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Patterns of Acquisition in Temporal Connectives from a Reichenbachian Perspective

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**Thesis submitted to the School of Graduate Studies and Research
in partial fulfillment of
the requirements for the degree of Master of Arts in Linguistics**

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Abstract

Since Clark's (1971) pioneering study, many experiments have been carried out which were designed to tap children's understanding of the temporal connectives *before*, *after*, *when*, and *while*. Many different patterns have been observed and different explanations have been invoked. In many instances, the reported results appear to be confounded by methodology, such as too great a demand on memory, or unnatural test materials.

The present study investigates in particular the implications that a Reichenbachian theory of time may have on understanding children's acquisition of these connectives, as first suggested by Stevenson and Pollitt (1987). Stevenson and Pollitt (1987) adopted Partee's (1984) proposed functions of R, E, and S in interpreting temporal relations between an adjunct and a matrix clause (i.e. the subordinate clause establishes the reference time in which the following main clause is interpreted). In their view, in order for a child to correctly interpret subordinate clauses, they must first have a good understanding of this time system.

To date, there have been no studies of the patterning of *before*, *after*, *when*, and *while* in naturalistic speech data. This study examines a body of speech data obtained from the CHILDES database in order to determine whether there exist patterns that can shed light on the conflicts found in the experimental literature, with a particular emphasis on motivating Reichenbachian ideas. As well, the data is examined for patterns that suggest whether it is the semantics or the syntax of these connectives that drive their acquisition.

All instances of *before*, *after*, *when*, and *while* were extracted from the speech of four children and their adult interlocutors. Two aspects of the data were focused on for analysis in this study: the frequency of the connectives throughout the selected files and the preposing of temporal *when*-clauses. An examination of the data revealed no patterns in support of an effect of adult input on acquisition.

The overall frequency results clearly indicate that *after* is more frequent than *before* in the speech of all subjects, and that *when* is overwhelmingly the most frequent connective across subjects.

The individual results for both children and adults support a consistent asymmetry: *after* is more frequent in comparison with *before*. These frequency results accord well with the hypotheses of Partee (1984) and Stevenson and Pollitt (1987): children and adults choose *after* more frequently because of the difficulty of the event representation of *before*. As argued by Stevenson and Pollitt (1987), the acquisition of *before* and *after* seems to be governed by the final event representation of the sentence. *When* may simply be the most frequent because it offers the fewest semantic constraints in its use.

Children and adults exhibited different behaviours with regard to preferences for pre- and postposing *when*-clauses. Whenever *preposing* was statistically significant, it was in the child data; whenever *postposing* was statistically significant, it was in the adult data. Children's manipulation of the marked syntactic structure of *when*-clauses suggests that they are using the clauses to set up the reference time in which the following main clause is interpreted. Because children's *preposing* of *when*-clauses is abundant and evident in the earliest files of use, and because *when* is the only connective judged productive in the children's speech, it suggests that *preposing* is relevant to understanding children's acquisition of these connectives. Once children are able to understand the temporal clause's function as reference time, these connectives become operative.

The proposed syntax of these connectives did not provide us with any reason for why *when* would be acquired earlier than the other temporal connectives. On the other hand, the findings of this study strongly support the view that the semantics of *before*, *after*, *when*, and *while* are the driving force in their acquisition.

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Chapter 1: Introduction

The acquisition of the temporal connectives *before*, *after*, *when*, and *while* has been the focus of much research since the pioneering study of Clark (1971). While some of Clark's original findings have found continued support across studies, the literature reveals many different developmental patterns and there exists no general consensus about what is important to acquiring these connectives.

The competing approaches offered in the literature draw upon both semantic and syntactic explanations in interpreting observed patterns of acquisition. However, as we will see, many factors suggested to be of importance can be attributed to differences in methodology and thus the problem remains in identifying genuine influences.

To date, there are no studies of the patterning of *before*, *after*, *when*, and *while* in naturalistic speech data. This study will examine a body of speech data in order to determine whether there exist patterns that can shed light on the conflicts found in the experimental literature. In particular this study will investigate the implications that a Reichenbachian theory of time may have on understanding children's acquisition (as first explored by Stevenson & Pollitt, 1987). As well, the data will be examined for patterns that suggest whether it is the semantics or the syntax of these connectives that drives their acquisition.

Chapter 2: Background Linguistic Theory

2.1 Lexical Semantics of *Before*, *After*, *When*, and *While*

2.1.1 Descriptive Studies

Before, *after*, *when*, and *while* are relational words which introduce clauses of time. Each relates the main clause to the temporal subordinate clause differently. Much research has been devoted to describing the semantics of these elements.

These four connectives can be initially grouped according to how they indicate the time of the main clause relative to the subordinate clause (Bree, Smit, Van Werkhoven, 1990; Silva, 1991). If the time of the main clause is approximately the same as that of the subordinating event, the temporal connectives *when* and *while* are used because they denote some degree of simultaneity.

1) John knocked on the door when Frank was reading.

2) John knocked on the door while Frank was reading.

On the other hand, if the events in the main and subordinating clauses are not approximately simultaneous, but need to be ordered with respect to one another, *before* and *after* are used (e.g. Leech, 1969; Clark, 1971; Comrie, 1986; Hornstein, 1990). *Before* and *after* are defined as (respectively): *a time preceding the time at which* and *a time following the time at which* (Leech, 1969):

3) John knocked on the door after Frank finished reading.

4) John knocked on the door before Frank finished reading.

When and *while* have been proposed to form a continuum of simultaneity that is determined by linguistic complexity¹. For example, Quirk et al. (1985: 1083) and Silva (1991) point out that

¹ *As* is also included in this continuum of simultaneity. It is suggested that *as* is the most linguistically complex, followed by *while*, and then *when* (Silva, 1991).

although *when* can govern either durative *or* non-durative clauses², *while* can *only* govern durative clauses³:

5) Frank was sleeping when John found the book. (non-durative)

6) Frank was sleeping when John searched for the book. (durative)

7) *Frank was sleeping while John found the book. (non-durative)

8) Frank was sleeping while John searched for the book. (durative)

While, unlike *when*, also requires that the subordinate event have an end (Silva, 1991):

9) Frank ran for mayor when he was a father.

10) ?Frank ran for mayor while he was a father.

Finally, *when* can indicate that the events in the main and subordinating clauses are overlapping *or* ordered sequentially. In this sense, *when* can assume a meaning similar to that of *while* *or* *after* (Quirk et al., 1985; Keller-Cohen, 1987; Hornstein, 1990)⁴. In 11) the clauses can be interpreted as being simultaneous *or* temporally ordered:

11) The problem became obvious to Frank when he ran an ad in the newspaper looking for someone selling tickets.

To recap, the linguistic literature suggests that *when* and *while* are two points along a continuum of simultaneity, differing in the aspectual categories they may govern, in the finality of the subordinate event, and in the exact temporal relationship each conveys.

² Non-durative clauses include punctual or accomplishment verbs. Punctual verbs require that an event take place at a particular point in time, accomplishment verbs require that the event be an activity with an end result, and durative verbs require that the event take place over an interval of time.

³ *As*, the other member of the continuum, requires that *both* the matrix and the subordinate clause be durative (Quirk et al., 1985: 1083):

i) ?Frank found the paper as John searched for the book.

⁴ Quirk et al. (1985: 1085) suggest that the *while*-interpretation of *when* arises with durative predicates, and the *after*-interpretation of *when* arises with non-durative predicates. Hornstein (1990) presents a different explanation of how these two senses of *when* are derived; it depends on the relationship between the main and subordinate event (cf. 2.1.3).

Among these four connectives in general, it also appears that *when* offers the fewest constraints in its use; it is certainly the least specific as to the exact temporal relationship between the main and subordinate events.

2.1.1.2 Other Semantic Functions

These connectives all have semantic functions other than being indicators of purely temporal relationships. The following sections detail some of these functions.

2.1.1.2.1. *When*

In addition to its purely temporal function, *when* is used quite commonly (e.g. Comrie 1986; Declerck, 1997)⁵:

i) As a restrictive or non-restrictive relative clause modifying a temporal NP that does/or does not have an adverbial function⁶:

- | | |
|--|-----------|
| 12) The <u>Monday when</u> Frank was to receive payment finally arrived. | (NP-RRC) |
| 13) John ran for Mayor in <u>1997, when</u> Frank was also just entering politics. | (NP-NRC) |
| 14) Frank gave John the present <u>yesterday when</u> he was on lunch. | (Adv-RRC) |
| 15) John went to the doctor last <u>January, when</u> he thought he broke his arm. | (Adv-NRC) |

⁵ This list of semantic functions is not exhaustive. See Declerck (1997) for a more detailed discussion of the typology of *when*-clauses.

⁶ *When*-clauses can also be used as free relatives. Free relatives are usually analyzed as relative clauses that lack an overt antecedent NP (e.g. Bresnan and Grimshaw, 1978). Section 2.2.2.1.1 discusses free relatives in more detail.

ii) To specify a case:

16) Custody usually goes to the father when the mother is seen as unfit.

17) People get bad credit ratings when they don't pay their bills.

iii) To imply concession and/or contrast:

18) Frank was still smoking when he had been warned to quit.

19) How can it be an old hole when you just made it?

(CHILDES: Brown files: Adam35: Line 1319)

Notice that in 16), 17), and 19) *when* can be paraphrased with the connective *if*. However, in most of the examples provided thus far and in most cases generally, *when* and *if* are not interchangeable.

It is well documented that conditionals are closely related to temporal adverbials both syntactically and semantically (Quirk et al., 1985; Comrie, 1986; Reilly, 1986). Syntactically conditional *if* and *when* are similar in that both are subordinators, both introduce adjuncts, and both can occur either pre- or post-main clause. Portions of the semantic fields of conditional *if* and *when* also overlap: both may link simultaneous or sequential events, and both may imply contingent and causal relationships (Reilly, 1986).

The crucial difference between *when* and *if* is the degree of certainty the speaker attributes to the occurrence of the event contained within the antecedent clause. *If* can be substituted with *when* in simple conditionals, that are anchored in reality, where the speaker strongly expects the event to take place. Simple conditionals include predictive, past, and generic conditionals⁷ (Reilly, 1986).

⁷ Generic conditionals are what Reilly (1986) calls *timeless dependencies*; that is, there exists a regular association between the subordinate and antecedent clause. A strong relationship has been observed between the two events in the past and thus the speaker feels more certain of the occurrence of the event in the future. In such cases, *when* can be paraphrased as *whenever*. Carlson (1979) argues that part of the meaning of *when* is in fact a generic operator (Gn) which turns the main clause into a generic clause.

Imaginative conditionals are thought by the speaker to occur with little or no certainty.

Imaginative conditionals include hypothetical and counterfactual sentences. In such instances, *if* cannot be substituted with *when*; hence the ungrammaticality of *when* in 20):

20) *If/*when* you had taken my advice, the problem would not exist.

Although *when* can be read conditionally, this use still presupposes knowledge of its time meaning (e.g. Quirk et al., 1985: 1085). Not all conditional readings are atemporal; rather time concepts (ordering and simultaneity) are of importance to their interpretation.

For example, the juxtaposition of the protasis (*if*-clause) and the apodosis (*then*-clause⁸) usually reflects temporal ordering between the two clauses:

21) *If/when* you eat this, you may leave the table.

In 21), although the exact location of event occurrence along the time continuum is unknown, the apodosis is contingent upon the occurrence of the protasis. In this example the protasis must be completed prior to the occurrence of the apodosis in time.

The protasis and apodosis can also be interpreted as occurring simultaneously, as in 22):

22) *If/when* you eat this, watch for crumbs.

Again, the exact location of event occurrence along the time continuum is unknown in the above example. Although this is still a contingent relationship, the protasis and the apodosis overlap in time (i.e. there is not complete time precedence between the two events) and thus the rendering of simultaneity.

2.1.1.2.2 *While, Before, and After*

While can be used atemporally to express concession and/or contrast between two situations:

23) *While* John played well against Frank's team, he didn't score any goals.

In addition to its purely temporal reading, *before* has a nonfactual reading as illustrated in the following example:

⁸ In English, the inclusion of *then* in the apodosis is optional.

24) John left the office before returning Frank's call.

24) can be interpreted temporally *or* nonfactually, depending on whether John did or did not return the call⁹. Other sentences are unambiguously non-factual *before* clauses:

25) John died before he said good-bye to Frank.

Before may also imply a conditional when the matrix clause is in the imperative voice (Quirk et al, 1985: 1081):

26) Leave before I lose my temper.

(Leave! If you don't, I'll lose my temper.)

Finally, *before* and *after* can be used to indicate spatial relations. In fact, the generally held view in the literature is that time relations are derived from spatial relations (e.g. Clark, 1971; Trosberg, 1982; Weist, 1991). However, in terms of frequency, it is suggested that the temporal use is far more common than the spatial use (Bennett, 1975; Quirk et al., 1985).

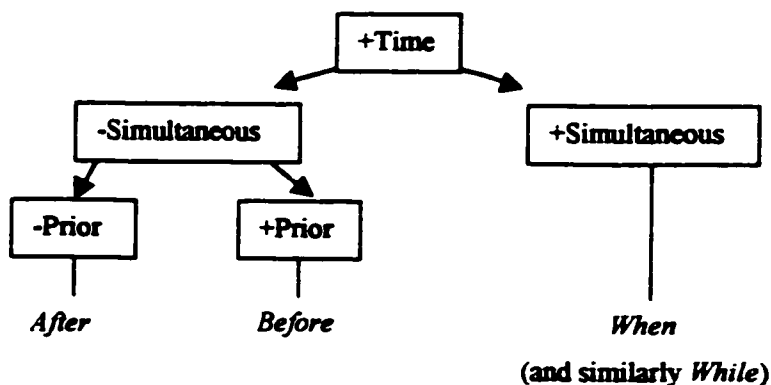
2.1.2 The Theory of Compositionality

The Theory of Compositionality holds that a word's meaning is made up of a set of primitives (e.g. de Swart, 1998: 39). For example, *man* may be composed of the features +human, +male, -young.

Adopting this theoretical perspective, Clark (1971) suggested that the semantic features of *before*, *after*, and *when* (and similarly *while*) are +Time, +/-Simultaneous, and +/- Prior. Clark suggested that these semantic features could be arranged into a hierarchy, dominated by the superordinate feature +Time. +Time dominates +/- Simultaneous, and -Simultaneous dominates +/- Prior, as illustrated in Figure 1:

⁹ Section 2.1.3 provides a detailed explanation of how this counterfactual reading is derived.

Figure 1.



Since *when* is composed of fewer features, this view holds that the meaning of *when* is less differentiated (i.e. more general) than that of *before* or *after*¹⁰.

Clark (1971) proposes the *Polarity Principle*: those features which are positive will be acquired before those features which are negative. According to this principle *when* will be acquired prior to *before/after*, and *before* will be acquired prior to *after*. In other words, an asymmetry is posited between simultaneous relations and ordering relations, and between *before* and *after*.

2.1.3 A Reichenbachian Theory of Time

2.1.3.1 Reichenbach's Inclusion of R

Most early theories of tense posited two points as necessary for interpreting the temporal location of an event: speech/utterance time (S) and event time (E)¹¹. For example, the past tense was interpreted as E taking place before S (E_S). In 27), this relationship is illustrated along a time line:

27) John ate his dinner.



¹⁰ Clark (1971) did not provide a feature analysis of *when* versus *while*.

¹¹ Comrie (1985) and Hornstein (1990) discuss various tense theories that have been proposed in the literature.

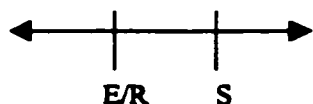
In the present tense E and S were analyzed as contemporaneous (E,S) and in the future tense E was analyzed as after S along the time line (S_E).

However, Reichenbach (1947) argued that a tense was a conglomerate of three points, not two. In his view, the temporal location of an event was specified not only by its relationship to the moment of speech, but also by a third point: reference time (R). The inclusion of R is a distinctively Reichenbachian concept.

R mediates the relationship between S and E. The interpretive effects of R are not visible in the simple tenses, such as the past or present, as demonstrated in 28):

28) John ate his dinner.

[[E/R] [S]]



In the previous example, the temporal location of the event was not affected by reference time, as these two points were contemporaneous along the time line. In a sentence with a perfect tense, such as the future perfect in 29), the effects of R are visible.

29) John will have eaten by 5 o'clock.

[S [E] [R]]



The event (John eating) takes place after the moment of speech but before the reference time (5 o'clock). This example clearly shows how the temporal specification of E is dependent upon R¹².

¹² Other theories also claim to explain the interpretation of perfect tenses, but without the inclusion of R. One such theory is known as the *Iterated Operator Theory* and it assumes that tenses act as sentential operators. Essentially the perfect tenses are built up by reiterating these operators. One problem with such a theory is that there is no limit to the degree of iteration and there is little motivation for restricting the iteration to a certain level of embedding (Hornstein, 1990).

