most frequently produced illocutionary acts by children with *because* (State/Claim) are not the same as the ones produced by their mothers (Commands), given the evidence from experimental studies in Chapters 4 and 5 (and also related patterns in Veneziano, 2001) that children do not necessarily expect to process a *because*-clause in relation to a command, it is possible that children's *because* Speech-Act sentences align with input more than the data initially suggests. That is, if children generally ignore the *because*-clauses when produced alongside commands, the next most frequent illocutionary acts in the input would likely be the ones they actually pay attention to most frequently. Given that these are State/Claims, it is possible to see how functional patterns associated with *because* Speech-Act may have a more direct influence on children's production.

Given these possibilities, it is difficult to definitively determine whether one connective is more strongly impacted by input. To better understand this, more data on children's comprehension of the Speech-Act type with different illocutionary acts would be helpful (this will be discussed again in subsequent sections) to determine how they align with input/usage patterns. However, regardless of how and why the patterns change across the two connectives, this data shows strong evidence that children's pragmatic usage of these Speech-Act sentences reflects patterns found in the input, even with the lower frequency (De Ruiter et al., in press) *if* Speech-Act. This shows how sensitive preschool-aged children are to pragmatic patterns in the input: even though children hear *if* Speech-Act far less frequently and overall patterns in *if* are more varied and complex (e.g. *if* can express simple, hypothetical and counterfactual meanings and has more varied clause

ordering; e.g. De Ruiter et al., in press), they still have an awareness of the functional patterns associated with this pragmatic type.

6.3.1.4 Study evaluation

This study used dense, longitudinal data to investigate patterns in naturalistic speech. This has been argued to be an appropriate method of assessing how children regularly use a particular form or structure and determining how this relates to input (Lieven & Behrens, 2012). The use of dense data, in particular, is considered to be important for the avoidance of thin sampling, which may yield inaccurate depictions of children's proportional productions, e.g. by overlooking highly infrequent uses (Lieven & Behrens, 2012). While this method is considered useful for exploring patterns in naturalistic speech, particularly in its comparison to input (Lieven & Behrens, 2012), there are some limitations to this approach that cannot be overlooked. For example, sampling often occurs in limited context (e.g. rarely at mealtime or outside), which may have implications for how frequently certain forms or functions are produced (De Ruiter et al., in press; Evers-Vermeul & Sanders, 2011). Therefore, the comparison to input in this study was particularly important, as the input was able to act as a control (Ambridge & Rowland, 2013). That is, in this study, children's patterns, although sampled under arguably limited contexts, were able to be compared to patterns produced by their mothers in the same contexts.

In terms of gaps, it is possible that, in grouping data together over a large window, some age-specific patterns may have been overlooked. While investigating age effects was not a primary aim of this study, it is possible that exploring how patterns change over time would contribute to a better understanding of how the functions of these sentences and the influence of input evolves. However, this was not feasible with the current dataset, particularly given the fact that there were 13 different codes for illocutionary acts and only 214 *if* Speech-Act utterances in the children's speech (292 in the mothers'). Therefore, in this study, we chose to focus on patterns related to specific illocutionary acts during a larger developmental window, rather than attempting to provide a potentially underpowered and less informative analysis on fewer illocutionary acts over shorter time frames.

Additionally, the difficulty of coding illocutionary acts should be mentioned. Illocutionary acts do not have a consistent form, but change with discourse (e.g. see review and discussion in Reeder, 1983). Additionally, as Reeder (1983) notes, one utterance can have multiple illocutionary acts. In the present study, the most prevalent illocutionary act was the one coded. For example, although an utterance like *shall we change the tyre like Grandma did on hers last night ? (be)cause I think it keeps going flat ,, doesn't it ?* (Gina's mother; 3;01:04) technically asks a question and has an interrogative form, it was coded as a suggestion, because it was decided that the primary function of the utterance was to present the idea for consideration, rather than to actually ask a question. Although these differences were often subtle, we used inter-rater reliability to ensure consistency in the interpretation. Furthermore, in line with Reeder (1983), we also relied on the context of the utterance to help discern the speaker's primary intention. That is, each utterance was interpreted in the context of the ten lines in the discourse that preceded it and the three that followed it. This helped to ensure that all utterances were interpreted, not simply on their structure, but in terms of how they related to the speaker's goals and the overall context of the discourse in which they were spoken.

6.3.2 Research question 2: Is there a difference in children's ability to understand *because* and *if* in Content and Speech-Act sentences; and (b) Can this be explained in terms of patterns in naturalistic speech and/or cognitive complexity?

6.3.2.1 Study background and aims

Although the data from Chapter 3 provided evidence that children produce Speech-Act sentences competently, nothing is known about children's understanding of them. Based on input frequency, Speech-Act should be easiest to understand for *because* and Content should be easiest for *if* (e.g. De Ruiter et al., in press). However, based on cognitive complexity, Speech-Act should be more difficult than Content because they require more complex metacommunicative skills (Zufferey, 2010). That said, while Zufferey (2010) argued that Speech-Act is more complex than Content, she expected minimal processing differences between the two pragmatic types. Additionally, as she was unable to find a difference in the age of acquisition for Speech-Act and Content in terms of production, it is not entirely clear how the differences in complexity between the two might impact comprehension. As such, this study aimed to provide a better understanding of children's

comprehension of the Speech-Act function via exploring whether there was a difference in children's (aged 3-5) ability to comprehend Content and Speech-Act sentences. Furthermore, in comparing predictions from the cognitive complexity account (e.g. Zufferey, 2010) with those based on input frequency (De Ruiter et al., in press), the study also aimed to determine which factor better explains children's pragmatic understanding of these connectives.

To test this, 92 children (and 20 adults) took part in a forced-choice picture task where they were asked to select the matching picture (from a target and distractor) after hearing Content and Speech-Act *because*- and *if*-sentences. Accuracy and response times were recorded. Children also took part in some additional tasks to provide information about their language and executive function skills. These additional tasks were two CELF (Wiig et al., 2004) sub-tests (Sentence Structure; Linguistic Concepts), a digit span test (adapted from Wechsler, 2014), a dimensional change card sort task (DCCS; Zelazo, 2006) and a measure of speech act understanding.