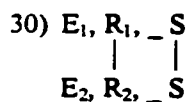
Reichenbach argued, however, that R be included in the temporal representation of not only perfect tenses, but also the simple tenses where its effect is semantically invisible. He argued that the temporal interpretation of structures and the syntax of their tense structures are distinct.

2.3.1.2 Hornstein (1990): Interpreting Complex Tense Structures

Hornstein (1990) demonstrates how Reichenbach's theory can be extended to interpret complex tense structures, such as those found between a main clause and a temporal adjunct modifying the main clause. The event time of the main clause (E_1) is specified by the event time of the adjunct (E_2). However, the temporal adjunct shares with the main clause both the S and R points. Within this framework, Hornstein provides an explanation of the subtle differences between *before*, *after*, *when*, and *while* clauses.

If the connective is *when*, then the events can be interpreted as either sequentially ordered *or* simultaneous, depending upon the relationship between E_1 and E_2 . Hornstein argues that if the event times are coincident, both interpretations are available, but the temporal ordering interpretation is preferred¹³. If the event times are *not* coincident, *only* the temporal ordering interpretation is available. Importantly, Hornstein is arguing that *when* usually infers an ordering relation, and not a simultaneous relation.

In example 30), the first line represents the main clause and the second line represents the temporal adjunct. This diagram shows that R and S are shared by the two clauses, that the event times are coincident, and finally that E and R are prior to S in time (as indicated by the space)¹⁴.



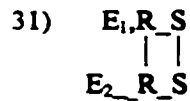
John scored when Frank left the goal crease.

(Hornstein, 1990:58)

¹³ *Coincident* simply means the two events are in the same relationship to their speech and reference times.

¹⁴ Hornstein (1990) calls this configuration a *complex tense structure (CTS)*.

In the previous example, the event times are coincident and so theoretically both readings of *when* are available. However, according to Hornstein (1990), the clauses are interpreted preferentially as sequentially ordered.



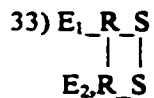
John scored when Frank had left the goal crease.

In 31) the E points do not coincide. E₁ is contemporaneous with R, but E₂ is not. In this case, the two clauses are interpreted as temporally ordered with respect to one another (E₁ taking place after E₂).

While strictly requires the two event times be contemporaneous, hence the strangeness of complex sentences mixing the past and perfect tenses with *while*.

32) ? John scored while Frank had left the goal crease.

With regard to *before*, its temporal reading arises when E₁ precedes E₂. The counterfactual reading (cf. 2.1.1.2.2) arises if the E points are coincident and E₁ receives a temporal location but E₂ does not (and therefore this event is interpreted as non-occurring). If the E points are not coincident, then a counterfactual reading cannot be derived (Hornstein, 1990:68), as in 33):



John had left the office before he returned the call.

Finally, the temporal reading of *after* arises when E₂ is located in time prior to E₁.

Hornstein (1990) claims that the lexical semantics of the connectives must be considered when the E points are coincident. If the E points are not coincident, the complex tense structure must match the lexical properties of the connective in order for the sentence to be acceptable.

2.3.1.3 Partee (1984): Setting the Value of R

The sharing of R by the main and subordinate clause was an idea with earlier roots than Hornstein (1990). For example, Partee (1984) attributed a specific function to a temporal subordinate clause: setting the value of the shared R. Partee (1984), modifying Hinrich's (1981) unification of the temporal structure of the past tense narrative discourse with the Theory of Discourse Representation, discussed how R's are updated by temporal subordinate clauses in discourse.

Partee agreed with Hinrichs that each event (an event excludes a state or process) in a narrative moves the R forward to a time 'just after' that event. If a sentence begins with an adverbial, then the adverbial overrides the R established by the prior event (e.g. a *when*-clause triggers the updating of R to a new time)¹⁵. And, if the main clause is an event-clause, the last step in its processing is the resetting of the R to a time 'just after' the main clause event.

An important implication of Partee's (1984) research is that *before* and *after* adjuncts have different effects on the establishment of reference time. Consider these simple narratives:

34) Mary turned the corner. When John saw her, she crossed the street. She hurried into a store.

35) Mary turned the corner. After she crossed the street, John saw her. She hurried into a store.

36) Mary turned the corner. Before John saw her, she crossed the street. She hurried into a store.

(Partee, 1984: 262)

Rather than draw the complex Discourse Representation Structures for these sentences, Partee provides the following sketches as shown 34a), 35a), and 36a) (respectively), in order to illustrate the effects of *when*, *after* and *before* in a simple discourse¹⁶:

¹⁵ On this point, Partee (1984) differs from Hinrichs (1981). Hinrichs argues that both pre- and post-posed adverbials are processed first before the main clause and therefore both have an effect on the updating of R, whereas Partee assumes that clause ordering is relevant and that only pre-posed adverbials have this effect. Partee also differs from Hinrichs in that she assumes that the *before*, *after*, *when*, and *while* clauses are never stative, but rather she interprets them as inchoative events.

¹⁶ I will provide the interpretation of 34a). R_0 is the given past reference time and within this reference time the first event (e_{turn}) takes place. This event moves R forward to a time 'just after' that event, or r_1 . ($\leq$ indicates a time 'just after' with the possibility of overlap between two events, while $<$ indicates complete

$$34a) \quad \begin{matrix} r_0 \\ e_{turn} \end{matrix} \leq r_1 < e_{see} \leq \begin{matrix} r_2 \\ e_{cross} \end{matrix} \leq \begin{matrix} r_3 \\ e_{hurry} \end{matrix} \leq r_4$$

$$35a) \quad \begin{matrix} r_0 \\ e_{turn} \end{matrix} \leq r_1 < e_{cross} < \begin{matrix} r_2 \\ e_{see} \end{matrix} \leq \begin{matrix} r_3 \\ e_{hurry} \end{matrix} \leq r_4$$

$$36a) \quad \begin{matrix} r_0 \\ e_{turn} \end{matrix} \leq r_1 < \begin{matrix} r_2 \\ e_{cross} \end{matrix} \leq \begin{matrix} r_3 \\ e_{hurry} \end{matrix} \leq r_4 \\ < e_{see}$$

In 36a), r_3 is introduced in the processing of the main clause (e_{cross}) and r_3 is required to be after r_2 . In 34a) and 35a) this continues the linear order, since the main clause was the last event, but for 36a) this leaves us with both r_3 and e_{see} following r_2 . Subsequent reference times follow r_3 , since it moves the narrative forward, and e_{see} , i.e. the *before*-clause, is not included in the linear order at all. It describes the temporal location of r_2 but otherwise it is not connected in the narrative. This demonstrates that the event representation of *before* is more complex than *after*, *when*, or *while*.

In sum, Reichenbach's (1947) ideas provided a foundation for Hornstein (1990) and Partee (1984) to develop a model of the function of temporal subordinate clauses.

2.1.4 Implications for Acquisition

The research on the lexical semantics of *before*, *after*, *when*, and *while* generates certain hypotheses concerning the acquisition of these elements. If the semantics of these connectives is a driving force in acquisition, then evidence of some of these hypotheses should be supported.

The descriptive studies strongly imply that *when* should be the earliest of these connectives to be acquired by children. Slobin (1973) argued that linguistic specificity and constraints in the linguistic system determine order of development. Since *when* is the least constrained as to the nature of the predicates it connects and the least specific as to the exact temporal relationship among the events, *when* should be acquired first (Quirk et al., 1985; Silva, 1991).

precedence between two events.) The next clause begins with *when* (and contains the event e_{see}) which therefore overrides r_1 and establishes a new reference time, r_2 . The event within the main clause, e_{cross} is interpreted with reference to r_2 , and then moves R forward to r_3 . The event e_{hurry} is interpreted with reference to r_3 and then this event moves the reference time forward to r_4 . Importantly, the reference times must follow one another in order and the events must follow one another temporally.

According to the Semantic Feature Hierarchy and the Polarity Principle constructed by Clark (1971), simultaneity relations will be acquired before ordering relations, and *before* will be acquired prior to *after*.

Finally, Reichenbach's inclusion of R in the interpretation of tense allowed Hornstein (1990) and Partee (1984) to conclude that the function of temporal subordinate clauses is to introduce the reference time with respect to which the main clause is interpreted. Importantly, Partee (1984) differs from Clark (1971) in that her research suggests *after* should be acquired prior to *before* because of event representation complexity.

2.2 Syntax of *Before*, *After*, *When*, and *While*

2.2.1 Temporal Adjuncts

Before, *after*, *when*, and *while* introduce temporal adjuncts: constituents that are not subcategorized for by the main verb and thus are structurally optional¹⁷. In X-bar theory, temporal adjuncts attach to a position outside the VP, but no higher than the subject NP. The exact location of their integration into the syntactic tree remains ambiguous. See Ouhalla (1994) for a discussion.

Although the tendency in English is for right-branching syntactic structure (i.e. for embedding and subordination to be sentence-final), the optional nature of temporal adjuncts allows them more freedom in sentence position (Quirk et al., 1972). For example, in addition to sentence-final position (i.e. *postposed*), they are more likely to occur sentence-initially (i.e. *preposed*) or sentence-medially than are subcategorized constituents. The following examples illustrate the possible sentence positions:

¹⁷ However, these temporal clauses become obligatory if they function, for example, as direct objects, subjects, or NP modifiers. Consider the following example in which the *when*-clause functions as the direct object of the verb *remember*, and thus cannot be preposed:

ii) Frank remembers [when he failed that exam].

37) John scored a goal after Frank left the net.

38) John, after Frank left the net, scored a goal.

39) After Frank left the net, John scored a goal.

The length and complexity of adjuncts are factors in the variation of its position. For example, the medial-position may not be preferred if the clause is particularly long or complex. As well, Quirk et al. (1972) suggest that preposing may be less preferred because of the limitation on left-branching structure to one level of embedding. Nonetheless, Quirk et al. (1972) still found that for temporal adjuncts preposing is *as* likely as postposing¹⁸. Other studies have found preposing to be *more* likely than postposing (e.g. Silva, 1991).

2.2.2 Syntactic Categorization

The linguistic literature has focused a great deal on categorizing syntactically *before*, *after*, *when*, and *while*. The debate centres upon whether these connectives are prepositions or complementizers. In general, most analyses suggest that *when* behaves much more like a complementizer than *before*, *after*, and *while*. On the other hand, *before*, *after*, and *while* tend to be more prepositional in nature than *when*.

2.2.2.1 *When* as a Complementizer

Dubinsky and Williams (1995) provide support for the bicategorical status of *after*, *before*, and *while* as complementizers and prepositions and for the monocategorical status of *when* as a complementizer.

Whereas nontemporal connectives (e.g. *without*, *about*) cannot occur with a tensed clause in English, temporal connectives can. Neither group can occur with an overt complementizer:

¹⁸ Clark (1971) (to be discussed in more detail in section 3.1) adds support to Quirk et al.'s claim. She suggests that structures with the subordinate clause after the main clause are generally seen as derivationally simpler than those with the subordinate clause first. However, in her act-out experiment with children she found equal error rates regardless of subordinate clause position.

- 40) John scored before Frank left the crease.
- 41) * John scored before that Frank left the crease.
- 42) * John scored without Frank came to help.
- 43) * John scored without that Frank came to help.

Dubinsky and Williams attribute the ungrammaticality of 42) and 43) to a constraint in Standard English against prepositions selecting tensed clauses. In 41), they argue that ungrammaticality arises because English does not allow multiple heads, i.e. *before* and *that* both occupying C⁰.

By positing two distinct reasons for the ungrammaticality of 42) and 43) versus 41), Dubinsky and Williams allow for the possibility of dialectal variation. Indeed, in certain southeastern dialects of American English, nontemporal prepositions are acceptable with a tensed clause and even an overt complementizer¹⁹:

- 44) %They never came to church without that they brought their bibles.
(Dubinsky and Williams, 1995: 126)

However, these dialects still do not permit temporal connectives followed by a tensed clause to occur with an overt complementizer²⁰:

- 45) *They came to church after that they read their Bibles.
(Dubinsky and Williams, 1995: 126)

Dubinsky and Williams attribute this difference to dialectal variation in a constraint: Standard English disallows tensed clauses with prepositions, whereas certain English dialects allow tensed clauses with prepositions. If *after* was considered to be a preposition in 45), then its ungrammaticality in this dialect could not be explained. On the other hand, if *after* were analyzed as a complementizer then this ungrammaticality could be attributed to the syntactic constraint against multiple heads.

¹⁹ For example, Ozark English allows this variation (Dubinsky and Williams, 1995).

In their view, *after*, *before*, and *while* are bicategorical: they can occupy either P⁰ or C⁰ depending on whether they select a phrasal or clausal complement. *When*, on the other hand, never selects a plain NP or PP, and therefore it is invariably considered to be a complementizer.

Further diachronic evidence supports Dubinsky and Williams' distinction. For example, historical evidence of the prepositional nature of *before* and *after* is discussed in Declerck (1997). It is claimed that *before* and *after* developed from the form *preposition + cataphoric demonstrative + relative clause* (e.g. *after then that*). Even at the end of the Old English period, *after* was still not used on its own as a connective.

When, on the other hand, does not appear to share this structural origin; rather Declerck (1997) claims it was first used as a question word which then came to be used as a relative at the end of the Old English period. At that time, it was most commonly used as a free (or headless) relative.

Other studies supporting the categorization of *when* as a complementizer include Quirk et al. (1972).

2.2.2.1.1 Analyzing *When* as a Free Relative Adverb

When-clauses perform a variety of syntactic functions: they can be used as direct/indirect questions, as relative clauses, as free relatives, and as adverbial clauses. As restrictive and non-restrictive relative clauses they can modify temporal NPs that do or do not have adverbial functions (cf. 2.1.1.2.1) (Declerck, 1997).

Declerck (1997) argues that all *when*-adverbial clauses should in fact be analyzed as free relative clauses. *When* would be considered a relative adverb, interpreted as *at a/the time at which*. Such an analysis is thus compatible with categorizing *when* as a complementizer. Other earlier studies have also advocated categorizing *when*-clauses as free relatives (e.g. Bresnan and Grimshaw, 1978; Enç, 1987).

²⁰ Dubinsky and Williams do not say whether temporal and nontemporal connectives in this dialect permit an overt complementizer followed by a phrase.

Free relative clauses are traditionally analyzed as relative clauses that lack an overt NP antecedent²¹. A free relative has also been characterized as performing a double syntactic function in a sentence:

46) John scored [*AdvP* [*AdvP* when] Frank left the goal].

In 46), the free relative *when* fulfils the role of adverb in the relative clause and the entire *when*-clause acts as an adverbial to the main clause. In the literature, this is referred to as a *matching effect*, because the syntactic category of *when* matches the category of the whole free relative clause (Bresnan and Grimshaw, 1978; Pittner, 1995)²².

Bresnan and Grimshaw (1978) did not support the view that free relatives lack an antecedent. They proposed that unlike other relative clauses, movement does not form free relatives, rather they are base-generated. They suggest that if movement formed free relatives, it would be impossible to predict the observed matching effects (i.e. it could not be ensured that the free relative assumed the same category as the clause as a whole). The base-generation of free relatives is considered by Bresnan and Grimshaw to be a special syntactic property of free relatives.

Assuming *when* to be a free relative adverb has empirical motivation. First, diachronic evidence detailing the origins of *when* supports such a hypothesis (Declerck, 1997). Secondly, relative clauses by definition contain a VP, thus if we adopt the view that *when* occurs in a relative structure, then the absence of NP complements to *when* can be explained.

According to Declerck (1997), advocating *when* as a free relative also explains the varied types of *when*-clauses. Since free relatives do not need an overt NP antecedent and are adjuncts, they can

²¹ Consult Bresnan and Grimshaw (1978) for a discussion of this analysis (known as the *Base Hypothesis*) in which the free relative is located in the head/antecedent position and is followed by S. Hirschbühler & Rivero (1983) and Pittner (1995) discuss other hypotheses concerning the actual structural position of the free relative. For example, in addition to the Base Hypothesis and the Empty Antecedent Hypothesis, an analysis in which the free relative occupies both the head and COMP position simultaneously has been posited.

²² Additional *matching effects* have been found in languages other than English. For example, in New High German the case of the relative pronoun in the free relative almost always matches the case required by the matrix clause (Pittner, 1995).

take the form of direct/indirect questions, as relative clauses (either restrictive or nonrestrictive, with or without overt antecedent), and as free relative clauses in adverbial function.

2.2.2.2 *When* as a Preposition

Many generative studies focusing on the internal structure of prepositional phrases (PP) have not reached a consensus about the richness of PP complementation. For example, Hendrick (1978) posits a simple structure to a PP: it is composed solely of a lexical P and a lexical NP. While it is universally agreed that a PP can take an NP complement, researchers such as Jackendoff (1973), van Riemsdijk (1978), and Emonds (1985) attribute a much greater range to PP complements.

In fact Emonds (1985) advocates collapsing the distinction between prepositions and complementizers altogether. In his view all subordinators are a subset of the category of preposition; e.g. in this framework *before*, *after*, *when*, and *while* would all be classified solely as prepositions. Collapsing these categories necessitates that prepositions accept a wide range of complements. Acceptable complements to PP would include CP, IP, NP, VP, et cetera²³.

In chapter six of his book, Emonds (1985) provides motivation for eliminating the category of COMP. These reasons do not need to be detailed for the present study. What is important to note is that within such a framework, there is no categorical distinction made between *before*, *after*, *when*, and *while*; they are all prepositions.

2.2.3 Implications for Acquisition

If the syntax of *before*, *after*, *when*, and *while* is a driving force in acquisition, then the categorical distinctions proposed should impact upon acquisition.

Assuming *when* behaves more like a complementizer than *after*, *before*, and *while*, this distinction should be reflected in patterns of acquisition. Studies such as Powers (1996) and Ling (1999) have argued that children gradually build up functional categories. Thus, these studies would predict that *before*, *after*, and *while*, which are more prepositional in nature, should be easier to acquire than *when*, which behaves more like a complementizer.

²³ Emonds also argues that particles are prepositions with $\emptyset$ complement.

If in fact *before*, *after*, *when*, and *while* are all of the same syntactic category, i.e. preposition, then, all things being equal, a difference in their acquisition patterns based upon the gradual build-up of structure should not be expected.

Chapter 3: Acquisition Studies of Temporal Connectives

In the last three decades, many experiments have been carried out which were designed to tap children's understanding of *before*, *after*, *when*, and *while*.

Clark's (1971) pioneering study was the catalyst for research into this area of acquisition. Most subsequent studies found Clark's hypotheses not compatible with their own results, and instead competing semantic or syntactic explanations were invoked. Despite extensive research, there is still little consensus about the factors that have a genuine impact on children's acquisition of these connectives.

The next two sections will discuss some pertinent experiments that have been done in this area of research. It will be made evident that the complexity and naturalness of test materials has an important influence on results.

3.1 Semantic Explanation of Patterns

Adopting the Theory of Compositionality, Clark (1971) constructed a semantic feature hierarchy for these connectives and proposed the Polarity Principle (cf. 2.1.2) based on the results from her act-out and production tasks with children²⁴.

In this model children learn the components of these connectives one at a time, beginning with the superordinate feature +Time, and in accordance with the Polarity Principle. This predicts that simultaneous relations will be acquired prior to ordering relations, and that *before* will be acquired prior to *after*²⁵. Before learning the superordinate feature +Time, children appear to use an *order-of-mention* strategy in which the order of mention of the clauses is interpreted as the actual event order.

²⁴ Clark's age groups were: 3;0-3;5, 3;6-3;11, 4;0-4;5, and 4;6-5;0.

²⁵ In fact Clark hypothesized that prior to learning the –Prior feature of *after*, some children will treat *after* to mean *before*.

In the older age groups, children preferred those structures that preserved event order, as opposed to those that did not. The examples below are presented following the order of difficulty in acquisition that Clark predicts for temporal clauses containing *before* and *after*:

47) The dog licked the boy before he ate the food. (B1)

48) After he ate the food, the dog licked the boy. (A1)

49) Before he ate the food, the dog licked the boy. (B2)

50) The dog licked the boy after he ate the food. (A2)

According to the Polarity Principle and the preference for event-order preservation, B1 is the easiest for children followed by A1, B2, and then A2.

Later studies disagreed with Clark's (1971) conclusion that simultaneous relations would be acquired prior to ordering relations (e.g. French and Brown, 1977; Keller-Cohen, 1987). In fact the opposite was argued: ordering relations would be acquired first. Whereas the interpretation of *before* and *after* may be facilitated by the redundancy of the semantic context, the interpretation of *when* and *while* is not. Consider the following examples:

51) The boy opened the can before he poured the soup.

52) He opened the can while he drank the pop.

(Keller-Cohen, 1987: 166)

In 51), even if the child has only partially acquired the meaning of *before*, the context may be used to infer the relation between the clauses²⁶. In 52) on the other hand, there is an arbitrary relationship between the clauses, which does not aid the child in interpreting *while*.

²⁶ Clause context will not always aid in the interpretation of *before/after*. In examples 47-50 a logical relation does not exist between the two clauses. However, the child may first learn *before* and *after* in supportive contexts and then apply this knowledge to sentences with arbitrary relations (Keller-Cohen, 1987).

Keller-Cohen's (1987) results showed that contextually unsupported *while* sentences were interpreted less successfully than contextually supported *before* or *after* sentences. The *after* sense of *when* was also interpreted better than the *while* sense of *when*²⁷. The conclusion reached was that because of the contribution of clause context, ordering relations will be learned first, and simultaneous relations will be learned later. Importantly, Keller-Cohen's (1987) approach does not predict a difference in order of acquisition between *before* and *after*.

Another study by Silva (1991) focused on the development of simultaneity itself, rather than on the position of simultaneity in the sequence of development. In section 2.1.1., the notion of a continuum of simultaneity was discussed; the continuum being determined by linguistic specificity and complexity. Compared to *while* (and *as*), *when* is the least specific as to the aspectual categories it may govern, as to the finality of the subordinate event, and as to the exact temporal relationship between the main and subordinate event.

Children (ages 4;10-11;11) were presented with sets of pictures and were required to make stories about what they observed in the pictures. Silva wanted to determine which connectives (among *when*, *while*, and *as*) the children would choose to use, which aspectual categories they would choose to use with the connectives, and to what degree they would prefer preposing of the temporal clauses. She compared the results with an adult control group.

In terms of frequency, children chose *when* the most, whereas *while* and then *as* were used very rarely by comparison. Children's grammaticality of and facility with *when*-clauses also increased with age²⁸. Adults chose *when* the most, followed by *as*, and then *while*, with greater frequency than the children did²⁹. *When* was also used by adults to indicate sequential and contingent relationships, in addition to simultaneity.

The distribution of aspect also differed between the children and adults, as shown in Table 1 taken from Silva (1991):

²⁷ Children did not show an understanding of *when-while* until around 5 years of age (Keller-Cohen, 1987).

²⁸ Reilly (1986) and Bowerman (1986) have also found that all the meanings and functions associated with *when* are not acquired instantaneously, but over time.

²⁹ The exact figures for children are *when*-91 occurrences, *while*- 16, *as*-2. The exact figures for adults are *when*-29 occurrences, *as*-18, *while*-10.

Table 1: Comparative Distribution of Aspects Occurring in Predicates of *When*-clauses (%)

Aspect	Adults	Children
Punctual	79.3	62
Stative	13.8	12
Durative	6.8	25

Importantly, children were far more likely to use a durative predicate with *when* than were adults. Recall from section 2.1.1 that *while* requires a durative predicate, whereas *when* may take a punctual *or* durative predicate. Silva (1991) suggests the greater use of durative aspect with *when* by the children can be attributed to the non-productivity of *while* in their linguistic repertoire. Until *while* becomes fully productive, *when* assumes some of its functions³⁰.

Another significant difference between adults and children was the preference for preposing *when*-clauses. The adults and the older children were more likely to prepose *when*-clauses than were the younger children (although all subjects preposed greater than chance), as shown in Table 2 taken from Silva (1991):

Table 2: Frequency of Pre- and Post-posed *When*-clauses

Group	N	# of <i>When</i> -clauses	% Preposed	% Postposed
1 (4;1-6;11)	20	18	66.7	33.3
2 (7;0-8;11)	28	35	60.0	40.0
3 (9;0-11;11)	23	38	89.5	10.5
Adults	26	29	89.7	10.3

Silva suggests that the greater the preference for preposing, the greater the ability of the speaker to take into consideration others' points of view, and use the *when*-clauses to set-up forthcoming information³¹.

In sum, support for a continuum of simultaneity was found in Silva's (1991) study. However, the children's continuum was underdeveloped; they used *when* not only almost to the exclusion of

³⁰ Once *while* become fully productive, Silva (1991) suggests that *when* would likely be primarily reserved for punctual predicates. This suggestion is compatible with Quirk et al. (1985), who say that the *when-after* interpretation arises with punctual predicates, and with Hornstein (1990), who says that the *when-after* is the preferred interpretation.

³¹ This finding can be interpreted in Partee's (1984) framework: children and adults are using the preposed *when*-clauses to set the reference time of the main clause.

while (and *as*), but *when* was used more often in contexts where adults were likely to choose *while* (or *as*) to represent the simultaneous relation. Silva's study also demonstrated that a preference for preposing exists from as young as 4;11, and this preference becomes greater with age.

Stevenson and Pollitt (1987) (henceforth S&P) first suggested the potential relevance of a Reichenbachian theory of time to understanding children's acquisition of *before*, *after*, *when*, and *while*. They adopted Partee's (1984) proposed functions of R, E, and S in interpreting temporal relations between an adjunct and matrix clause. In their view, in order for a child to correctly interpret these subordinate clauses, they must first have a good understanding of this time system³². In particular, they must understand the adjunct's role as indicator of reference time.

S&P believed that Clark's (1971) experimental task made it difficult for children to truly demonstrate their understanding of these temporal terms. Children were required to remember and act-out two past-tense clauses with a third party agent. Consider the following example:

53) After he jumped the gate, he patted the dog.

[S [R] [E]]

(Clark, 1971)

In 53), the two events both occurred prior to speech time. Acting out these past-tense sentences may have been difficult for Clark's children, hence the errors. The order-of-mention strategy may thus be a result of children's difficulty with the task and not their difficulty with *before* or *after*. Finally, S&P argued that Clark's task placed a great memory demand on children because both events had to be held in memory and then acted out in the correct event order.

³² Weist (1991) develops these ideas into the notions of *mono-referential* and *bi-referential* temporal location. Weist suggests that in earlier stages of development (i.e. between 1;6 and 2;0) temporal location is strictly *mono-referential* because children can only use speech time as the point of reference. In later stages, children have *bi-referential* temporal location since they can locate the time of an event relative to both the speech time *and* the reference time. Whereas locative prepositions such as *in/on* are *mono-referential*, *before/after* are *bi-referential* and thus acquired later.

In their experiment, S&P's children (aged 2;11-4;5) only needed to act-out the main clause in a command in order to demonstrate comprehension:

54) Before the train stops, move the blue car

[S [R] [E]]

(S & P, 1987)

In 54), the child was required to watch the experimenter, and when the child saw the train slowing, the correct response was to move the car. Therefore the demand on memory was reduced in these materials.

Children were given both Clark test materials and S&P's test materials³³. The results showed that children's performance on the S&P materials was superior to their performance on the Clark materials³⁴. Furthermore, the results showed the order-of-mention strategy to be specific to Clark's materials.

Using the S&P materials, children as young as 3;4-3;9 successfully acted out *before* and *after* 71% of the time and were more likely to omit subordinate clauses from sentences containing *before* than those containing *after*. Children also tended to act-out the first clause in *before* sentences (whether matrix or subordinate).

These results are consistent with Partee (1984). *Before*-clauses are not included in the linear narrative; therefore children omitted them because of event representation complexity. The acting out of the initial clause with *before* sentences may also be a strategy children use when confronted with a *before*-clause they are incapable of integrating into the narrative.

Stevenson and Pollitt concluded that too great a memory demand masked children's knowledge of *before* and *after* in Clark's (1971) task. They claim that children's acquisition of *before* and

³³ S&P also tested Crain (1982) materials. Again, they argued that Crain placed too great a demand on children's memory by requiring them to act out both clauses.

³⁴ Children's performance on the S&P materials was also superior to their performance on the Crain (1982) materials. There was no difference in overall errors between the Clark materials and the Crain materials. The only characteristic shared by these two tasks was the requirement to act-out both clauses (i.e. the demand on memory).

after is governed by the final event representation of a sentence, and not by the features associated with each connective or by strategies.

3.2 Syntactic Explanation of Patterns

In another critical examination of Clark (1971), Amidon and Carey (1972) (henceforth A&C) presented their act-out task in the form of a game, with all instructions worded as commands. For example:

55) Before you move a red plane, move a blue plane.

To test Clark's (1971) proposed semantic feature hierarchy, A&C included a control group which received sentences containing *first* and *last*, for example:

56) Move a blue plane first; move a red plane last.

The researchers argued that *first* and *last* share with *before* and *after* the semantic features +Time, +/- Simultaneous, and +/- Prior. However, *first* and *last* differ syntactically: they are adjuncts without complements, whereas *before* and *after* introduce subordinate clauses. A&C argued that a difference in performance between these two sets could only be attributed to their syntax, as semantically they were identical on the three features.

Their results further revealed that *first/last* were easier for children than *before/after*. Unlike Clark (1971), *before* was not found to be any easier than *after* for the children. Although *first/last* do not differ significantly in semantic features from *before/after*, they do differ syntactically. *First/last* are adjuncts without complements, whereas *before/after* introduce subordinate clauses

When given no feedback regarding their performance, children can be supposed to have omitted subordinate clauses more than main clauses, regardless of whether the subordinate clause was pre- or post-posed³⁵. A&C called this the *main-clause-first* strategy: children focus on the main clause because of its saliency and ease of processing. With feedback³⁶ in the practice session or post-test training performance improved; when children acted out both clauses, they sequenced

³⁵ Subordinate clauses were omitted 68% of the time (A&C, 1972).

them in the correct order more significantly than they did not. Finally, clause order made no difference for omission errors, but more reversal errors occurred when the clause order did not correspond with the actual event order³⁷.

Children's improved performance with feedback, their use of a *main-clause-first* strategy, and their facility with *first/last* suggested to A&C that a semantic feature theory was an inadequate explanation for children's performance. Rather they claimed that children's difficulty lies with subordinating syntax³⁸. They suggest that Clark did not see these omissions because she focused children's attention on both clauses throughout the experiment.

Coker (1978) similarly concluded that subordinating syntax is problematic for children. Three comprehension and production tasks demonstrated that performance with *before* and *after* as prepositions was superior to that of subordinating conjunctions³⁹. Subjects were kindergarteners (5;3-6;4) and first-graders (6;3-7;7).

Unlike A&C (1972), Coker did *not* cite use of a main-clause-first strategy as evidence for children's difficulty with the subordinating syntax of *before* and *after*; rather Coker demonstrated that the use of order-of-mention and main-clause-first strategies was dependent on the experimental task. Like A&C (1972) and contrary to Clark (1971), no evidence was found for an invariant order of acquisition between *before* and *after*.

Pseudo-superior performance on *before* or *after* in the tasks was attributed to the use of an order-of-mention or main-clause-first strategy. Upon eliminating from the analysis those children who appeared to use one of these strategies, the correct response rates for *before* and *after* became very similar⁴⁰. In the second task, which allowed no strategy, there was no difference at all between *before* and *after* (e.g. 64.72% vs. 66.67% correct for kindergarteners). Importantly,

³⁶ Feedback focussed children on both clauses. For example, if a child made an error in the practice session, the experimenter would correct them, show them the proper act-out, and then get the child to try it again.

³⁷ This supports Clark's conclusion that children prefer those sentences that preserve event order.

³⁸ S&P (1987) suggest that A&C's findings are not incompatible with their approach. That is, if children regard the subordinate temporal clause as an indicator of reference time, and not an action, then they might be inclined to omit the subordinate clauses from act-out. On the other hand, it could also be that A&C's findings are simply a result of the nature of the task (to be discussed).

³⁹ Powers (1996) and Ling (1999) support such a finding. Their studies also show that children gradually build up functional categories.

⁴⁰ For example, in the third task, after eliminating those children who used a main-clause-first strategy (which resulted in the pseudo-superior performance on *before* sentences), the difference between *before* and *after* drops from 11.14% to 5.86% (Coker, 1978).

Coker claimed that the use of a particular strategy was not indicative of a lack of knowledge of *before* and *after*, since most of these children demonstrated some awareness of their meanings on a prepositional task.

Coker argues that the order of mention strategy observed in Clark's (1971) study and the main clause first strategy observed in A&C's (1972) are both derivative of the tasks. When Clark focussed attention on both clauses the order-of-mention strategy prevailed, but when this focus is not provided by A&C (1972), children opted to act out the more salient clause, and thus the main-clause-first strategy prevailed⁴¹.

The results of the study strongly suggested to Coker that there is no one particular, invariant order of acquisition between *before* and *after*, rather performance is dependent upon the nature of the task. The task may promote the use of a strategy that is independent of children's knowledge. Finally, it was concluded that *before* and *after* are acquired first as prepositions, because of the complexity of subordinating syntax.

However, Coker shares a methodological problem with Clark (1971) in that a great demand was placed on children's memory. In the prepositional tasks, the children had to remember all the pictures and their order of presentation; in the subordinate clause tasks, the children had to remember both clauses and act them out correctly with a third-party agent (i.e. a puppet). This memory demand again may have interfered with children's ability to fully demonstrate their knowledge of *before* and *after*, particularly in subordinate clauses.