6.3.2.2 Results summary

Results showed that children were most accurate on *if* Content, but this pattern was primarily related to the data from the girls in the study. For response times, children were fastest with Content, but were slowest overall with *because* Speech-Act sentences. This means that while children were most accurate where cognitive complexity and input frequency converge, there was an inverse relationship between the time taken to respond and input frequency. Given the unlikeliness that input frequency impedes response times, an alternative proposal was suggested: children were slower with *because* Speech-Act because of the way they regularly hear this sentence type used in naturalistic speech. That is, as shown in corpus data in Chapter 3, children primarily hear *because* associated with commands. Given the salience of this type of illocutionary act and the argument by Shatz (1978) that children, when appropriate, prefer to respond to directives with action, children may prioritise the command in these utterances in naturalistic speech. This would mean they do not process the *because*-clause in relation to these commands. This also seems to relate to Veneziano's (2001) finding that children learn to pay less attention to their mothers' justifications for oppositional utterances. If this is the case, children may have been more likely to process the two clauses of *because*

Speech-Acts separately in this study (e.g. Millis & Just, 1994), which would explain their slower response times. This would explain the accuracy data, as well: if children do not regularly process the two clauses of these sentences together, they would actually have little experience processing these sentence types in their entirety. This would mean that the overall input frequency is not a reliable measure of how often children process these sentences. As such, if *because* Speech-Act is not actually interpreted with high frequency, children may perform better with *if* Content because, of the four sentence types included in this study (based on patterns reported in De Ruiter et al., in press), it would be the only sentence type that they regularly hear and interpret in naturalistic speech.

6.3.2.3 Study implications

This study showed that neither input frequency nor cognitive complexity on their own explain comprehension of the pragmatic function of *because* and *if* in Content or Speech-Act sentences. However, while the accuracy data initially suggested that it was cognitive complexity that interacts with input frequency, this could not explain the response time data. Conversely, an account based on the interaction between overall input frequency and specific usage patterns was able to explain both. While this could not be resolved based on this study alone, these results provide support for a usage-based prediction that input frequency often interacts with other factors to influence acquisition (e.g. Ambridge et al., 2015).

As there was little consistent evidence of a difference based on cognitive complexity, the results of this study suggest that the additional complexity of Speech-Act is not particularly problematic for children, at least not in comparison to the Content form. This provides evidence for Zufferey's (2010) argument that, by three, children possess the requisite metacommunicative skills for Speech-Act. Additionally, although there was weak evidence that they took longer to respond to Speech-Act, overall, this was primarily driven by slower response times for *because* Speech-Act, specifically (recall, there was no evidence that children were slower with *if* Speech-Act in comparison to *if* Content). This means, as hypothesised by Zufferey (2010), there was no consistent evidence that children incurred "a processing cost" for Speech-Act relative to Content based on complexity differences. Thus, although the two pragmatic types differ in the level of

complexity they contain (Zufferey, 2010), there is no evidence from the present study that this, on its own, impacts comprehension.

This study also reported some unexpected gender differences, which did not appear to be explained by overall language ability. Rather, it appeared that the boys' competency with this task emerged later, but equally across all pragmatic types; girls, however, appeared to acquire competence on *if* Content earlier. Although this was not a primary focus of the study, and we made no initial predictions about gender differences, there is some evidence that boys use causal connectives less frequently in play with peers (Kyratzis et al., 2010). As gender differences were not a focus of our corpus study, the results of Chapter 3 do not provide evidence in support or against this, as relevant to the specific pragmatic types (nor am I aware of any other studies that do). However, given this finding, future studies might want to investigate this further to determine if there are gender-based differences in children's sensitivities to, or competency with, the different pragmatic functions expressed by these connectives.

6.3.2.4 Study evaluation

This study is the first (to my knowledge) to provide evidence of children's understanding of Speech-Act sentences. Given this previous lack of information, this study provides a helpful first indication about children's overall competence with this pragmatic type in comparison to the type that is most frequently assessed (i.e. Content). Furthermore, use of the forced-choice picture selection paradigm allowed for investigation of this with minimal additional cognitive demands (Ambridge & Rowland, 2013).

In this study, children's comprehension of connective function was tested via isolated sentences. While this may create somewhat unrealistic conditions for interpreting meaning (Emerson & Gekoski, 1980), this was chosen to reduce the amount of additional information children needed to process. However, given that Speech-Act meaning relates to a discourse (e.g. Pander Maat & Degand, 2001), it is possible that the lack of context created especially unlikely conditions for interpretation of this pragmatic meaning. For example, if the picture did not include enough information for a child to understand what would motivate a speaker's production of the given illocutionary act in a Speech-Act trial, these sentences may have been more likely to be misunderstood. However, as accuracy was relatively high on all sentence types for all groups but three-year-old boys, this does

not seem to have been a problem on this task, overall. Rather, it seems the opposite might be the case. As argued in the discussion of Chapter 5, children's interpretation of *because* and *if* in this study may have been supported by cues from the full sentence. Given arguments from previous research on *because*- and *if*-sentences, this certainly seems plausible. For example, Emerson and Gekoski (1980) suggested that their data provided evidence that young children use "available contextual cues" (pp. 222 – 223) to interpret event ordering in *because*- and *if*-sentences. This means that the results from the present study likely reflected children's ability to interpret sentences with connectives expressing certain pragmatic meanings, rather than the connectives, themselves.

The illocutionary acts used in this study were the same for both connectives (i.e. directives). This was done to control the variables across the sentences as much as possible. While this is helpful in terms of showing that the delay in processing a Speech-Act sentence with a directive in the main clause only occurs with *because* (this will be discussed further in section 6.3.3.4), it also means that the illocutionary acts used with the *if* Speech-Act sentences were not the most frequently heard ones in the input (recall from the corpus study in Chapter 3, these are Permits). In terms of providing a first investigation into children's processing of these sentences, however, this standardisation was important, particularly when the measures in the study (accuracy, response time) did not allow for insight into where any specific processing delays occur. That is, if different illocutionary acts were used for each connective and a difference occurred as a result of this, it would not be possible to determine whether this was related to the illocutionary act itself, or the relationship between the illocutionary act and the connective.

This leads to reflection on the measures used in this study. Although the accuracy and response time measures were unable to provide a detailed account of processing, they were still informative, particularly when combined. That is, had only accuracy information been provided, it is likely that specific usage patterns would have been overlooked as an explanation. Therefore, although the measurements in this study were not sensitive enough for us to be able to understand definitively where and why the processing delay occurred, they do present new information about children's comprehension of these sentences (i.e. they show children's ability to interpret sentences containing connectives expressing different pragmatic functions and suggest that neither cognitive complexity

nor input frequency can, on their own, explain children's acquisition of the pragmatic function of these connectives).

6.3.3 Research question 3: (a) Do children have a preferred pragmatic function for either *because* or *if*; and (b) how is this explained in terms of patterns in naturalistic speech and/or cognitive complexity?

6.3.3.1 Study background and aims

This study aimed to provide a clearer picture about how children's comprehension of these connectives is impacted by pragmatic variation by examining their expectations about connective function in the context of a discourse. That is, although the results from the study in Chapter 4 showed that children can understand Content and Speech-Act sentences, there was some weak evidence that their comprehension and processing may have been impacted by specific patterns in the input. However, this hypothesis was not verifiable based solely on the accuracy and response times to full sentences reported in Chapter 4. Additionally, as that study only compared Content and Speech-Act sentences, it was not possible to ascertain a full pattern of development for acquisition of all three pragmatic functions (i.e. Content, Epistemic, Speech-Act; Sweetser, 1990). As such, to better understand how children expect these connectives to function and how cognitive complexity and input patterns contribute to these expectations, this study explored children's processing and interpretation of all three pragmatic types of *because* and *if* via use of multiple methods (i.e. predictive looking, accuracy and response time).

In this study, 92 3-5 year-olds (and 22 adults) took part in in a forced-choice eye-tracking task, where after hearing short stories, they selected a picture to complete *because*- or *if*-sentences. All three of Sweetser's (1990) pragmatic types (Content, Epistemic, Speech-Act) were included. Accuracy, response time and looking time data (both during the connective and the subordinate clause) were analysed. Additionally, to provide information about children's language and executive function skills, and the relationship between these skills and the main task, children were also assessed on the CELF Sentence Structure subtest (Wiig et al., 2004), a digit span task (adapted from Wechsler, 2014) and tests of inferencing skill (adapted from Freed & Cain, 2016; Language and Reading Research Consortium (LARRC) & Muijselaar, 2012) and speech act causality.

6.3.3.2 Results summary

Three-year-olds looked more to target for *because* Content and *if* Epistemic during the connective, while five-year-olds looked more to target for *because* Speech-Act and *if* Content. Children were most accurate with Content overall, with some weak evidence that accuracy was above the mean for *because* Content and below the mean for *because* Epistemic, with no differences to the mean for any pragmatic type with *if*. With response times, five-year-olds were slowest with *if* Speech-Act, although the 8-second average response time for three-year-olds suggested difficulty with the task, overall.

In interpreting all the data together, the results show that the pattern of acquisition differs across the two connectives. Both groups acquired an understanding of Content before the other pragmatic types, although this occurred earlier for *because* than *if.* In particular, three-year-olds' understanding of *because* was primarily built around this pragmatic type, as indicated by higher overall accuracy and more looks to target. By contrast, the three-year-olds were not more accurate on any sentence type with *if* and, in fact, looked more to target for Epistemic, which should be most difficult based on both cognitive complexity (e.g. Zufferey, 2010) and input frequency (De Ruiter et al., in press). However, the patterns associated with the three-year-olds' *if* Epistemic most likely indicated difficulty with it, rather than a more reliable understanding; it was suggested that the more consistent looks to target might reflect a lack of attempting to decipher meaning on these sentences due to finding them particularly difficult.

By five, however, children were less confident in predicting a Content function with *because.* Although they were still more accurate with it, overall, their understanding of the different pragmatic types had increased. However, five-year-olds made predictions about speaker meaning during the illocutionary act (command) of *because* Speech-Act, rather than during the connective, providing evidence for the hypothesis in Chapter 4 regarding the influence of specific usage patterns on this sentence type. By contrast, with *if*, five-year-olds looked more reliably to Content, even looking before the connective onset, suggesting they may have used cues in the main clause to help predict this meaning. Additionally, higher accuracy than would be expected based on input frequency, particularly in comparison to *because*, on both *if* Epistemic and Speech-Act

suggested that children may be more likely to use a general understanding of *if* to interpret these sentence types.

6.3.3.3 Study implications

This study presents new and detailed information about children's acquisition of the pragmatic meanings of *because* and *if*. Two results are of particular relevance to the patterns reported in existing literature, where children have been found to have difficulty with these connectives (e.g. De Ruiter et al., 2018; Emerson & Gekoski, 1980). First, although at age three, children's understanding of *because* is primarily built around the Content function, by age five, they no longer have these expectations. Rather, despite above chance accuracy on Content and Speech-Act at age five, they do not make online predictions about what sort of pragmatic meaning *because* will express. While this points to the influence of input at age five, it may also help explain why children at this age have difficulty interpreting a Content meaning in comprehension studies. More specifically, if, at age five, children are aware that *because* can perform different functions and do not know which one to expect when hearing it in the speech of others, this lack of confidence may result in difficulty when asked to interpret connective meaning. This kind of confusion may be particularly problematic when they have to interpret the connective meaning in the context of temporal ordering (which is not consistent across pragmatic types; e.g. Donaldson, 1986; Pander Maat & Degand, 2001) and/or there are fewer cues on which they can rely to interpret the functional meaning.

Secondly, there was evidence that children did not establish a primary pragmatic meaning for *if* until age five. However, at this age, they appeared to use a general understanding of *if* to interpret meaning, resulting in similar levels of accuracy across all three pragmatic types. That is, even without having a full understanding of all pragmatic types, if they had some understanding that *if* signals a conditional relationship, they may have used this general understanding to decipher Speech-Act and Epistemic sentences. Indeed, Donaldson (1986), drawing on arguments from Johnson-Laird (1983, as cited in Donaldson, 1986), argued that children likely adapt their representations of the underlying semantic concepts connectives express to reflect their interpretation of specific utterances. Although her argument was in relation to causal connectives, specifically, the data from this study suggested children were more likely to use this

strategy with *if* than *because*. For example, children at both age groups performed poorly on *because* Epistemic, providing little evidence that children used a broad understanding of causality to interpret this type of meaning. However, if (as argued in Chapters 4 and 5) children learn that *if* is more important to overall sentence meaning than *because* (particularly for Speech-Act sentences), and therefore more regularly interpret *if* in a wider variety of sentence types, they may have a more flexible understanding of how to interpret *if*-sentences, making this strategy more suitable for *if* than *because.* This would suggest that, although they may be more difficult, overall, five-year-olds may have a better understanding of *how* to interpret *if*-sentences than *because*-sentences.