3.3 Summary of Reported Patterns in Previous Acquisition Studies

Clark's (1971) study proved to be the catalyst for subsequent research into the acquisition of *before*, *after*, *when*, and *while*. The experiments discussed in the last two sections have appealed to both semantic and syntactic explanations in understanding children's acquisition patterns. While some findings have found continuous support across studies, there is generally no consensus on what is important in acquiring these connectives.

⁴¹ Johnson (1975) also replicated both Clark's (1971) and A&C's (1972) findings in a single sample. Johnson also concluded that the difference in results was due simply to the nature of the task; Clark cued her subjects to pay attention to both clauses whereas A&C did not.

There have been a number of recurrent themes throughout these acquisition studies:

- i) the sequence of simultaneous and ordering relations in acquisition,
- ii) the order of acquisition of *before* and *after*,
- iii) preferences in clause ordering,
- vi) the relevance of subordinating syntax complexity, and importantly ..
- v) the complexity and naturalness of test materials

To begin, Clark (1971) argued that simultaneous relations would be acquired first whereas Keller-Cohen (1987) argued that ordering relations would be acquired first. All of the studies discussed have disagreed on whether there exists a particular sequence of acquisition within ordering relations: either *before* is acquired first, *after* is acquired first, or the order of acquisition is variable and depends on the individual.

Interestingly, clause ordering does not appear to impact children's performance. For example, Clark (1971), A&C (1972), Coker (1978), S&P (1987), and Silva (1991) have found that children do not have any great difficulty with preposed clauses, unless the order of clauses does not preserve the actual event order.

A&C (1972) and Coker (1978) have rejected the importance of, for example, a semantic feature approach to acquisition. Rather they have argued that the syntactic complexity of subordinating constructions interferes with children's acquisition of these connectives.

Most importantly, it is evident that the complexity and naturalness of the test materials has a very strong influence on the nature of the results. For example, although Clark (1971) emphasized the significance of an order-of-mention strategy and A&C (1972) emphasized the significance of a main-clause-first strategy, Johnson (1975) and Coker (1978) have found that these strategies may be independent of children's knowledge. Furthermore, the form of the test instructions and the demand on children's memory are factors which may have influenced, for example, Clark's (1971), A&C's (1972), and Coker's (1978) results. Among the studies conducted thus far, S&P's (1987) results appear the least tainted by methodology.

Chapter 4: Goals of Present Study

To date, there are no studies of the patterning of *before*, *after*, *when*, and *while* in naturalistic speech data. This study will examine a body of speech data in order to determine whether there exist patterns that can shed light on the conflicts found in the experimental literature. In particular this study will investigate the implications that a Reichenbachian theory of time may have on understanding children's acquisition (as first suggested by S&P, 1987). As well, the data will be examined for patterns that suggest whether it is the semantics or the syntax of these connectives that drive their acquisition.

Among the studies discussed in chapter three, adopting a Reichenbachian perspective to understanding children's acquisition of these connectives appears the most promising. To begin, S&P's approach is desirable because it is rooted in the strong theoretical linguistic framework of Reichenbach (1947) and Partee (1984). Furthermore, compared to other studies S&P (1987) have best reduced the demands on children's memory and produced the most natural materials thus far. Their results have provided strong preliminary evidence that understanding the time function of temporal clauses is important to acquisition.

Chapter 5: Data and Method

5.1 Naturalistic versus Experimental Data

As discussed in chapter four, obtaining a representative picture of children's understanding of *before*, *after*, *when*, and *while* is often difficult, particularly since experimental results tend to be influenced by methodological difficulties.

The act-out procedure has been a common technique used in assessing children's understanding of these connectives. Unlike a yes/no task, the act-out procedure is popular because it permits a child a range of responses under controlled conditions. However, as explored earlier, this technique tends to require a great deal of children's memory. Many researchers also argue that experimental tasks such as act-out can inadvertently force a child to use a desired construction, independent of whether the child has actually mastered the syntax of that construction (Stromswold, 1996).

An alternative method to the experimental situation is to study naturally occurring speech. Stromswold (1996) suggests that naturalistic data is the method the least susceptible to extraneous influences from the experimental situation. Naturalistic data is also a useful tool for studying the development of language longitudinally and for identifying developmental trends, provided it is carefully collected and coded. By studying the naturally occurring speech of adult interlocutors it can also be determined how frequently grammatical instructions typically occur in speech.

Naturalistic data has its own problems and limitations. The absence of a construction in a naturalistic corpus does not indicate absolute absence of productivity in the child's grammar. As discussed by Demuth (1996), the absence of the construction could be due to undersampling, lack of appropriate discourse context, or actual lack of linguistic ability. It is difficult therefore to determine why the construction did not appear⁴². It is also a widely supported belief in the literature that children's productions under-represent (and appear later than) children's actual comprehension of particular constructions (Demuth, 1996).

This study will use naturally occurring speech data in order to shed light on some of the conflicts found in the experimental literature, as discussed in chapter four. It is not being suggested that

naturalistic data will completely explain how these connectives are acquired, rather it is an additional, relatively untapped source of data that may complement the findings of Stevenson and Pollitt (1987).

5.2 CHILDES Database

A body of naturalistic speech data was obtained from the CHILDES database (child language data exchange system: MacWhinney, 1999). This database is accessible on the World Wide Web at: <http://poppy.psy.cmu.edu/childes/index.html>. The individual files and the package of analysis programs (known as CLAN- *child language analysis*) were downloaded from this site.

5.2.1 Description of Database

The database includes cross-linguistic corpora, although English predominates. Contributors to the CHILDES database must conform to stringent guidelines in transcribing and coding the data (consult MacWhinney (1999) for details). All the files include coded speech data from the children's adult interlocutors. The adult interlocutors are primarily the mother or father and non-familial investigators. Including parent-child interactions is important because children tend to speak more freely, and use more complex constructions, in those environments and situations in which they feel the most comfortable (Demuth, 1996).

5.2.2 Selection of Files

The subdirectories of Brown (1973), Clark (1979), Sachs (1983), and Wilson and Peters (1988) were chosen for analysis. These subdirectories contained longitudinal studies of children's speech and therefore allowed for a good examination of patterns of development in the temporal connectives. In each of these subdirectories naturalistic data from the adult interlocutors was also included for analysis.

Selective files in each subdirectory were picked for analysis. Quarters of the Adam files in the Brown (1973) subdirectory were chosen and the mean MLU (mean-length-of-utterance) was

⁴² However, Demuth (1996) suggests that if a wide range of cross-linguistic studies found a similar absence, then it could be concluded that the construction was not yet part of a child's linguistic abilities.

calculated for each grouping⁴³. MLU is the ratio of morphemes to utterances and is widely held to be the best index of a child's linguistic development (Brown, 1973)⁴⁴. Using a child's age as an index of development is considered inadequate because it is well documented that linguistic abilities do not advance at identical ages across childhood.

The MLU average group values obtained from Adam provided the basis for selection of materials from the other subdirectories. Similar MLU quarters were found in the Shem files (Clark subdirectory), the Seth files (Wilson and Peters subdirectory), and the Naomi files (Sachs subdirectory). Particular attention was focused on choosing groups of files whose MLU values appeared representative of the child's development.

5.3 Data Files

5.3.1 Adam Files

Within the Brown (1973) subdirectory, the speech of Adam and his adult interlocutors was examined. However only the naturalistic data from his mother (MOT⁴⁵) and the investigator Ursula (URS) was included for analysis⁴⁶. His father (FAT), the investigator Colin (COL), and the Diaperman (DIA) were excluded since *before*, *after*, *when*, and *while* were essentially absent from their speech⁴⁷. The actual amount of conversational time in which these adults participated was minimal. As well, all other children interlocutors were excluded from the analysis.

⁴³ The CLAN program MLU was used to calculate the MLU for each file. The mean was then calculated for the four MLUs in each quarter grouping.

⁴⁴ Brown (1973: 54) provides detailed rules for calculating MLU, e.g. what counts as one morpheme, excluding fillers, etc.

⁴⁵ These short forms, e.g. MOT for mother, are used when coding the naturalistic data. When conducting a particular analysis of the data, e.g. MLU, the speaker tier (i.e. the short form) must be specified so that the appropriate lines are isolated.

⁴⁶ These interlocutors did not participate equally in conversations with the children. Therefore, as it will be shown in chapter six, each adult contributes a different proportion of the total connectives used.

⁴⁷ By 'essentially/near/relatively absent' I mean that there were less than 5 uses of these connectives in total by each interlocutor.

There are 55 files in the Adam corpus. Quarters of the 55 files were selected and the mean MLU was calculated for each quarter. Table 3 displays this information:

Table 3: Adam: Ages and MLUs

ADAM FILE	AGE	MLU
Adam 1	2;3.4	2.101
Adam 2	2;3.18	2.133
Adam 3	2;4.3	2.380
Adam 4	2;4.15	1.828
<i>Adam 1-4</i>		<i>2.11</i>
Adam 17	2;10.30	2.939
Adam 18	2;11.13	2.438
Adam 19	2;11.28	3.260
Adam 20	3;0.11	3.302
<i>Adam 17-20</i>		<i>2.98</i>
Adam 33	3;5.29	3.835
Adam 34	3;7.7	3.965
Adam 35	3;8.0	4.096
Adam 36	4;6.24	4.568
<i>Adam 33-36</i>		<i>3.88</i>
Adam 49	4;6.24	4.568
Adam 50	4;7.0	4.520
Adam 51	4;7.29	5.271
Adam 52	5;2.12	4.558
<i>Adam 49-52</i>		<i>4.73</i>

5.3.2 Shem Files

Clark (1979) provided the data for Shem. The adult interlocutors included in the analysis were his mother (MOT) and the investigator Cindy (INV). Shem's father (FAT) and the adults coded as GUY and MRX were excluded from the analysis because of a near absence of these connectives in their speech. As well, all other children interlocutors were excluded from the analysis.

There are 47 files in the Shem corpus. Corresponding MLU averages were matched (as closely as possible) for three of Adam's quarters. It was not possible to find a grouping of Shem files with an MLU mean of approximately 2.11. Therefore, there is no matching group for Adam 1-4 in the Shem files. This information is shown in Table 4:

Table 4: Shem: Ages and MLUs

Shem File	AGE	MLU
Shem 1	2;2.16	2.952
Shem 2	2;2.23	2.885
Shem 3	2;3.2	3.438
Shem 4	2;3.16	3.223
<i>Shem 1-4</i>		<i>3.13</i>
Shem 15	2;6.6	3.491
Shem 16	2;6.27	3.891
Shem 17	2;7.10	3.915
Shem 18	2;7.18	6.007
<i>Shem 15-18</i>		<i>4.33</i>
Shem 35	3;0.13	5.262
Shem 36	3;0.20	4.980
Shem 37	3;1.5	4.682
Shem 38	3;1.13	4.353
<i>Shem 35-38</i>		<i>4.82</i>

Importantly, this difference does not appear to greatly influence the child data since Adam showed no use of any of the temporal connectives in files 1-4. Nor does this difference appear to impact the adult data: there were 78 tokens of these connectives in the speech of Shem's adults versus 80 tokens in the speech of Adam's adults.

5.3.3 Seth Files

The Seth corpus was obtained from Wilson and Peters (1988). Interlocutors excluded from the analysis are Dana (DAN), Dabee (DAB), Seth's grandfather (GRF), another child (DJ), and a non-human speaking machine (SNS). Seth's father (FAT) was the only interlocutor included in the analysis.

There are 30 files in the Seth corpus. Again the MLU average of each Adam quarter was matched as best as possible with a similar grouping in the Seth corpus. Table 5 displays this information:

Table 5: Seth: Ages and MLUs

SETH FILE	AGE	MLU
Seth 24_0	2;0.0	1.794
Seth 24_2	2;0.2	2.033
Seth 25_0	2;1.0	2.271
Seth 25_2	2;1.2	2.585
<i>Seth 24_0-25_2</i>		<i>2.17</i>
Seth 28_2	2;4.2	2.545
Seth 29_0	2;5.0	3.699
Seth 29_2	2;5.2	3.526
Seth 30_0	2;5.0	2.968
<i>Seth 28_2-30_0</i>		<i>3.18</i>
Seth 35_0	2;11.0	3.898
Seth 36_0	3;0.0	3.372
Seth 38_1	3;2.1	4.495
Seth 40_0	3;4.0	4.468
<i>Seth 35_0-40_0</i>		<i>4.06</i>
Seth 41_3	3;5.3	4.376
Seth 43_3	3;7.3	4.944
Seth 46_2	3;10.2	5.202
Seth 49_0	4;1.0	5.213
<i>Seth 41_3-49_0</i>		<i>4.93</i>

5.3.4 Naomi Files

Sachs (1983) provided the data for Naomi. The adult interlocutors included in the analysis were her mother (MOT) and her father (FAT). Jennifer (JEN) and a student (STU) were excluded from the analysis because of a relative absence of these connectives in their speech.

There are 93 files in the Naomi corpus. Again the average MLU for each Adam quarter was matched as closely as possible with a similar grouping in the Naomi files. Table 6 displays this information:

Table 6: Naomi: Ages and MLUs

NAOMI FILE	AGE	MLU
Naomi 18	1;10.23	2.084
Naomi 19	1;10.25	2.260
Naomi 20	1;10.28	1.985
Naomi 21	1;11.2	2.204
Naomi 18-21		2.13
Naomi 51	2;2.25	2.750
Naomi 52	2;3.0	3.133
Naomi 53	2;3.17	3.271
Naomi 54	2;3.19	3.524
Naomi 51-54		3.17
Naomi 82	3;3.26	3.119
Naomi 83	3;3.27	4.027
Naomi 84	3;4.0	4.152
Naomi 85	3;4.18	3.778
Naomi 82-85		3.77
Naomi 90	3;8.19	2.996
Naomi 91	4;7.28	4.881
Naomi 92	4;7.29	5.140
Naomi 93	4;9.3	4.426
Naomi 90-93		4.36

5.3.5 MLU Summary

Table 7 provides a summary of all MLU groupings:

Table 7: MLU Summary

Adam	MLU	2.11	2.98	3.88	4.73
Shem	MLU	/	3.13	4.33	4.82
Seth	MLU	2.17	3.18	4.06	4.93
Naomi	MLU	2.13	2.17	3.77	4.36

The only Adam MLU average lacking a match was 2.11 (Adam files 1-4) in the Shem corpus.

The most any MLU deviates from an original Adam value is .45 (Adam 3.88 vs. Shem 4.33); the least any MLU deviates from an original Adam value is .02 (Adam 2.11 vs. Naomi 2.13).

5.4 Extraction of *Before*, *After*, *When*, and *While* from the Data

The package of analysis programs, named CLAN, was downloaded from the CHILDES web-site. The CLAN program KWAL (keyword analysis) was used to extract all instances of *before*, *after*, *when*, and *while* from the selected Adam, Shem, Seth, and Naomi files.

Four lines of context were also extracted around all target utterances (two lines before and two lines following each target). This context was necessary in order to clarify the meanings of any unclear utterances and to help identify repetitions and imitations. In the few cases where four lines of context were not sufficient to clarify any ambiguity, eight lines were examined. If any amount of context was insufficient, those ambiguous utterances were excluded from analysis.

5.4.1 Inclusions and Exclusions

5.4.1.1 *When*

As discussed in section 2.1.1.2.1, *when* may be read conditionally. This conditional use is not necessarily atemporal; in many instances this use still presupposes knowledge of the time-meaning of *when*. Therefore, those conditional uses of *when* that invoked time concepts were included for analysis. One interesting example found in the Shem data illustrates how easily *when* and *if* are interchanged in the speech of the investigator:

57)

*SHE: oh .
 *INV: cause <when> [/] **when you try to turn it on +...**
 *SHE: yeah .
 *INV: it's not like yours # **if i turn the power on** # nothing happens .

(Clark, 1979: Shem 15, lines 361-364)

57) illustrates a generic conditional (cf. footnote 7) in which a regular relationship has been observed in the past between the protasis (*if/when the power is turned on*) and the apodosis (*nothing happens*). In fact the predominant use of conditional-*when* by children and adults was to express a generic relationship.

The interpretation of *when* was very often ambiguous: it could be read both as a regular temporal connective relating two clauses in time, and as a generic conditional, as in 57) and 58):

58)

*CHI: you throw the gun .
 *CHI: **when you throw them** missiles come out of dem .
 *CHI: let's go hunting .

(Brown, 1973: Adam 34, Lines 217-219)

The only uses of conditional-*when* in the data that were excluded (because they did not invoke time concepts) were two contrastive uses found in the speech of Adam's mother. Consider 59):

59)

*CHI: I got a wrong place # in Italy .
 *MOT: why d(o) you think that's the wrong place in Italy **when**
 you're not in Italy ?
 *CHI: I am not in Italy # Mommy .