It was also argued that later establishment of a single, preferred pragmatic meaning for *if* compared to *because* was related to the higher amount of variation associated with *if* (i.e. semantic, clause ordering), meaning that children were not able to establish a clear meaning of this connective, even in the high-frequency/low complexity Content form, until later (see De Ruiter et al., in press, for related arguments). However, the ability to interpret all three pragmatic types of *if* with similar levels of accuracy, through use of both a general understanding and cues from the sentence, points to children's general pragmatic awareness and resilience in resolving meaning in complex structure.

In terms of supporting the hypothesis from the study in Chapter 4, this study also provided evidence that children do not expect to have to process *because*-clauses in relation to commands. Rather, they appear to make a prediction based on the command, itself, and then have to re-adjust to interpret that meaning in relation to the connective. Although the study also provided evidence that not all illocutionary acts are processed that way (recall no predictions were made during the illocutionary acts with *if*), the pattern associated with *because* Speech-Act commands is relevant as it suggests that overall frequency counts of the different pragmatic types may overestimate the experience children actually have in interpreting them. This problem of relying on overall frequency counts and overlooking pragmatic patterns has been argued elsewhere. For example, Shatz et al. (1983) showed that children's earliest use of mental state verbs were solely to "direct the interaction" (e.g. "*Remember where the dirt is*?", p. 308) and not express any real understanding of mental states, causing the authors to argue that it is important to consider functional patterns rather than relying on overall frequency

counts. This further highlights the importance of understanding which factors may influence acquisition of a form, particularly when it is a highly-frequent form, when establishing predictions about acquisition (e.g. Ambridge et al., 2015)

This study also emphasises the benefit of using mixed measures to explore language acquisition. As argued in section 6.3.2.4 in relation to the study in Chapter 4, if this study had relied solely on one measure, the overall summary of results and discussion would likely be very different. For example, based on the accuracy data, alone, the evidence for the influence of input would be far less than when it is considered alongside the looking behaviour data. The benefit of using both online and offline measures in child language acquisition research has been shown elsewhere. For example, Reuter et al. (2018) suggested that the two measures can provide different information due to differences in precision, statistical power and associated cognitive demands.

6.3.3.4 Study evaluation

The results from this study show that it was a challenging task overall, particularly for three-year-olds, who took an average of 8 seconds to respond to correct trials, had particularly noisy looking data and, for whom, only two sentence types showed any evidence of above-chance accuracy. In comparison to the results in Chapter 4, this provides evidence that children's comprehension of these connectives is rather fragile and highly influenced by methodology (e.g. De Ruiter et al., 2018; Donaldson, 1986; Peterson & McCabe, 1985). In this study, there was also a relationship between task performance and both memory and inferencing skills, meaning children who had poorer skills in those areas performed worse overall, regardless of their ability to interpret meaning of any individual pragmatic type. However, in naturalistic speech, children do not necessarily have to interpret connective meaning in the context of previously heard information. This means that backward recall skills and general pragmatic inferencing (i.e. relating to the information they have heard and its relationship to a cause/condition) may be less critical in real-world situations than they were in the present task. Still, as children do use heuristic cues to interpret meaning (as argued by Emerson & Gekoski, 1980), it is possible that these skills are relevant to real-world situations. For example, it may be easier for children to understand a Speech-Act sentence like "maybe we could read a story quietly, because the baby is sleeping" if the child recalls previously learned

information, such as it being important for the baby to have a nap. Relatedly, if a mother uses the Content function to explain that she will be late if she does not hurry, children may have an easier time understanding that sentence if they can relate it to knowledge about the fact that the mother is going out and why she would not want to be late. However, as the different pragmatic types differ with regard to the level of inferencing/assumptions they require (Pander Maat & Degand, 2001; Sweetser, 1990; Zufferey, 2010) and children have differing levels of experience with the different sentence types (De Ruiter et al., in press) more data on exactly how these skills directly relate to comprehension of these pragmatic types would be helpful, especially as this study did not directly test inferencing or recall skills with regard to connective function.

As noted in section 6.3.3.3, the looking behaviour prior to the onset of the connective differed based on the illocutionary acts used in the Speech-Act sentences. That is, predictions were made during the illocutionary act for those directing behaviour (*because*), while this was not the case for ones relating to politeness (*if*). While this is interesting, as it shows how acquisition of these connectives is impacted by specific differences in the input, it means we do not have a direct comparison of how children process the two connectives online in relation to the same illocutionary acts. While there is some weak evidence from the study in Chapter 4 that children show a delay when responding only to *because* Speech-Acts with commands (i.e. not *if),* more data on processing of the connectives in relation to different illocutionary acts is needed. Through this, we would gain more information about how Speech-Act understanding emerges, and how this relates to both input patterns and overall acquisition.

6.4 Overall implications

6.4.1 Children's pragmatic awareness

The research presented in this thesis provided evidence that children are sensitive to pragmatic patterns associated with function words. Children, like their mothers, used *because* to build on their utterances, allowing them to be more co-operative in the discourse (in line with Ford, 1993; Ford & Mori, 1994; Orsolini, 1993). They also used *if*-clauses, often in the form of an idiomatic phrase, to express politeness, primarily when expressing permission, making a request/suggestion or issuing a promise/offer. These patterns show children have at least some awareness that these connectives can be used

for functions other than explaining causes of/conditions for events in the world around them (i.e. the Content function).