(Brown, 1973: Adam 35, Lines 877-879)

Lastly, any utterances in which *when* was used as a question marker or used in a formulaic expression were exempt from further analysis.

5.4.1.2 *Before, After, and While*

All uses of *before* and *after* as adverbs were excluded⁴⁸. For example:

60)

*CHI: is dat (e)nough ?
 *MOT: do it more # until it's tight .
 *CHI: **I never seen this before** .
 *CHI: <is it> [//] # it's don't have wheels .
 *MOT: no # it doesn't have wheels .

(Brown, 1973: Adam File 33, lines 228-232)

⁴⁸ In the literature, *before* and *after* as adverbs are sometimes analyzed as truncated prepositional phrases (Quirk et al., 1972).

Also excluded were any utterances in which *before* and *after* formed part of a formulaic expression⁴⁹.

Utterances in which *while* was used contrastively (cf. 2.1.1.2.2), used as a noun (61), or used in a formulaic expression were excluded from the analysis.

61)

*SHE: now # we wanna lift this .
 *SHE: now we haf to take [//]hey # i need to use dis for a **while**.
 *INV: okay .

(Clark, 1979: Shem 37, Lines 1255-1257)

5.4.1.3 Imitations and Repetitions

Imitations and repetitions were identified and excluded⁵⁰. An utterance was labeled an imitation if within the previous context (4 lines maximum) a different interlocutor had uttered the same words. An utterance was labeled as a repetition if in the previous context (4 lines maximum) the same speaker had uttered the same words. 62) represents an imitation, 63) represents a repetition⁵¹:

62)

*INV: rght # when it's day+time # c'mere .
 *SHE: **when it's day+time** .
 *INV: sit here # next to me .

(Clark, 1969: Shem 17, lines 1060-1062)

⁴⁹ There were no instances of *before* and *after* being used spatially. As suggested by Bennett (1975) and Quirk et al. (1985), it does appear that their temporal uses are far more common than their spatial uses.

⁵⁰ There were 10 tokens of repetitions and imitations (combined) in children's speech, and 6 tokens (combined) in adults' speech.

⁵¹ CHILDES transcription makes use of many codes. For example, unintelligible speech is coded as 'xxx', untranscribed material is represented as 'www', ? symbolizes the researcher's best guess at a word, ### represents a very long pause, and +/- represents an interruption (MacWhinney, 1999). Researchers can also elect to code, for example, speech acts and phonetic transcriptions on separate tiers within the database.

63)

*MOT: well # after you-'re finished .
 *MOT: you can-'nt do it while you-'re eating your popsicle .
 *MOT: you can-'nt do it while you-'re eating your popsicle .
 *CHI: sticky .

(Sachs, 1983: Nina File 51, lines 272-275)

Sometimes no amount of surrounding context could clarify the intent of the utterance, and therefore it had to be excluded:

64)

*INV: it vams all the water up ?
 *SHE: yeah # when [//] when it has a bi [//] be [//] be [//] big
 mess your pen # fr [//] from duh pen an(d) ink .
 *INV: from the pen an(d) ink when it gets all messy ?
 *SHE: yeah .
 *INV: what vams the water up ?

(Clark, 1979: Shem File 38, Lines 790-794)

5.5 Searching for Patterns in the Extracted Utterances

As mentioned previously, the purpose of this study is to shed light on the conflicts found in the experimental literature, with a particular emphasis on motivating a Reichenbachian perspective of time. The study also seeks to determine whether it is the semantics or the syntax of these connectives that drives their acquisition.

Two aspects of the data were focused on for analysis in this study: the frequency of the connectives throughout the children's development and the preposing of temporal clauses.

The frequency analysis reveals any overall frequency patterns, as well as how much individual children /adults use each connective. In particular the frequency analysis of the adults' speech permits a discussion about the effect of input on children's language.

By examining the preposing of temporal clauses, evidence may be found in support of the proposals of Partee (1984) Stevenson and Pollitt's (1987). The discussion section will explain in detail *how* preposing serves as evidence.

Chapter 6: Results

This chapter presents the results of the frequency and preposing analyses of the extracted utterances. Section 6.1 details the results of the frequency analysis and section 6.2 details the results of the preposing analysis.

6.1 Frequency Analysis of *Before*, *After*, *When*, and *While*

6.1.1 Overall Frequency

6.1.1.1 Children

Table 8 displays the overall frequency of these connectives in the speech of all children. *When* is clearly the most popular of these connectives (constituting almost 78% of connectives used), followed by *after* (15%), *while* (5%), and lastly *before* (3%).

Table 8: All Children: Total Frequency of Connectives⁵²

Connective	N	%
When	120	77.42
After	24	15.48
While	7	4.52
Before	4	2.58
<i>Total</i>	<i>155</i>	<i>100</i>

To demonstrate that no data from any one child dominated the results, the percent of total connectives extracted from each child was calculated, and displayed in Table 9:

Table 9: Percent of Total Connectives per Child

File	Frequency	Percentage per File
Adam	53	34.19
Shem	44	28.39
Seth	40	25.80
Naomi	18	11.61
<i>Total</i>	<i>155</i>	<i>100</i>

⁵² Note: these numbers reflect the exclusions discussed in 5.4.1 (i.e. the exclusions are not included in the total count).

The individual contributions to the total connectives used do not vary greatly, ranging 22.58%. This indicates that no one child supplied the majority of the data to the analysis.

For each child, *when* is the most frequent and *after* is the second most frequent (Table 10). *While* is the third most frequent for three of the children, and *before* is the least frequent for two of the children. *While* and *before* are tied in frequency in the speech of Shem.

Table 10: Overall Rank of Connective Frequency for Children

Corpus	<i>When</i>	<i>After</i>	<i>While</i>	<i>Before</i>
Adam	1	2	4	3
Shem	1	2	3	3
Seth	1	2	3	4
Naomi	1	2	3	4
<i>Rank</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>

6.1.1.2 Adults

As shown in Table 11, *when* is used the most frequently by the adults (approximately 70% of the time), followed by *after* (14%), *while* (10%), and lastly *before* (7%)⁵³:

Table 11: All Adults: Total Frequency of Connectives⁵⁴

Connective	N	%
When	184	69.69
After	37	14.02
While	25	9.47
Before	18	6.82
<i>Total</i>	<i>264</i>	<i>100</i>

In order to determine whether one corpus contributed the majority of the adult data (thus skewing the results), the percent of connectives used per adult speaker and per corpus was calculated. This information is displayed in Table 12:

⁵³ Although the order of connective frequency is the same for children and adults, it is interesting to note that the percentage range between *after* and *before* in the children (12.9%) is somewhat larger than the percentage range between *after* and *before* in the adults (7.23%).

⁵⁴ Note: these numbers reflect the exclusions discussed in 5.4.1 (i.e. the exclusions are not included in the total count).

Table 12: Percent of Total Connectives per Adult Speaker and per Corpus

Corpus	Frequency	Percent per Adult	Percent per Corpus
Adam:			
Ursula	9	3.41	30.30
Mother	71	26.89	
Shem:			
Mother	18	6.82	29.55
Investigator	60	22.73	
Seth:			
Father	63	23.86	23.86
Naomi:			
Mother	29	10.98	16.28
Father	14	5.30	
Total	264	100	100

The percent of total tokens contributed by each adult corpus does not vary greatly, ranging only 14.02 %. Within each corpus, some adults contribute more tokens than do other adults. As mentioned earlier, this difference is due to an overall difference in conversation participation⁵⁵. It would be expected that if the adults participated equally in conversation, then similar total frequency counts would be found.

When is unanimously ranked first in adult frequency (Table 13), as it was for children. However, there is more variation in the individual rankings of *after*, *while*, and *before* than there was in the children's ranking of these connectives (cf. Table 10). *After* is the second most frequent for only 3 adults, and *while* and *before* exhibit greater fluctuation in their rankings as well.

Table 13: Overall Rank of Connective Frequency for Adults

Corpus	When	After	While	Before
Adam	1	3	2	4
Shem	1	2	4	2
Naomi	1	2	2	4
Seth	1	2	4	3
Rank	1	2	3	4

⁵⁵ This was determined by using the KWAL program FREQ (frequency) which listed the frequency of all words used by a particular speaker. FREQ allowed me to determine which speakers played larger roles in the recorded conversations.

6.1.2 Frequency Results for Individual Files

The individual results from the frequency analysis are presented in this section. It is important to emphasize the first *productive* use of these connectives. Many of children's early usages are non-productive and unstable; that is, the item may occur early in a session but drop out in subsequent sessions (but cf. Demuth's observations, 5.1). In this study a connective was classified as productive at the file after which no more than one session passed without one occurrence of it.

In the children's tables the highlighted files represent the beginning of productivity for that connective. A problem arises with regard to the adult data: whatever criteria are used for labeling a connective as productive in the speech of children must apply to the adults as well. However, it would be unreasonable to suggest that these connectives are not productive in adults' speech. This problem will be addressed in chapter seven, however the productivity criteria are maintained for the children's data.

6.1.2.1 Adam

The frequency of connectives in Adam's speech across the individual files is shown in Table 14:

Table 14: Adam: Frequency of Connectives

File Number	<i>When</i>	<i>After</i>	<i>Before</i>	<i>While</i>
1-19				
20	2			
33	4			
34	4			
35	4			
36	3	1	1	
49	5	5		
50	4	1	1	2
51	5			
52	9	1	1	
<i>Total</i>	<i>40</i>	<i>8</i>	<i>3</i>	<i>2</i>

From file 20 onwards, *when* is used productively in Adam's speech, whereas *after*, *before*, and *while* occur with less frequency. Table 15 shows that the adults use *when* from the first file onwards, with even greater strength than did Adam, especially in comparison with *while*, *after*,

and *before*⁵⁶. Although *while* occurs with greater frequency in the adults' speech, the asymmetry between *before* and *after* is not as pronounced.

Table 15: Adam Adults: Frequency of Connectives

File Number	When	While	After	Before
1	4	1		
2	2			1
3	5			
4				
17	5		1	1
18	5			
19	3	1		
20	7			
33	2	1	2	
34	1			
35	6	3		1
36	4			
49	3		1	
50	7	1	1	
51	3			1
52	6	1		
Total	63	8	5	4

6.1.2.2 Shem

When strongly occurs in the speech of Shem from file 2 onwards, and is labeled as productive at file 16. *After* is the only other connective (of the four) to occur in his speech from the selected files; *before* and *while* have zero occurrences. Again, the asymmetry between *after* and *before* is maintained.

Table 16: Shem: Frequency of Connectives

File Number	When	After	Before	While
1				
2	1			
3	5			
4	3			
15		2		
16	1			
17	3	2		
18	9	1		
35	1			
36	1			
37	4			
38	10	1		
Total	37	6	0	0

⁵⁶ The shaded portions in the frequency tables of the adult interlocutors represent the file of productivity for their respective child interlocutor.

Like Adam's interlocutors, Shem's adults use *when* with great frequency from early on in the files (Table 17). *After* and *before* are not asymmetrical in the adults' speech, rather they occur with equal strength throughout the files.

Table 17: Shem Adults: Frequency of Connectives

File Number	When	After	Before	While
1		2		1
2	7		1	1
3	2			
4	8		3	
15	4			
16	4	3	1	1
17	11		1	1
18	6		1	1
35	3	1		1
36	5			
37	2	1		
38	6			
<i>Total</i>	<i>58</i>	<i>7</i>	<i>7</i>	<i>6</i>

6.1.2.3 Seth

When continues to be the most frequently occurring connective in the speech of Seth as well, as displayed in Table 18. *When* is labeled as productive in file 43_3, and *after* is tentatively labeled as productive at 46_2⁵⁷. The asymmetry between *after* and *before* is also maintained in this data.

Table 18: Seth: Frequency of Connectives

File Number	When	After	While	Before
24_0-28_2				
29_0	1			
29_2				
30_0	2			
35_0		1		
36_0	1			
38_1	1			
40_0	5	2	2	
41_3				
43_3	4		1	
46_2	13	2		
49_0	1	3		1
<i>Total</i>	<i>28</i>	<i>8</i>	<i>3</i>	<i>1</i>

⁵⁷ I only tentatively conclude that *after* is productive since its productivity can only be attested to in the last two files, and because it is not yet productive in the speech of the other child subjects.

Table 19: Seth's Father: Frequency of Connectives

File Number	When	After	Before	While
24_0		1	1	
24_2			3	
25_0	1			
25_2				
28_2				1
29_0	2		1	
29_2	2	3		
30_0	3	1		
35_0	4	4		
36_0	2	2		
38_1	4			
40_0	5	4		
41_3	8			
43_3	1			1
46_2		1		
49_0	7			
Total	39	16	5	2

In conformity with the pattern witnessed thus far, Seth's father uses *when* the most frequently throughout the files. Compared to the other individual results seen, *after* occurs with much greater frequency than *before* in this data (16 tokens versus 5 tokens). The use of *after* is not confined to a certain number of files either, it is observed in the earliest and the latest files.

6.1.2.4 Naomi

Table 20 shows that *when* occurs productively from file 83 onwards. Although the number of tokens is small, the asymmetry between *after* and *before* is maintained in Naomi's speech.

Table 20: Naomi: Frequency of Connectives

File Number	When	After	While	Before
18-82				
83	1		1	
84	3	1		
85	1			
90	1			
91	3	1		
92	2		1	
93	3			
Total	14	2	2	0

Table 21: Naomi Adults: Frequency of Connectives

File Number	<i>When</i>	<i>After</i>	<i>While</i>	<i>Before</i>
18				
19				
20			1	
21	1			
51	1	4	1	
52	2			
53	1			
54				
82	1			
83	5	1		1
84	1	1		
85				
90	1	3	2	
91	7		3	
92	3		1	
93			1	1
<i>Total</i>	<i>23</i>	<i>9</i>	<i>9</i>	<i>2</i>

Naomi's interlocutors show use of *when* early on in the selected files, *after* and *while* occur with equal frequency, and *before* occurs with the least frequency. Interestingly, the use of *after* and *while* is distributed throughout the files, and not to one particular section (e.g. after file 83).

6.2. Preposing Analysis of *When*-Clauses

6.2.1 Coding of *When*-Clauses

When-clauses were coded as either preposed (+P), postposed (-P), no main clause (no MC), or other (O). No other temporal clauses were coded as such because the numbers were simply too small to permit this analysis.

Examples of children's preposing include:

65)

*CHI: you like all these toys ?

*CHI: **when you were a little child** # you liked all these toys ?

*MOT: well # I did-'nt have those toys when I was a little child

(Sachs, 1983: Naomi 84, Lines 92-94)

66)

*CHI: dis time you kill him # ok ?
 *CHI: **when I whistle** # you stop .
 *CHI: stop .

(Brown, 1973: Adam 49, Lines 973-975)

The following are examples of postposing:

67)

*FAT: gonna be a cool night .
 *CHI: yes ## .
 *CHI: better put a rain+coat on me **when it's rain-ing** .
 *FAT: yes .
 *CHI: do you have a (um)brella ?

(Wilson and Peters, 1988: Seth 40_0: lines 610-614)

68)

*INV: yeah # it's day+time .
 *SHE: but it's not dark <when> [/] **when we sleep** .
 *INV: but it's not dark what ?

(Clark, 1979: Shem 18, Lines 151-153)

In many instances, like 69) and 70), the main clause was missing; thus only the *when*-clause was present:

69)

*CHI: say um .
 *CHI: uppy@ .
 *CHI: **when we do this** .
 *CHI: let me hear Naomi talk .
 *CHI: let me hear Naomi do the xxx xxx again .

(Sachs, 1983: Naomi 85, Lines 329-333)

70)

*CHI: dey are sticking out my head everywhere .
 *CHI: I better keep dem back in .
 *CHI: **when** [?] **the hammer knock me down** .
 *MOT: when the hammer knocked you down .
 *MOT: what hammer ?

(Brown, 1973: Adam 36, Lines 70-74)

On the other hand, there were a number of examples similar to 70), where at first it appeared that the main clause was missing, but an examination of surrounding context proved otherwise. In 71), the main clause is transcribed on a separate line (634) than the subordinate temporal clause (633), so in fact the child's utterance is complete. This example was coded as a preposed *when*-clause:

71)

*FAT: good .
 *CHI: now I'am gonna cut your head [/] hair , .
 *CHI: and # **when you go to school** , . (line 633)
 *CHI: **every+body**'will say <oh your hair is red> ["]., (line 634)
 *CHI: and then you'll say <oh I have a red head> ["] .

(Wilson and Peters, 1988: Seth 46_2, Lines 633-637)

72) is another example where at first it appears as if the main clause is missing, but it can be recovered from the surrounding context. The *when*-clause is coded as postposed in this example:

72)

*MOT: it what ?
 *CHI: **tickles me** .
 *CHI: **when I put my ear on it** .
 *MOT: Adam # maybe you can use these [= crayons] .
 *CHI: I have some .

(Brown, 1973: Adam 33, Lines 51-55)

Some *when*-clauses also fell into the category of 'other'. This category included *when*-clauses that cannot be preposed (cf. footnote 17), clauses that are placed in a medial position, and clauses whose utterance positions cannot be determined. For example, in 73), the *when*-clause cannot be preposed because it functions as the direct object of *tell*, in 74) the *when*-clause is placed in a medial position, and in 75) the position of the *when*-clause within the utterance is ambiguous:

73)

*FAT: +< oh , make'(th)em go , and then we'(wi)ll make'(th)em
stop #5 .

*CHI: you'll tell me **when to stop** ?

*FAT: ok .

(Wilson and Peters, 1988: Seth 46_2, Lines 429-431)

74)

*CHI: no # I not [?] .

*CHI: where rubber band **when you turn it** # go # huh ?

*MOT: it turns too .

(Brown, 1973: Adam 33, Lines 302-304)

75)

*MOT: wow # I bet it does-'nt even hurt any more # does it ?

*CHI: yes # it does # **when I scratch it** # it does .

*MOT: oh # it looks much better .

(Sachs, 1983: Naomi 92, Lines 26-28)

6.2.2 Overall Findings of Preposing Analysis

The most important finding is that children and adults behave differently with regard to preposing: children prefer overall to prepose *when*-clauses (47.5%) than to postpose (22.5%), whereas adults prefer overall to postpose *when*-clauses (56.0%) than to prepose (25.0%) (Tables 22 and 23). On the other hand, the results from the children and adults were similar in the number of *when*-clauses coded as *no main clause* and *other*⁵⁸.

Table 22: All Children: Classification of *When*-clauses

Preposed	Postposed	No Main Clause	Other	Total
57	27	17	21	120
47.50%	22.50%	14.17%	15.83%	100%

⁵⁸ There were no errors made by children (or adults) in preposing *when*-clauses that should/could not have been.

Table 23: All Adults: Classification of *When*-clauses

Preposed	Postposed	No Main Clause	Other	Total
46	103	12	23	184
25.00%	55.98%	6.52%	12.50%	100%

6.2.3 Preposing Results for Individual Files

6.2.3.1 Adam

Tables 24 and 25 present the results of the classification analysis of *when*-clauses throughout Adam's and his adult interlocutor's speech:

Table 24: Adam: Classification of *When*-Clauses

File Number	Preposed	Postposed	No Main Clause	Other
1-19				
20		1		1
33		2	1	1
34	2	1		1
35	1	1		2
36		1	2	
49	3	2		
50	2	1		1
51	4	1		
52	5	3		1
Total	17	13	3	7

Table 25: Adam Adults: Classification of *When*-Clauses

File Number	Preposed	Postposed	No Main Clause	Other
1		4		
2		3		
3	2	1	1	1
4				
17		4		1
18		5		
19	1	1		1
20	1	5		1
33	1		1	
34		1		
35	2	1	1	
36	2	2		
49		2		1
50	2	1		4
51	2	1	1	
52	1	3	2	
Total	14	34	6	9

The test for binomial proportion using the normal approximation supports the null hypothesis (H_0) that preposing and postposing will occur with equal frequency in the speech of Adam ($z = 0.91, p > .10$, two-tail). On the other hand, using the same test on the adult data, the null hypothesis was rejected ($z = 3.03, p < .001$, two-tail). The source of significance was a greater preference by the adults for postposing *when* clauses.

6.2.3.2 Shem

Tables 26 and 27 present the results of the classification analysis of *when*-clauses throughout the speech of Shem and his adult interlocutors:

Table 26: Shem: Classification of *When*-Clauses

File Number	Preposed	Postposed	No Main Clause	Other
1				
2	1			
3	2	1		2
4	1		1	1
15				
16				1
17		1		2
18	6	2	1	
35		1		
36		1		
37	3		1	
38	5	2	2	1
<i>Total</i>	<i>18</i>	<i>8</i>	<i>5</i>	<i>7</i>

Table 27: Shem Adults: Classification of *When*-Clauses

File Number	Preposed	Postposed	No Main Clause	Other
1				
2	1	5	1	
3	1	1		
4	1	6		1
15		2	1	1
16	1	3		
17	4	4	1	2
18	3	2	1	
35		3		
36	1	3		1
37	1	1		
38	1	5		
<i>Total</i>	<i>14</i>	<i>35</i>	<i>4</i>	<i>5</i>

The test for binomial proportion using the normal approximation rejected the H_0 that preposing and postposing will occur with equal frequency in the speech of Shem ($z=2.16$, $p < .05$, two-tail). The H_0 was even more strongly rejected in the Shem adult data ($z=3.14$, $p < .001$, two-tail). The source of significance for the children was a greater preference for preposing *when* clauses, and the source of significance for the adults was a greater preference for postposing *when* clauses.

6.2.3.3 Seth

Tables 28 and 29 present the results of the classification analysis of *when*-clauses in the speech of Seth and his father.

Table 28: Seth: Classification of *When*-Clauses

File Number	Preposed	Postposed	No Main Clause	Other
24_0-28_2				
29_0			1	
29_2				
30_0			2	
35_0				
36_0				1
38_1	1			
40_0	2	3		
41_3				
43_3	2	1	1	
46_2	10		1	2
49_0		1		
Total	15	5	5	3

Table 29: Seth's Father: Classification of *When*-Clauses

File Number	Preposed	Postposed	No Main Clause	Other
24_0				
24_2				
25_0		1		
25_2				
28_2				
29_0	1	1		
29_2	1	1		
30_0		2	2	
35_0	2	1		1
36_0		2		
38_1	2	2		
40_0	3	2		
41_3	4	2		
43_3		1		2
46_2				
49_0	3	3		1
Total	16	18	2	4

The binomial test rejects the H_0 that preposing and postposing will occur with equal frequency in the speech of Seth ($p < .05$). The source of significance was a greater preference by Seth for preposing.

The test for binomial proportion using the normal approximation did not reject the H_0 in the data obtained from Seth's father ($z = 0.51$, $p > .30$, two-tail). That is, he did not show a greater preference for preposing or postposing.

6.2.3.4 Naomi

Tables 30 and 31 present the results of the classification analysis of *when*-clauses in the speech of Naomi and her adult interlocutors.

Table 30: Naomi: Classification of *When*-Clauses

File Number	Preposed	Postposed	No Main Clause	Other
18-21				
83		1		
84	1		1	1
85			1	
90			1	
91	3			
92			1	1
93	3			
<i>Total</i>	7	1	4	2

Table 31: Naomi Adults: Classification of *When*-Clauses

File Number	Preposed	Postposed	No Main Clause	Other
18-20				
21		1		
51		1		
52		2		
53		1		
54				
82		1		
83		4		1
84		1		
85				
90		1		
91	2	2		3
92		2		1
93				
<i>Total</i>	2	16	0	5

The two-tailed binomial test did not reject the H_0 that preposing and postposing will occur with equal frequency in the speech of Naomi; her preposing fell just short of significance ($p = .07$). On the other hand, a binomial test done on the data obtained from Naomi's adults strongly rejected the H_0 ($p < .01$). The source of significance was a greater preference by the adults for preposing *when* clauses.

6.2.4 Preposing Summary

Table 32 summarizes the speakers' preferences for pre- or post-posing *when*-clauses:

Table 32: Source of Significance: Greater Pre- or Post-posing

Speaker	Greater Preposing	Greater Postposing
Adam	X	X
Adam Adults	X	✓
Shem	✓	X
Shem Adults	X	✓
Seth	✓	X
Seth Adults	X	X
Naomi	X	X
Naomi Adults	X	✓

This table illustrates an important trend found in children's versus adults' pre- and postposing of *when*-clauses: whenever preposing is significant, it is in the children's speech, and whenever postposing is significant, it is in the adults' speech. The children and adults within any of the four subdirectories are never behaving identically with regard to pre- and postposing preferences.

Chapter 7: Discussion: Supporting a Reichenbachian Perspective

I will now undertake a discussion of how the results of the frequency and preposing analyses mesh with a Reichenbachian perspective of time.

7.1 Frequency of Connectives

A pattern of connective frequency emerges in the data: overall, for both the children and adults, *when* is the most frequent, followed by *after*, *while*, and lastly *before* (Tables 8 and 11). Although individuals vary slightly in this order, *when* is invariably the most frequent, and *before* never occurs more often than *after*. The following sections discuss in more detail the significance of the frequency results.

7.1.1 *Before* versus *After*

Acquisition studies have disagreed on whether there exists a particular sequence of acquisition within ordering relations: either *before* is acquired first (e.g. Clark, 1971), *after* is acquired first (e.g. Stevenson & Pollitt, 1987), or the order of acquisition is variable and depends upon the individual (e.g. Amidon & Carey, 1972; Coker, 1978).

The overall results (6.1.1) clearly indicate that *after* is more frequent than *before* in the speech of all subjects. Out of the four connectives examined, children used *after* overall 15.48% of the time, but only used *before* overall 2.58% of the time. Likewise, the overall findings for the adults revealed *after* to be used 14.07% of the time, whereas *before* was only used 6.84% of the time. The percentage range between *before* and *after* use also revealed that children used *after* more in comparison with *before* (range = 12.9%), than did the adults (range = 7.23%).

The individual results (6.1.2) for both children and adults support a consistent asymmetry: *after* is more frequent in speech than is *before*⁵⁹. For some subjects, this difference is quite pronounced (e.g. Seth's father 15 vs. 5) and for others it is minimal (e.g. Adam's adults 5 vs. 4).

⁵⁹ Shem's adult interlocutors were the only subjects whose *after* use (7 tokens) did not outnumber their *before* use (7 tokens). However, this result is not inconsistent with the observed pattern since *before* is not more frequent in speech than is *after*.

Other researchers who have examined the frequency of English words in written texts have found *while* to be the least frequent of these four connectives, and *before* and *after* to be essentially identical in their rate of occurrence (e.g. Thorndike & Lorge, 1944; Johansson & Hofland, 1989)⁶⁰. That in this present study *while* is often more frequent than *before* is an interesting result; suggesting again that there is something complicated about *before*⁶¹.

These frequency results accord well with the hypotheses of Partee (1984) and Stevenson & Pollitt (1987): children *and* adults choose *after* more frequently because of the difficulty of the event representation of *before*. This difficulty persists into adulthood (although it is less pronounced as indicated by the range of use between *before* and *after*), as it would be expected to continue given the inherent difficulty of the event representation of *before*. That *while* is often used more frequently than *before* is also indicative of its complexity.

These findings therefore do not support Clark's (1971) claim that *before* is easier than *after*, according to her semantic feature hierarchy and the Polarity Principle⁶². Of course, it could be argued that the Prior feature could be changed to accommodate this finding, or that there is no reason to assume that positive features are acquired before negative features, but such an explanation would be ad hoc. Nor do these results complement Amidon & Carey's (1972) and Coker's (1978) claim that the order of acquisition is variable. On the other hand, Partee (1984) and Stevenson and Pollitt (1987) furnish an explanation that is rooted in Reichenbachian theory.

7.1.2 *When* versus *Before*, *After*, and *While*

The finding that *when* is more frequent than *before* or *after* in children's speech may also have an explanation based in Reichenbachian theory. Recall that Weist (1991) argued that temporal location is mono-referential for children between the ages of 1;6-2;0; that is, speech time is the only point of reference for interpreting events. As children get older, Weist argues that they

⁶⁰ Thorndike & Lorge (1944) cite the Lorge Magazine count that found *when* occurred 14,775 times, *after* occurred 5552 times, *before* 5011 times, and *while* 3340 times.

⁶¹ The difference in results between the present study and Thorndike and Lorge's study could be due to the smallness of the present study's sample. On the other hand, it might also be argued that given the event complexity of *before*, one might expect *before* to be favoured more in writing, which tends to be more planned than spontaneous speech.

⁶² Nor do the results fully support Clark's (1971) proposal that simultaneous relations should be acquired prior to ordering relations, since *while* was not any more frequent than *before* or *after*. On the whole, this study rejects the importance of a feature analysis in explaining the acquisition of these connectives.

develop bi-referential temporal location; that is they can locate the time of an event relative to both the speech *and* reference times. Therefore one possibility for the greater frequency of *when* might be that children have not yet fully developed bi-referential temporal location⁶³. Perhaps once children are able to locate the time of the primary event relative to both speech time and reference time, *before* and *after* will become productive.

One major difficulty with accepting the previous explanation is that *when* is also the most frequent in the speech of adults and yet we must assume that they have developed bi-referential temporal location. Alternatively, *when* could be the most frequently occurring connective simply because it offers the fewest semantic constraints in its use (cf. 2.1.1).

Why would *when* be more frequent than *while*, which also denotes simultaneity? This is difficult to determine given that there are so few instances of *while*. But if we accept the idea of a continuum of simultaneity (cf. 2.1.1), then we could expect this result. *While* is very complex linguistically, requiring a durative predicate, an end to the subordinate event, and a very specific temporal relationship between the two clauses. So, although its event representation is no more difficult than *when* or *after*, it is more complex in other respects.

Additional support for the continuum might be found by analyzing the nature of the predicates and the finality of the subordinate events in all *when* and *while* clauses. In a previous study I reported evidence of this continuum after examining the use of *when* and *while* with punctual, durative, and stative predicates in the speech of Adam's mother⁶⁴. This analysis has been left for future research.

⁶³ Consider the following sentences:

iii) [When Frank went to the store], John was reading.

iv) [Before Frank went to the store], John was reading.

If children only possess mono-referential time location, interpretation of iii) is still possible, but not iv). In iii) the speech time is the present, and the two events can both be interpreted prior to the speech time as occurring simultaneously. In iv), the speech time is the present, but since a simultaneous reading is not available for the *before*-clause, the children may be unable to understand what it means (as they have not yet developed bi-referential temporal location).

⁶⁴ I found that Adam's mother was much more likely to use both punctual and durative predicates with *when*, and more likely to use just durative predicates with *while*.

7.1.3 Effect of Input on Acquisition

I have suggested that the frequency of these connectives is a result of their semantics.

Alternatively, it may be argued that children's connective frequencies are driven by the input they receive from the adults. For example, *when* is frequent in adult input to the children; therefore because children hear *when* more often, they come to use it more often, independent of any linguistic principle.

Although it is difficult to determine what impact input may have on acquisition (if any), there are some objective measures for examining the relationship between adults' and children's speech in this body of data. In section 6.1.2, the individual results of the frequency analysis are displayed in tables, and the number of connectives occurring in each file throughout the data is provided. If input is the determining factor in children's acquisition, then certain patterns should be evident in the data.

To begin, if input is the critical factor in acquisition, then adults' use of *when* should start in/close to the file of productivity of their child interlocutor⁶⁵. As well, it would be expected that the more a child hears of a connective, then the more they themselves should produce it.

However, these hypotheses about input are not supported in this data. For example, Table 15 shows that *when* is productive in the speech of Adam from file 20 onwards, but the adult interlocutors use *when* in the earliest Adam files and with great strength in numbers. Adam is receiving a great deal of input long before *when* becomes productive in his speech at file 20. Similarly, as displayed in Table 17, *when* is not productive in Shem's speech until file 16, even though he receives a great deal of input prior to that time. Although Seth hears many *when*-clauses in the speech of his father (Table 19), he does not productively use *when* until file 43_3; and although Seth receives a great deal of *after* in the adult input, he does not show the same magnitude of use, and *after* is not (tentatively) labeled as productive until the latest files. Finally, Table 21 shows that Naomi's productive use of *when* starts at file 83, and yet she too hears a number of *when*-clauses prior to that time.

⁶⁵ Alternatively, it could be argued that the child is taking in the adult input and then there is a sudden triggering of knowledge and production.

The patterns in the rankings of connective frequency are also more rigid in the children's data than in the adults' data; that is the children are more alike in their frequency patterns (Tables 10 and 13). As well, within the individual corpora the rankings of connective frequency are not identical between the child and their adult interlocutor(s).

Finally, if input is important we might also expect that Seth's ordering of acquisition (first *when* then *after*) should be reflected in the speech of his father; that is *when* should be used by the father first, followed strictly by *after*. However such a pattern is not visible in Table 19: *after* is not used strictly after *when*; in fact, *after* and *before* are both used prior to showing any use of *when*.

Taken together this evidence suggests that it is not simply a matter of the children imitating what they hear in the input; if that were the case, we would expect more similarities between the child and adult data. Rather the children in this study show a great deal of independence from the adults in terms of their patterns of connective use. These patterns of connective frequency do not appear to be driven by the input, but driven by semantics.

7.2 Preferences for Preposing

The most important finding in 6.2 was that children and adults exhibited different behaviours with regard to preferences for pre- and postposing *when*-clauses. Overall children preposed *when*-clauses in 47.50% of the cases, whereas adults only preposed in 25.00% of the cases. On the other hand, adults preferred overall to postpose *when*-clauses in 55.98% of the cases, compared to children who only postposed *when*-clauses 22.50% of the time.