The comprehension data in this thesis also support the idea that children have an awareness of the different pragmatic functions – at least in the case of five-year-olds, whose predictions and interpretations in the study in Chapter 5 appeared to be impacted by the presence of this pragmatic variation. However, they also show that there is a difference between being aware of the different pragmatic functions and their associated patterns (and producing these in one's own speech) and being able to demonstrate comprehension of, or make predictions about, these functions in the speech of others. In the case of production, the patterns in Chapter 3 align with Tomasello's (2001) argument that children try out patterns they hear in input in their own speech, which then become established as typical usage patterns through practice. However, there may also be some overlap between these Speech-Act uses and "holophrases", which Tomasello (2001) argues children use to achieve a specific function, even without necessarily understanding their composite parts. That is, it is possible that children's Speech-Act productions are more of a reflection of habitual patterns in their own speech (learned from the input), rather than any deeper conceptual understanding of the connective's meaning when performing this function. Certainly, there is some evidence of this with the idiomatic phrasing in *if* Speech-Act. Additionally, in the case of *because*, Veneziano (2001) provides some evidence that children learn there is a benefit to producing these kinds subordinate clauses, but also that children become somewhat immune to this function in the speech of others. Although she showed that this sort of justification was not always produced with a connective, both French-speaking mothers and children (1-2 years old) in her study had a greater tendency to "give in" to each other's oppositional illocutionary acts (denying, prohibiting, protesting, refusing) when they were justified. However, she also found that children were less likely to do so as they got older. She argued that there is a developmental trajectory associated with these justifications: children first learn the benefit of this function before producing it themselves; after it appears in their own speech, they begin to pay less consideration to it in the speech of others. She also hypothesises that, later in development, children will both produce, and be influenced by, this function. The patterns reported in this thesis seem to align with the mid-point of

Veneziano's (2001) trajectory, where children produce patterns relating to input (Chapter 3), but focus on the commands over the associated explanation in comprehension tasks (Chapters 4 and 5). Thus, although children have abstracted the Speech-Act function from input and understand the "how and when" (to borrow phrasing from Clark, 2014, p. 107) of its use, this does not mean they fully understand, or attend to, this same functional meaning in the speech of an interlocutor.

The data also show that the ability to interpret these meanings develops gradually and, in line with other research on these connectives, varies greatly with methodology (e.g. Donaldson, 1986; Peterson & McCabe, 1985). While hearing the full sentence (Chapter 4) seemed to support interpretation, hearing more information from a broader discourse (Chapter 5) did not. In fact, this information appeared to pose additional cognitive demands on the children, such that a relationship was found between performance on this task and inferencing and backwards recall skills. These patterns are not necessarily surprising, given findings and arguments in other literature. For example, Emerson and Gekoski (1980) found a relationship between more challenging synonymy tasks (e.g. recognising *X because Y* as being the same as *Because Y, X*) and children's understanding of more general concepts of ordering (e.g. ordering of "real-life" events; p. 217), seriation and reversibility. For inferencing, arguments in more theoretical literature have suggested that the Epistemic and Speech-Act types, in particular, require interlocutors to draw inferences and assumptions (Pander Maat & Degand, 2001; Sweetser, 1990; Zufferey, 2010). However, the additional difficulty children had in the task in Chapter 5 compared to the task in Chapter 4 suggests that the level of inferencing and memory required to interpret the connectives in the context of a discourse (and without the full sentence for support) is one that is more advanced.

Taken altogether, these studies suggest that children have a general sensitivity to pragmatic patterns that allow them to establish patterns of use for these connectives, which are reinforced in their own speech. However, this general awareness is less helpful when trying to interpret the actual pragmatic meaning in the speech of others. This is not uncommon in the child language acquisition literature, however, where several authors (e.g. De Ruiter et al., 2018; Hood & Bloom, 1979; Kuczaj & Daly, 1979; A. E. McCabe et al., 1983) have argued that interpreting an utterance based on someone else's ideas is more

difficult than producing something related to your own. As such, children often use cues in a sentence to interpret connective function (Donaldson, 1986; Emerson & Gekoski, 1980). However, there are limits on their ability to do this: at five, their ability to use information from a broader discourse to predict the meaning is still only emerging, likely hindered (at least in part) by the additional socio-cognitive demands of retrieving and incorporating discourse information. Overall, then, this shows that children's pragmatic awareness is developing in the preschool years, such that they can establish competent patterns of usage through a broad sensitivity to function, but cannot use more advanced pragmatic skills to reliably establish expectations until many years later.

6.4.2 Comprehension of *because* and *if*

The data from the eye-tracking study in Chapter 5 showed that, for both connectives, children first develop expectations based on the Content function. While this would seem to suggest that Content stimuli used in experimental studies match children's understanding more than I (and others, e.g. De Ruiter et al., in press; Kyratzis et al., 1990) have suggested it might (see Chapter 2 - Introduction), the data also show that acquiring these pragmatic meanings is not straight-forward. For example, the data show that, although children establish a meaning primarily around *because* Content at age three, by age five, they have lost confidence in this pragmatic meaning; at five, the other pragmatic meanings appear to compete with expectations of *because* Content. Furthermore, while their understanding at three is most strongly related to *because* Content, this is still only an emerging understanding, particularly when interpretation of pragmatic meaning is reliant on additional executive function skills (see section 6.4.1). Therefore, while the data here supports arguments and evidence from previous literature that children's comprehension of *because* is fragile and impacted by methodology (e.g. De Ruiter et al., 2018; Donaldson, 1986; Emerson & Gekoski, 1980; French, 1988; Peterson & McCabe, 1985), it also provides evidence that, as children become more aware of how this connective functions, they also become less confident that a Content meaning is the one being used.

This change in expectations cannot be excluded as a factor contributing to children's difficulty (as reported in many studies, e.g. De Ruiter et al., 2018; Emerson, 1979, 1980; Emerson & Gekoski, 1980; Johnson & Chapman, 1980; Kuhn & Phelps, 1976) with this

connective, particularly when, in some contexts, it is difficult to determine which pragmatic type a speaker is using (Sweetser, 1990; Zufferey, 2010). If, at five, children are aware of the different pragmatic types and do not have suitable context, it is possible they may misinterpret the sentence or just fail to understand it (Donaldson, 1986). Donaldson (1986) shows how this could be particularly problematic in the case of "acceptability" or "silly/sensible" tasks (e.g. Corrigan, 1975; Emerson, 1979; Johnson & Chapman, 1980; Peterson & McCabe, 1985), where children are presented with sentences in logical/forward or illogical/reversed order (e.g. *The chair got wet because the glass of water spilled* vs. *The glass of water spilled because the chair got wet;* Emerson, 1979, p. 290) and asked to determine whether or not they make sense. Donaldson (1986) notes the difficulty trying to discern (in Sweetser's, 1990, terms) an illogical Content from a logical Epistemic. For example, in reference to Corrigan's (1975) example *Kathy was angry with Paul because she kicked him* (p. 196 in Corrigan; repeated on Donaldson, 1986, p. 32), Donaldson (1986) argues that it is not possible for children to know that this is (in Sweetser's, 1990, terms) an illogical Content sentence, rather than a logical Epistemic sentence, particularly when they are presented with Epistemic sentences throughout Corrigan's (1975) task (e.g. *John had a white block because there were only white ones*; Corrigan, 1975, p. 196). As these studies often report that children give higher judgments of "sensible/acceptable" rather than "silly/unacceptable" (e.g. Corrigan, 1975; Emerson, 1979; Johnson & Chapman, 1980; Peterson & McCabe, 1985), Donaldson (1986) suggests that children may be more likely to adjust their interpretation to render a logical meaning. In a related way, then, studies drawing conclusions about children's comprehension of these connectives based on ordering (e.g. De Ruiter et al., 2018; Emerson & Gekoski, 1980) may underestimate the influence of pragmatic patterns. That is, given that ordering differs across pragmatic types (Donaldson, 1986; Pander Maat & Degand, 2001; see discussion in Chapter 2 - Introduction), children may either confuse the type of ordering in a given sentence with one from another pragmatic type (e.g. Content for Speech-Act), or it may be less reliable a concept to acquire (Donaldson, 1986). Thus, as it has been argued before (e.g. De Ruiter et al., in press; Donaldson, 1986; Orsolini, 1993), considering the different functional patterns greatly enhances our understanding of children's acquisition of connectives; this is even more so the case when these patterns are considered alongside results from existing literature.

The data in this thesis also suggest that overall input frequency counts overestimate how frequently children actually interpret causal and conditional meaning with these connectives. With *if*, as argued in Chapter 3, the high number of idiomatic phrases may overestimate how frequently children interpret this type of conditional meaning. As these only accounted for 23% of *if* Speech-Act input (Chapter 3) and Speech-Act only accounts for 28% of *if* input (De Ruiter et al., in press), however, this likely has stronger implications for children's ability to establish a clear meaning of the Speech-Act function, in particular, rather than having a significant impact on the overall frequency with which they interpret a conditional meaning with *if.* With *because,* the most frequently heard Speech-Act sentence (i.e. those co-occurring with Commands) are ones where children appear to overlook the subordinate clause (Chapters 4 and 5). This means that that the number of times children interpret a causal meaning with a Speech-Act sentence would reduce by about 40% from the numbers predicted in corpus studies (e.g. De Ruiter et al., in press; Kyratzis et al., 1990). Given that Speech-Acts are the most frequent type of *because*-sentence (De Ruiter et al., in press; Kyratzis et al., 1990)*,* this also has implications for the number of times they actually interpret a causal relationship in speech. In raw numbers, based on the dataset used for Chapter 3 and in the additional coding reported in De Ruiter et al. (in press), this means the number of *because*-sentences children interpreted in input reduces from 1586 to 1220 (a reduction of 23%). While this is still a relatively large number, it is based on the removal of only one illocutionary act. If children similarly overlook the subordinate clause in requests or questions, which, in line with arguments by Shatz (1978), may also motivate a focus on action, the number could be much lower. While more data is needed on how children interpret these connectives in relation to different illocutionary acts, this shows how problematic it can be to rely on overall counts to establish predictions about acquisition (e.g. Shatz et al., 1983).

Overall, the data here show that, in line Emerson and Gekoski's (1980) arguments about semantic understanding, children's pragmatic understanding of these connectives emerges slowly over time. Similarly, also like their semantic understanding (Peterson & McCabe, 1985), their pragmatic understanding of these connectives is also very dependent on methodology. When children can use heuristic cues in the sentence structure and there are no additional cognitive demands, they are very competent at

interpreting the pragmatic meaning of these connectives (at least for Content and Speech-Act) by age five. When the same heuristic cues are not as available and the task poses additional demands on executive function, children's overall accuracy decreases. Children's understanding of how others will use these connectives pragmatically also appears to be strongly influenced by very specific patterns in speech. These patterns mean that children's expectations about functional meaning are inconsistent across age groups and the two connectives, at least into early school years. When these factors are considered, they can help explain some of the difficulty reported in tasks assessing semantic comprehension of these connectives (e.g. De Ruiter et al., 2018; Emerson & Gekoski, 1980).

6.4.3 Evaluation of the usage-based approach

The results from this thesis provide strong evidence for the usage-based approach (e.g. Tomasello, 2001). However, they also suggest that children's production and understanding of connective function are not solely explained by frequency. There was no evidence that children's understanding of these pragmatic functions was directly predicted by the overall frequency with which they heard them in input. Rather, as discussed in section 6.4.2, children's acquisition was more related to more specific patterns in usage, which differed for the two conenctives. This provides evidence for Ambridge et al.'s (2015) *Interaction Thesis*, where other factors in speech interact with frequency to predict acquisition. The data for *because* provided evidence that Speech-Act's frequent co-occurrence with commands impacted children's comprehension of that pragmatic form, as children did not appear to expect to interpret *because*-clauses in relation to these. This is similar to Naigles and Hoff-Ginsberg's (1998) finding that when verbs appeared at the end of the sentence, children were less creative with them. In both cases, a specific pattern (co-occurrence with commands; placement in a sentence) provided a context which negatively impacted children's learning of how to use a form with a full range of meanings.