Table 32 summarized the individual patterns of preposing. Whenever *preposing* was statistically significant, it was in the child data; whenever *postposing* was statistically significant, it was in the adult data. In the speech of Naomi, preposing fell just short of significance, and in Adam's speech preposing was not found to be significant. However, statistical tests revealed that the degree of postposing exhibited by Naomi's and Adam's adult interlocutors was highly unusual ($p < .01$ and $p < .001$, respectively).

The individual results also reveal that Adam's adults, for example, mainly postpose *when*-clauses prior to *when* being productive in Adam's speech, and yet he does not show this preference for

postposing⁶⁶. Both the group results and these individual results provide additional evidence for the view that children are not simply imitating what they hear in their input, since the children and their adult interlocutors never behave identically with regard to pre- and postposing *when*-clauses.

If the children are not imitating the adult patterns, why then are they choosing to prepose *when*-clauses? According to Ward (1988), a speaker's choice of one syntactic form over another is not haphazard, rather structural options are exploited to achieve specific pragmatic ends. Ward (1988) also argues that a speaker's ability to choose one syntactic form over other truth-conditionally equivalent forms presupposes knowledge of how these forms differ. In this view, children's preposing is not a random act, but an act with purpose. Indeed preposing seems to be a sophisticated syntactic movement for children of this age, which suggests that it somehow is relevant to children's acquisition of *when*.

Partee (1984) argued that the function of temporal subordinate clauses was to set the value of the reference time. Stevenson and Pollitt (1987), building upon the ideas of Partee (1984), suggested that in order for a child to fully acquire these connectives, they must first understand the function of the temporal clause as indicator of reference time.

Children's manipulation of the marked syntactic structure of *when*-clauses suggests that they are using the clauses to set up the reference times in which the following main clauses are to be interpreted. Perhaps preposing *when*-clauses is more natural to the children, since as the reference time it influences the interpretation of what follows. On the other hand, adults, who showed a preference for postposing *when* clauses, may not have difficulty with the naturalness of having the reference point follow the main clause. It may also be the case that adults are more concerned with children hearing the essential information (i.e. the main clause) first.

Earlier acquisition studies have also generally found that children do not have any great difficulty with preposed clauses⁶⁷. Recall that Silva's (1991) experimental study reported preferences for

⁶⁶ The same is true for Shem, Seth, and Naomi.

⁶⁷ For example, Clark (1971), Amidon & Carey (1972), Coker (1978), and Silva (1991) all reported no difficulties with preposing, unless event order was violated. The present study did not examine whether the preposed *when*-clauses did or did not preserve event order. Nor did the present study analyze the contribution of clause length and complexity to preposing. These factors should be examined in future studies.

preposing *when*-clauses (cf. Table 2) in children as young as 4;1. Importantly, the results from the present study confirm a preference for preposing as early as 2;7 (the age of *when*-productivity for Shem)⁶⁸.

Silva had suggested that the greater the preference for preposing, the greater the ability of the speaker to take into consideration others' points of view, and use the *when*-clauses to set-up forthcoming information. Silva's findings can also be interpreted in the framework of Partee (1984) and Stevenson & Pollitt (1987). Children choose to prepose *when*-clauses because as the reference time, it will influence the interpretation of what is to follow.

Stevenson & Pollitt (1987) found that children as young as 3;4-3;9 were successful in interpreting *before* and *after*. The present study was unable to examine preferences for preposing in *before* and *after* (and *while*) temporal clauses because there simply was not enough data to permit such an analysis. Perhaps if the study were extended to include more files from the corpora, and/or more subjects, patterns of preposing could be examined.

In summary, because children's preposing of *when*-clauses is abundant and evident in the earliest files of use, and because *when* is the only connective judged productive, it suggests that preposing is relevant to understanding children's acquisition of these connectives. The conclusion reached is that once children are able to understand the temporal clause's function as reference time, these connectives become operative.

7.3 Acquisition of Conditionals

An interesting byproduct of this temporal connective analysis was the observation of prevalent generic-conditional use in the speech of children as young as 2;7 (the age of *when*-productivity for Shem).

Generic conditionals (and conditionals in general) are proposed to involve complex cognitive underpinnings. For example, the literature suggests that a generic conditional use requires the

⁶⁸ However, Silva also reported that her *adult* subjects showed a strong preference for preposing (89.7% of the cases); a finding that was not supported in the present study. It is uncertain why adults were more likely to prepose in Silva's study; perhaps it is because Silva's experimental task elicited longer narratives from the subjects. Long narratives involve more organization of information flow, so subjects may be more likely to prepose temporal clauses, than they would in interactive, spontaneous speech.

ability to decentre in time, and this sense of timelessness does not appear to develop until the ages of 4;0-4;6 (Cromer, 1968 [as cited in Bowerman, 1986]). The present study has found that as early as 2;7, children show frequent use of generic-conditionals.

However, Reilly (1982 [as cited in Bowerman, 1986]) argued that these early uses are only superficial generic-conditionals, because the children are not using them to make statements about habitual or timeless relationships. Instead these pseudo-generics refer to a particular instance of the relationship.

As I discussed in section 5.4.1.1, the *when*-clauses were often ambiguous between a true generic reading and a regular temporal meaning. That is, it was difficult to determine the child's intentions about whether the *when*-clause was referring to a general relationship or to a specific situation. This naturalistic data therefore does not refute Reilly's claim that these early generic-conditionals do not demonstrate a true ability to decentre in time and speak of a habitual relationship between two events.

7.4 Productivity Problem

A problem was identified earlier when speaking of connective productivity: whatever criteria are used for labeling a connective as productive in the speech of children must apply to the adults as well. However, no matter how productivity was defined, it was not possible to find a rational set of criteria that would find *after*, *before*, *when*, and *while* 'productive' in all of the adults' speech. But it would be unreasonable to suggest that these connectives are *not* productive in adults' speech.

Nonetheless the productivity criteria were applied to the children's data because the notion of productivity is important in describing children's speech. Although a child may produce a form periodically, it does not mean that they have control of its meaning. Intuitively, this makes sense.

Likewise, intuition tells us that adults do have control over these forms. Consider that the longest stretch of files for which any connective is absent in adults' speech is 9 files (Naomi corpus: *before*). On the other hand, *all* of the children have stretches longer than that for one or more of the connectives, and these stretches are at the beginning of the files for children, but not invariably so for adults. This late-use pattern in children's speech suggests that they have

difficulty with the connectives in the early files, whereas adults' use of the connectives is more frequent and dispersed throughout the files, and does not reflect a genuine difficulty.

7.5 What Drives Acquisition: Syntax or Semantics?

The proposed syntax of these connectives does not provide us with any reason for why *when* would be acquired earlier than the other temporal connectives. No evidence has been recovered which supports any of the hypotheses generated in section 2.2.3. For example, the categorical distinctions proposed by Dubinsky and Williams (1995) and Emonds (1985) cannot explain the observed patterns of use in the naturalistic data. Even if we assume that *when* is a complementizer, the literature offers us no reason to believe that complementizers are acquired earlier than prepositions. In fact, the opposite is more likely to be advocated: prepositions are acquired prior to complementizers (e.g. Powers, 1996; Ling 1999). If we assume that *when* is a preposition along with *before*, *after*, and *while*, we still lack an explanation of the observed patterns of use.

On the other hand, the findings of this study strongly support the view that the semantics of *before*, *after*, *when*, and *while* are the driving force in their acquisition. The ideas of Partee (1984) and Stevenson and Pollitt (1987) provide a basis for explaining these patterns.

Chapter 8: Conclusion

Acquisition studies to date have been unable to reach a consensus about what is important in acquiring *before*, *after*, *when*, and *while*. The conflicting patterns observed in the experimental literature appear to result largely from methodology; the complexity and naturalness of test materials having a very strong influence on the nature of the results.

The present study focussed on a body of naturalistic speech data in order to determine whether there exist patterns that can shed light on these conflicts. In particular this study investigated the implications that a Reichenbachian theory of time has on understanding children's acquisition. The data was also examined for patterns that suggest whether it is the semantics or the syntax of these connectives that drives their acquisition.

Reichenbach's (1947) inclusion of R in the interpretation of tense allowed Partee (1984) to propose that the function of temporal subordinate clauses is to introduce the reference time with respect to which the main clause is interpreted. Partee (1984) also differed from earlier researchers (such as Clark (1971), Amidon and Carey (1972), and Coker (1978)), in that her research implied that *after* should be acquired prior to *before* because of event representation complexity.

Stevenson and Pollitt (1987) built upon Partee's ideas in suggesting that children would not acquire these connectives until they understood their function as indicators of reference time. Compared to earlier acquisition studies, Stevenson and Pollitt (1987) best reduced the demands on children's memory and produced the most natural experimental materials thus far. Their results provided strong preliminary evidence that understanding the time function of temporal clauses is indeed critical to acquisition.

Using longitudinal studies from the CHILDES database, evidence for Partee's (1984) and Stevenson and Pollitt's (1987) claims were supported in this study. The fact that children and adults consistently used *after* more frequently than *before* was taken as support for Partee's hypothesis that the event representation of *before* is more complex than that of *after* (or *when* and *while*). As argued by Stevenson and Pollitt (1987), the acquisition of *before* and *after* seems to be

governed by the final event representation of the sentence, and not by the features associated with each connective or by use of a particular strategy (cf. Clark, 1971; Amidon and Carey, 1972).

Semantic proposals were also put forth to explain the frequency patterns of *when* versus *before*, *after*, and *while*. *When* may be more frequent than the other connectives because of a delay in developing bi-referential temporal location, or simply because it offers the fewest semantic constraints in its use. *While*, on the other hand, may be the least frequently occurring because of its overall semantic complexity.

Since children's preposing of *when*-clauses was abundant and evident in even the earliest files, and because *when* was the only connective judged productive, it strongly suggested that preposing was relevant to acquisition of these connectives. Specifically, children's use of the marked syntactic structure of *when*-clauses can be interpreted as evidence that they were using the clauses to set up the reference time in which the following clauses were to be interpreted.

The proposed syntax of these connectives did not provide us with any reason for why *when* would be acquired earlier than the other temporal connectives. The syntactic determinants of performance in the studies of Amidon and Carey (1971) and Coker (1978) were not reflected in the natural speech data examined here.

On the other hand, the findings of this study strongly support the view that the semantics of *before*, *after*, *when*, and *while* are the driving force in their acquisition. In particular, the use of naturalistic data has allowed evidence to be found for the importance of a Reichenbachian perspective of time to temporal connective acquisition.

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APPENDIX I: ADAM CORPUS

ADAM

Adam 1

 No instances of *before*, *after*, *when*, or *while*.

Adam 2

 Line 1651. Keyword: *before*
 *CHI: yeah .
 *RIC: have you read this book before ?
 *CHI: Mommy read book (be)fore .
 *RIC: you have ?
 *CHI: Mommy read book (be)fore .
 Exclude: *adverb*

Line 1654. Keyword: *before*
 *CHI: Mommy read book (be)fore .
 *RIC: you have ?
 *CHI: Mommy read book (be)fore .
 *CHI: ok .
 *MOT: what are you doing # Adam ?
 Exclude: *adverb*

Adam 3-4

 No instances of *before*, *after*, *when*, or *while*.

Adam 17

 Line 1584. Keyword: *when*
 *MOT: you just rubbed on the bench .
 *MOT: sometimes it hurts to do that .
 *CHI: Mommy # when me want (?) it (?) ?
 *CHI: where me sleep ?
 *CHI: sleep .
 Exclude: *question*

Adam 18

 No instances of *before*, *after*, *when*, or *while*.

Adam 19

 Line 1788. Keyword: *when*
 *CHI: what landing tower doing ?
 *MOT: that's what they have to land on .
 *CHI: when they driving ?
 *MOT: so that they're go where they want to go .
 *CHI: what dat ?
 Exclude: *question*

Adam 20

 Line 2015. Keyword: *when*
 *CHI: you gon put # back on ?
 *MOT: yes # good night .
 *CHI: why you turn it off when you sing ?
 *MOT: because I don't sing very well .
 *CHI: yep # you sing +...
 Coded as: -p

Line 2035. Keyword: when
 *CHI: ope(n) +...
 *CHI: # xxx .
 *CHI: I don't know when [?] you [?] been [?] .
 *CHI: I sing +...
 *CHI: xxx .
 Coded as: 0

Adam 33

Line 53. Keyword: when
 *MOT: it what ?
 *CHI: tickles me .
 *CHI: when I put my ear on it . (continuation of previous utterance)
 *MOT: Adam # maybe you can use these [= crayons] .
 *CHI: I have some .
 Coded as: -P

Line 202. Keyword: when
 *CHI: this is moving .
 *CHI: I never seen this jet .
 *CHI: I better show this # to Daddy when he comes # home .
 *CHI: I throw it up again .
 *CHI: I never seen this jet .
 Coded as: -P

Line 229. Keyword: before
 *CHI: is dat (e)nough ?
 *MOT: do it more # until it's tight .
 *CHI: I never seen this before .
 *CHI: <is it> [//] # it's don't have wheels .
 *MOT: no # it doesn't have wheels .
 Exclude: adverb

Line 303. Keyword: when
 *CHI: huh ?
 *CHI: no # I not [?] .
 *CHI: where rubber band when you turn it # go # huh ?
 *MOT: it turns too .
 *MOT: see how the band is being twisted ?
 Coded as: 0

Line 1500. Keyword: when
 *CHI: a space .
 *CHI: do # we watch a +...
 *CHI: # when we lived in Pembroke ?
 *MOT: no # what was that that we watched ?
 *CHI: # when we get frightened .
 Exclude: question

Line 1502. Keyword: when
 *CHI: # when we lived in Pembroke ?
 *MOT: no # what was that that we watched ?
 *CHI: # when we get frightened .
 *MOT: I don't remember .
 *CHI: I do remember .
 Coded as: no MC

Adam 34

Line 218. Keyword: when
 *CHI: we have two .
 *CHI: you throw the gun .
 *CHI: when you throw them missiles come out of dam .
 *CHI: let's go hunting .
 *CHI: let's go hunting .
 Coded as: +P

Line 262. Keyword: when

*CHI: dese are +...
 *CHI: # dance .
 *CHI: when you throw # it's dance .
 *CHI: it's dance all de way .
 *CHI: let's beat dem up .

Coded as: +P

Line 336. Keyword: when

*CHI: I punch this .
 *MOT: why would you do that ?
 *CHI: they come out when you throw them .
 *CHI: you throw and throw and +...
 *MOT: you missed .

Coded as: -P

Line 677. Keyword: when

*CHI: did you remember the one <popped> [/] # popped in the air # like a
 airplane ?
 *MOT: which one # Adam ?
 *CHI: when we lived over in Cambridge ?
 *CHI: a jet airplane .
 *CHI: do you use a rubber band for de airplane ?

Exclude: question

Line 804. Keyword: when

*MOT: yes .
 *CHI: d(o) you (re)member +... (utterance interrupted and continues on next line)
 *CHI: when dat blast off take off de head ?
 *CHI: d(o) you member ?
 *CHI: when we lived in Cambridge ?

Coded as: 0

Line 806. Keyword: when

*CHI: when dat blast off take off de head ?
 *CHI: d(o) you member ?
 *CHI: when we lived in Cambridge ?
 *MOT: what happened ?
 *CHI: it's blast off de head .

Exclude: question

Line 933. Keyword: after

*CHI: went up the hill to fetch a pail in Italy .
 *CHI: Jack broke his crown .
 *CHI: and Jill came after tumbling .
 *MOT: Jack fell down and broke his crown .
 *CHI: to fetch a pail of water .

Exclude: formulaic expression

Line 940. Keyword: after

*CHI: to fetch a pail of water .
 *CHI: Jack broke his crown .
 *CHI: and Jill came after tumbling .
 *CHI: yo+yo .
 *CHI: punch a punch a punch .

Exclude: formulaic expression

Adam35

Line 152. Keyword: when

*CHI: I don't know .
 *MOT: maybe to clean the track .
 *CHI: when they get dirty ?
 *MOT: mmhm .
 *CHI: a black train .