Based on the data here, it is not possible to determine exactly how much of children's difficulty with *if* can be explained by the presence of the pragmatic types in comparison to variation in clause ordering or semantic meaning. However, the data from Chapter 5 suggest children have difficulty establishing a clear functional meaning of this connective

in comparison to *because*. As *if* is lower in input frequency compared to *because* overall (De Ruiter et al., in press; Diessel, 2004), pragmatic and semantic patterns are compressed over a fewer number of utterances for *if*. This means children likely hear very few consistent patterns with this connective (De Ruiter et al., in press). This relates to Ambridge et al.'s (2015) *Levels and kinds Thesis*. Here, they distinguish between Token frequency and Type frequency, where the former is overall frequency and the latter is the frequency within a particular type or structure. In the case of *if,* although Token frequency is relatively high (both overall and in comparison to many other connectives; De Ruiter et al., in press; Diessel, 2004; see discussion in Chapter 2 - Introduction, section 2.3), the Type frequency is also very high, meaning that input frequency of any individual sentence type is likely low. As Ambridge et al. (2015) argue that the more you hear a specific type, the easier it is to acquire, this can help explain why children have difficulty establishing an understanding of *if*. Although there is currently no data on the frequency of all of the different types of *if*-sentences in the input, data from De Ruiter et al. (in press) provide some evidence for this argument. For example, while De Ruiter et al. (in press) do not offer a summary by speaker group (i.e. parents and children), they show that, in mother-child discourse, Content sentences occur 33% of the time in main-subordinate order and 67% in subordinate-main order. They also show that Content sentences express simple conditionality 81% of the time, hypothetical 17% of the time and counterfactual 2% of the time. This means that, although the most frequent type of sentence appears to be a subordinate-main ordered Content sentence expressing simple conditionality, children also hear likely hear subordinate-main ordered Content sentences expressing hypothetical conditionality or possibly even main-subordinate ordered Content sentences expressing counterfactual conditionality. While more data is required to fully understand the extent to which the different factors contribute to children's difficulty with this connective, these patterns do seem relevant to explaining children's performance with *if* in Chapter 5 of this thesis.

While the relationship between input and comprehension was rather complex, the relationship between input and production was more straightforward. Children produced Speech-Act sentences to serve the same specific functional purposes as their mothers. As noted in section 6.3.1.3, it is not entirely possible to conclude whether children produced

mostly State/Claims because it better suited their conversational goals or whether it was because they ignored their mother's explanations of commands, nor was it possible to conclude whether the similarities between mothers' and children's use of *if* Speech-Act was related solely to input or because the politeness function of *if* is just generally more limited. Regardless, the data here show the same overall pattern as the comprehension studies: children are highly sensitive to functional patterns in their caregivers' speech. That is, even in the more variable *if*, where Speech-Act accounts for a lower proportional frequency (De Ruiter et al., in press), children were aware of, and adopted, the functional uses they heard in the input.

6.4.4 Evaluation of the cognitive complexity approach

The data in this thesis provided no strong evidence that cognitive complexity predicted comprehension of these connectives. That is, while there were results in both Chapters 4 and 5 for which I could not entirely rule out the influence of cognitive complexity, the evidence in the thesis, overall, appears to be stronger for the influence of input. For example, although the accuracy results in Chapter 4 could be explained in terms of an interaction between input frequency and cognitive complexity, the explanation accounting for specific input patterns in place of complexity could account for both the accuracy and response times. Furthermore, even if the accuracy results in Chapter 4 were best explained by an interaction between frequency and complexity, this means that complexity only explains acquisition in frequent forms. Put differently, if it does influence acquisition, it does not do so on its own.

In terms of the cognitive skills related to these pragmatic types, this provides support for Zufferey's (2010) hypothesis that children possess the metacommunicative skills necessary for Speech-Act by about the age of three. While children in the study in Chapter 5 still only had an emerging understanding of Epistemic at age five, that there were differences across the connectives suggest this was more related to input patterns than solely because of the complexity of these sentences (i.e. assuming that the complexity is equal across the connectives, we would not expect those kinds of differences based on complexity alone). Still, as noted above, the complexity of this pragmatic type cannot be ruled out in contributing some level of difficulty to these

sentences (see Zufferey et al., 2015 for related argument regarding children's difficulty on Epistemic sentences in comparison Content).

However, it is also possible that the levels of complexity are not as clearly defined as Zufferey (2010) suggests. In fact, in Pander Maat and Degand's (2001; Degand & Pander Maat, 2003) model, Speech-Act relationships appear at the farthest end of the continuum from Content, with Epistemic in the middle. This is because, in their model, pragmatic types are classified in terms of the amount the speaker is involved in constructing the causality. Because the causality in Speech-Act sentences is established in the mind of the speaker, they have the highest level of speaker involvement in their model. This, then, might have implications on the overall level of complexity in these sentences which is not considered by Zufferey (2010). For example, as noted in Chapter 2 – Introduction, Zufferey (2010) gave the example "Max is ill, because he didn't come to work today", and argued that, to interpret a sentence like this, the speaker needs to understand how being ill is related to not being at work. Arguably, however, so long as these utterances are related to patterns children understand (e.g. eggs breaking after falling, as in French, 1988; or a birthday being a cause for a party, as in Johnston & Welsh, 2000), this should not be particularly difficult for children to resolve. As argued by Pander Maat and Degand (2001) these utterances are still based on observable evidence or regular patterns. However, they argue that, in a Speech-Act utterance, there is no such reliance on observable patterns; it is reliant on the speaker in a particular discourse. If children have a less reliable understanding about a speaker's motivations than they do about observable facts, these Speech-Act sentences may be just as, if not sometimes more, difficult to fully resolve. Additionally, as Veneziano (2001) draws a connection between justification and theory of mind (e.g. in relation to awareness of the emotional and mental states of interlocutors), it is possible that Speech-Act meanings require cognitive skills more akin to the ones required for Epistemic than Zufferey (2010) suggests.

That said, the data in this thesis show that children, at least by age five, have some understanding of how to interpret the Speech-Act function (particularly when they can use the full sentence structure to interpret connective meaning). This means that the complexity of this pragmatic type, even if it contributes some level of additional complexity for children, is not especially problematic by the time they reach school age.

This provides some further evidence that the level of cognitive complexity, overall, does not seem to be a strong predictor of preschool-aged children's comprehension of these connectives, at least not in and of itself.

6.5 Future directions

6.5.1 How do children process Speech-Act clauses associated with different illocutionary acts?

The data in the present thesis provided evidence that children do not expect to interpret a *because*-clause following a command. However, the same pattern did not occur with the illocutionary acts associated with *if* in Chapter 5, so it appears this might be specifically limited to commands. Yet, as Veneziano (2001) found children became less influenced by their mother's justification of all kinds of opposition and Shatz (1978) argued that children prefer to respond to both imperatives and interrogative directives (e.g. *Can you shut the door?*, p. 41) with action, there may be similar patterns when *because*-clauses co-occur with requests or even questions. As such, future studies should investigate processing and comprehension patterns of Speech-Act clauses in relation to different illocutionary acts. This should contribute to a broader understanding of how these illocutionary acts influence children's processing of Speech-Act clauses, which would, in turn, provide more information about how input impacts acquisition of the pragmatic types, as well as children's overall competency in understanding this pragmatic meaning.

6.5.2 How much do semantic and pragmatic factors contribute to children's comprehension of *if*?

The data in this thesis provided evidence that children have more difficulty establishing a clear understanding of *if,* especially compared to *because*. As children hear *if* expressing different semantic meanings (e.g. hypothetical, counterfactual, simple; De Ruiter et al., in press) and in different clause orders, which vary in frequency with pragmatic type (De Ruiter et al., in press), this is not surprising. As such, I have argued in this thesis, in line with arguments and evidence presented in De Ruiter et al. (in press), that the presence of the three pragmatic types (i.e. Content, Epistemic, Speech-Act) is simply one more type of variation relevant to this connective. I have also argued that it is the presence of all of these together which likely contribute to a higher Type frequency, thereby impacting acquisition (in line with Ambridge et al., 2015). To better resolve how much any single

factor accounts for children's difficulty with *if*, future studies might evaluate the frequency with which children hear different Types of *if*-sentences (e.g. where clause order, pragmatic type and semantic meaning are all factors) and how this, in turn, relates to comprehension.

6.5.3 To what extent is children's difficulty with ordering related to pragmatic variation?

Although some studies have found that children have difficulty with the temporal ordering of these sentences (e.g. De Ruiter et al., 2018; Donaldson, 1986; Emerson, 1979, 1980), other studies have shown that children do have a general understanding of the causal ordering these connectives express (e.g. Donaldson, 1986; French, 1988). While Donaldson (1986) argues that children's difficulty with the temporal ordering is its "secondary" functional meaning, she also provides some evidence for how different pragmatic types express meaning differently (see also Degand & Pander Maat, 2003; Pander Maat & Degand, 2001). However, children's understanding of temporal ordering of the events in these sentences has never (to my knowledge) been tested outside the Content meaning. Exploring this could provide more concrete information about children's understanding of ordering signalled by these connectives and how this relates to, or is influenced, by different pragmatic functions.

6.6 Conclusions

Existing literature has presented conflicting results on children's acquisition of the adverbial connectives *because* and *if.* However, even if children appear to have difficulty understanding these connectives (e.g. Emerson & Gekoski, 1980), they appear to be confident in how to use them at a young age (e.g. Diessel, 2004; Hood & Bloom, 1979; A. E. McCabe et al., 1983). In particular, their speech shows evidence that use of these connectives is related to the pragmatic functions they perform (De Ruiter et al., in press; Kyratzis et al., 1990). To explore how children's understanding of these connectives is related to pragmatic function, this thesis explored children's production, comprehension and processing of sentences expressing the pragmatic functions described by Sweetser (1990): Content, Epistemic and Speech-Act. Additionally, this thesis explored whether any differences could best be explained in terms of either cognitive complexity (e.g. Sanders,

2005; Zufferey, 2010) or via patterns in the input (i.e. via a usage-based approach, e.g. Tomasello, 2001).

The corpus data provided evidence that children do use the Speech-Act type for specific functions (co-operation and politeness, for *because* and *if,* respectively). It also provided evidence that input patterns play a role in children's acquisition of how these connectives function. Relatedly, while the data from the study in Chapter 4 showed that children were generally competent with both Content and Speech-Act meanings, it also provided some evidence that input patterns were likely a stronger predictor in children's comprehension and processing of these sentences than cognitive complexity. A similar pattern was found in the study in Chapter 5, where the data showed that children first learn a Content function with both *because* and *if*, but because of specific patterns in the input, this occurs at different ages for the two connectives. It also provided evidence that specific patterns in the input impact children's ability to interpret the pragmatic meaning for the Speech-Act and Epistemic pragmatic types, but again, this differed by connective. For *because*, the regular co-occurrence of Speech-Act clauses with commands means that children do not expect to process these clauses together; children have to overcome these expectations in order to interpret meaning in these sentences. For *if*, a better understanding of the importance of *if* to overall utterance meaning*,* likely learned through hearing *if* used to express conditional permission (see arguments in Chapter 4), helps children interpret the Speech-Act and Epistemic meanings, even without a more detailed understanding of these pragmatic functions. Thus, children's acquisition of the function these connectives perform is impacted by specific patterns in the input (in line with Ambridge et al., 2015), even years after children are competently producing them. As such, their understanding of what speakers mean when they produce these connectives – and associated semantic meanings (e.g. ordering) – are likely impacted by these pragmatic patterns in speech, which helps to explain their poor performance on many comprehension studies (e.g. Emerson & Gekoski, 1980).

However, although the data here presents a story in which children's pragmatic understanding of these connectives is related to specific patterns in input, there is very little other data to support these specific arguments. That is, no other studies (of which I am aware) have compared children's comprehension of the pragmatic types for *if,* nor

have any explored children's comprehension of the Speech-Act meaning. In the case of Speech-Act, this means we cannot be certain as to how patterns of comprehension change with other illocutionary acts and how these patterns may relate to overall comprehension. As such, this should be an avenue for future research. Similarly, more research is needed to determine exactly how often children reliably hear *if*-sentences expressing specific semantic and pragmatic meaning and how this relates to comprehension. This would provide a better understanding of how the specific patterns in speech relate to children's understanding of these pragmatic meanings. Additionally, to help resolve the issue of children's difficulty with the ordering meaning inherent in these connectives and what role connective function plays in complicating this, future research should investigate children's understanding of ordering as it relates to the different pragmatic functions of these connectives. In better understanding these more specific patterns in speech and their relation to the different pragmatic functions, we can better understand how children come to establish a functional understanding of these connectives and how this relates to their ability to understand the meaning they express.

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