Exclude: question

Line 224. Keyword: when
 *MOT: oh ?
 *CHI: doesn't +...
 *CHI: # me when I +...
 *CHI: # Italy .
 *MOT: what did you say ?
Coded as: 0

Line 504. Keyword: when
 *URS: yes .
 *CHI: it's <has> [///] # sure has lots o(f) accidents here .
 *CHI: **when de street light says stop if you have a accident # you knock it down .**
 *URS: you need some more track # don't you ?
 *CHI: is dis your dime ?
Coded as: +P

Line 630. Keyword: when
 *CHI: yes .
 *CHI: see my light <one (th)e> [/] # <one (th)e> [///] # in (th)e sign .
 *CHI: **says when to stop .**
 *MOT: said what ?
 *CHI: when to stop .
Coded as: 0

Line 632. Keyword: when
 *CHI: says when to stop .
 *MOT: said what ?
 *CHI: **when to stop .**
 *MOT: winter stop ?
 *CHI: yeah .
Exclude: repetition

Line 849. Keyword: when
 *CHI: yeah .
 *MOT: why are they wrong ?
 *CHI: **they don't turn when I get on the floor .**
 *CHI: dese doesn't work .
 *CHI: I can't take dis apart .
Coded as: -P

Adam 36

Line 72. Keyword: when
 *CHI: dey are sticking out my head everywhere .
 *CHI: I better keep dem back in .
 *CHI: **when [?] the hammer knock me down .**
 *MOT: when the hammer knocked you down .
 *MOT: what hammer ?
Coded as: no MC

Line 89. Keyword: when
 *CHI: I gonna eat myself up .
 *CHI: cradle will rock # all by itself .
 *CHI: **when the wind blows it .**
 *CHI: dat is all about it .
 *MOT: all about what ?
Coded as: no MC

Line 637. Keyword: after
 *MOT: a pineapple .
 *CHI: a pineapple .
 *CHI: **I want to have pineapple after lunch .**
 *CHI: and some peanuts .
 *MOT: do you know who this is ?

Line 945. Keyword: before

*MOT: to what ?
 *CHI: to race your cars on .
 *CHI: **hurry up (be)fore Daddy comes home .**
 *CHI: I di(d)n't do dis .
 *CHI: dat what Captain Bob <has> [//] # have .

Line 1233. Keyword: when

*CHI: what is dat ?
 *MOT: what d(o) you think it is ?
 *CHI: **I gonna shoot dat over when I go to California .**
 *MOT: this is a fish fly .
 *CHI: did everyone see a fish fly ?
 Coded as: -P

Adam 49

Line 61. Keyword: when

*CHI: I don't know .
 *CHI: you want to see what happens ?
 *CHI: **when I push dis up .**
 *CHI: **dan [: then] I go up . (continuation of previous utterance)**
 *CHI: see ?
 Coded as: +P

Line 419. Keyword: after

*MOT: how about what ?
 *CHI: new one # sir .
 *CHI: **after I finish it # I'm gonna buy a new one # ok ?**
 *CHI: I'm gonna fill dis baby up .
 *DIA: 0 [=! singing] .

Line 773. Keyword: when

*CHI: I'm strong .
 *URS: hmm ?
 *CHI: **I'm strong when I eat a apple .**
 *CHI: is dat right # Ursula ?
 *URS: yes # I think so .
 Coded as: -P

Line 835. Keyword: after

*CHI: dey looking out de window # see ?
 *CHI: dey looking out de window .
 *CHI: **I see dey go after dem and lock dem up .**
 *CHI: you know which one I like ?
 *CHI: dis one .

Line 974. Keyword: when

*CHI: dis is sharp .
 *CHI: dis time you kill him # ok ?
 *CHI: **when I whistle # you stop .**
 *CHI: stop .
 *CHI: stop .
 Coded as: +P

Line 997. Keyword: when

*MOT: what happens when you blow the whistle ?
 *CHI: I'm gonna start blowing .
 *CHI: **you gonna have to beat me when I blow de whistle .**
 *CHI: I'm gonna beat you .
 *CHI: I start blowing until the whistle goes ooo@o .
 Coded as: -P

Line 1005. Keyword: after

*CHI: gon (t)a eat him .
 *CHI: you gonna have dat bird .
 *CHI: **you gonna have dat bird after we get him .**
 *CHI: I'm gonna knock him and keep him +...
 *CHI: ok # let's fire him .

Line 1199. Keyword: when

*MOT: where did you learn how to do that ?
 *CHI: I know how to do that now .
 *CHI: **when I was a little baby # I fell # didn't I ?**
 *CHI: babies don't know better .
 *MOT: that's right .

Coded as: +P

Line 1397. Keyword: after

*CHI: now dey are off de truck .
 *CHI: now it's time for dinner .
 *CHI: **after dey have dinner # dey gonna be so excited .**
 *CHI: here # dis is Callie@c .
 *CHI: dis is John .

Line 1402. Keyword: after

*CHI: his name is Wig@c .
 *CHI: Wig@c .
 *CHI: **<after dey eat> [//] # after Wig@c eats his dinner # he's gon (t)a
 get on for a nice good ride . (exclude first after: retraced)**
 *CHI: he's gonna stay on de ride .
 *CHI: it's nice .

Adam 50

Line 163. Keyword: while

*CHI: **le(t) me see if you can find a envelope .**
 *URS: alright .
 *CHI: **while I look for de scissors . (continuation of previous utterance)**
 *URS: maybe .
 *CHI: you got lots more toys [?] # don't you ?

Line 260. Keyword: when

*CHI: my brother died .
 *CHI: she's my sister .
 *CHI: **I wonder when I'm gonna get a brother .**
 *MOT: you have a brother .
 *CHI: a brother .

Coded as: 0

Line 348. Keyword: before

*MOT: I don't think she thought it was a tiger .
 *MOT: but she thought it was somebody who didn't live here .
 *CHI: **she thought that was tiger # that what she told me # before she went
 upstairs .**
 *MOT: oh # is that what she told you ?
 *CHI: you know dat was de magic .

Line 385. Keyword: when

*CHI: a puppy ?
 *URS: I saw her when she was a puppy but not since then .
 *CHI: **you saw her when she was a little puppy ?**
 *URS: yes .
 *CHI: little puppies can't bite no one # right ?

Coded as: -P

Line 492. Keyword: when

*CHI: and I'm right .
 *DIA: uhhuh .
 *CHI: **when I talk to someone # he say # me and Diandros are watching #
 right ?**
 *CHI: and he's working .
 *CHI: and Diandros is +...

Coded as: +P

Line 578. Keyword: after

*CHI: hey # Mommy # we going on a train+go+round@c .
 *CHI: here we go .
 *CHI: I wan(t) (t)a play with dis after I finish .
 *MOT: well # why don't you let Paul play with it while you're doing that ?
 *CHI: I'm finished now .

Line 1216. Keyword: when

*CHI: no [?] .
 *CHI: yes # he does .
 *CHI: when Mommy takes everything off of him # he's a cry baby .
 *URS: but is that the same as naughty ? ..
 *CHI: no .
 Coded as: +P

Line 1445. Keyword: while

*URS: doesn't it spin for long time ?
 *CHI: it looks like it not going to stop # right ?
 *CHI: # while I see it spin # I'm gonna shoot de marbles .

Adam 51

 Line 145. Keyword: when

*URS: ow .
 *CHI: I know I'm not +...
 *CHI: # I don't holler when someone gives me a shot .
 *ROB: here's some medicine .
 *CHI: oh # dat's a door .
 Coded as: -P

Line 475. Keyword: when

*MOT: that wouldn't be nice to do .
 *MOT: would you like for me to leave you down here without any dinner ?
 *CHI: when Ursula goes home # don't give him no dinner # if he's +...
 *CHI: what is dis supposed to be ?
 *URS: that's another pill box .
 Coded as: +P

Line 618. Keyword: when

*MOT: she's not a cry baby ?
 *CHI: she doesn't cry # Mommy .
 *CHI: when I hit her in the tummy # she doesn't cry .
 *CHI: here's the top .
 *CHI: I do it my own self .
 Coded as: +P

Line 624. Keyword: when

*CHI: where you go ?
 *CHI: how it stays ?
 *CHI: when I jump de pills fall out .
 *CHI: Mommy # you are taller dan Ursula .
 *CHI: Ursula's short .
 Coded as: +P

Line 967. Keyword: when

*CHI: you have to wind it and wind it and wind it .
 *CHI: if you can go it fast the pictures might run .
 *CHI: Mommy # when we saw those girls # dey were running # weren't dey ?
 *MOT: where is that ?
 *CHI: on that .
 Coded as: +P

Adam 52

Line 97. Keyword: when

*MOT: David is eleven now .
 *CHI: I'm eleven too .
 *CHI: Mommy # when I get eleven # I'm gonna have one .
 *CHI: Urs(u)la # touch this .
 *CHI: it's nice # it's strong .

Coded as: +P

Line 109. Keyword: when

*CHI: playing a banjo is good exercise for your thumb .
 *CHI: I wish I have a banjo like dis .
 *CHI: Mommy # when I be a big man # could I have one of these banjos ?
 *MOT: I think so .
 *CHI: Mommy # what song you want hear ?

Coded as: +P

Line 147. Keyword: when

*URS: where is it ?
 *CHI: I don't know .
 *CHI: I always lose things when I move .
 *URS: oh # I see .
 *URS: but you went away for awhile # didn't you ?

Coded as: -P

Line 470. Keyword: before

*CHI: is that strong enough ?
 *CHI: well # where's the other one ?
 *CHI: now # put him back on before he breaks again .
 *URS: does your tiger eat oranges ?
 *CHI: uhhuh .

Line 488. Keyword: when

*URS: I'll make a handle for the basket .
 *CHI: how'd [=? how] you make a handle ?
 *CHI: it gets bigger and bigger when you do that .
 *CHI: how come ?
 *CHI: how ?

Coded as: -P

Line 778. Keyword: after

*CHI: Mommy was trying to unscrew that .
 *CHI: Mommy was trying to unscrew it .
 *CHI: and let me cover it after you finish that .
 *CHI: and tear off this one .
 *CHI: you almost to the finish line .

Line 962. Keyword: while

*CHI: where xxx .
 *MOT: Adam .
 *CHI: Mommy # I'm gonna talk to Urs(u)la for a little while # ok ?
 *MOT: ok .
 *CHI: can we play that again ?

Exclude: noun

Line 1264. Keyword: when

*MOT: peculiar .
 *CHI: strange .
 *CHI: when I say strange # I mean strange .
 *MOT: oh # you don't mean peculiar ?
 *CHI: I mean everything else strange # not peculiar .

Coded as: +P

Line 1314. Keyword: when

*CHI: hold your hands up .
 *CHI: pow .
 *CHI: watch # now when I shoot # watch .
 *CHI: I got you .
 *CHI: I shot you # now you dead [?] .

Coded as: 0

Line 1563. Keyword: when

*CHI: and the one that misses # I'm gonna go and I'm gonna give it a hug
 and it's gonna be mine # ok ?
 *CHI: hey # Mommy .
 *CHI: Mommy # when this comes # you +... ..
 *MOT: ssh # take your time .
 *CHI: when this comes # when these come # you move this truck out of the
 way .

Exclude: +P

Line 1566. Keywords: when

*CHI: Mommy # when this comes # you +...
 *MOT: ssh # take your time .
 *CHI: when this comes # when these come # you move this truck out of the
 way . (exclude first when: incomplete)
 *CHI: if it hits it # it's no good .
 *CHI: if it doesn't hit it # it's good .

Exclude: repetition

Line 1618. Keyword: when

*MOT: thirty+two .
 *CHI: forty+two .
 *CHI: when I say forty+two # I mean +...
 *CHI: Mommy # you say the same .
 *CHI: you say forty+two Williams Street and Greenwich Park # ok ?

Coded as: +P

Line 1817. Keyword: when

*CHI: no # you write this time .
 *MOT: are you going to pick the blocks up while I'm making what I want to
 make ?
 *CHI: and then give it to me when you finish and then I'm gonna make
 mines#n .
 *CHI: there # now .
 *CHI: here # Ursula .

Coded as: -P

APPENDIX I: ADAM CORPUS

ADAM'S MOTHER

Adam 1

 Line 717. Keyword: when

*CHI: jump .
 *MOT: don't jump .
 *MOT: **he can't write when you jump .**
 *CHI: my pillow .
 *CHI: my .

Coded as: -P

Line 1034. Keyword: when

*MOT: record is playing ?
 *CHI: yes # record player .
 *MOT: **what does it do when it plays ?**
 *CHI: horn .
 *MOT: do you hear a horn playing ?

Coded as: -P

Line 1155. Keyword: when

*URS: do you want to bring over the high stool for me to sit on ?
 *CHI: sit water ?
 *MOT: **that's the stool I use when I wash dishes .**
 *MOT: minestrone .
 *CHI: minestrone .

Coded as: -P

Line 1688. Keyword: when

*CHI: chew apple mouth .
 *MOT: apple mouth ?
 *MOT: **you had an apple when you got up from your nap .**
 *CHI: apple in [?] Adam mouth .
 *MOT: what's that ?

Coded as: -P

Line 1970. Keyword: while

*MOT: what's that ?
 *CHI: pull wagon .
 *MOT: **<while I catch a> ["] +...**
 *CHI: +, fish .
 *CHI: oh # funny .

Adam 2

 Line 285. Keyword: when

*CHI: Adam m@l .
 *MOT: <d@l a@l m@l> ["] .
 *MOT: **he always leaves the a@l off when he's spelling .**
 *MOT: did you write it already ?
 *CHI: yep .

Coded as: -P

Line 366. Keyword: before

*CHI: put (pa)jama my car .
 *MOT: <put pajamas on and we can ride the car> ["] .
 *MOT: **he had his bath before supper and he put his pajamas on and he this last night .**
 *CHI: where racket ?
 *CHI: Daddy racket .

Line 1616. Keyword: when

*MOT: girl ?
 *CHI: no # dat Adam .
 *MOT: **when ?**
 *CHI: who dat ?
 *CHI: who dat ?

Exclude: question

Line 2217. Keyword: when
 *CHI: ha(ha) .
 *MOT: poor Bambi .
 *MOT: **did you hurt your head when you feel ?**
 *MOT: did he hurt his head ?
 *CHI: hurt head ?
 Coded as: -P

Adam 3

 Line 255. Keyword: when
 *MOT: <that's Adam-'s baby> ["] .
 *CHI: put shoe on # Mommy .
 *MOT: **when are you going to learn to put your shoe on yourself ?**
 *CHI: self .
 *CHI: oh # don't drop it .
 Exclude: question

Line 643. Keyword: when
 *CHI: op(en) op(en) op(en) door .
 *CHI: op(en) op(en) op(en) the door .
 *MOT: **when you open the door and go outside what do you put on ?**
 *CHI: put glove .
 *MOT: <you put your gloves on> ["] ?
 Exclude: question

Line 756. Keyword: when
 *MOT: <moon picks the dirt up> ["] ?
 *CHI: moon take Adam xxx .
 *MOT: **when do you see the moon ?**
 *CHI: moon up up sky .
 *MOT: <up in the sky> ["] ?
 Exclude: question

Line 780. Keyword: when
 *MOT: no # you don't need your temperature taken .
 *MOT: you're well .
 *MOT: **Mommy just takes your temperature when you are sick .**
 @Time Duration: 11:00-12:00
 *CHI: take temper(ature) # Mommy .
 Coded as: 0

Line 800. Keyword: when
 *MOT: shoes help keep your feet warm .
 *CHI: keep feet warm ?
 *MOT: **what do you wear over your shoes when it's raining ?**
 *CHI: oh no xxx wear shoes .
 *CHI: don't bite .
 Coded as: -P

Line 1428. Keyword: when
 *CHI: yeah .
 *CHI: whistle # Mommy .
 *MOT: **it's here # but not when you want to throw it .**
 *CHI: oh no # hurt (your) head .
 *MOT: when you throw it # it hurts your head .
 Coded as: no MC

Line 1430. Keyword: when
 *MOT: it's here # but not when you want to throw it .
 *CHI: oh no # hurt (your) head .
 *MOT: **when you throw it # it hurts your head .**
 *MOT: don't throw it .
 *CHI: throw Cromer ?
 Coded as: +P

Adam 4

 No instances of *before*, *after*, *when*, or *while*.

Adam 17

Line 409. Keyword: when

*MOT: are you going to be little ?

*CHI: yes .

*MOT: when ?

*CHI: Friday .

*CHI: yeah .

Exclude: question

Line 430. Keyword: when

*MOT: here it is .

*CHI: big helper .

*MOT: **see what happens when you put it in ?**

*CHI: let [?] you [?] want drink it [= cocoa] ?

*MOT: if you want to drink it .

Coded as: -P

Line 989. Keyword: after

*MOT: I think you've had enough .

*CHI: where you put it ?

*MOT: **I'll put them up here for after lunch # ok ?**

*CHI: yeah .

*CHI: look at dat # busy bulldozer .

Line 1017. Keyword: when

*MOT: his tail # yes .

*CHI: what dat on his tail ?

*MOT: **I suppose that's something to keep his tail up when he hops .**

*MOT: do you think he can hop to Missouri ?

*CHI: yes .

Coded as: -P

Line 1472. Keyword: before

*RIC: it's not time to sleep now .

*CHI: it's time you sleep .

*MOT: **I just took a nap before I came .**

*CHI: took nap # just like Adam .

*MOT: took a nap just like Adam .

Line 1527. Keyword: when

*MOT: did you tell Urs(u)lla and Cromer about your trip on Saturday ?

*CHI: what trip ?

*MOT: **when you went down to the Boston+Common ?**

*CHI: what Boston comment ?

*MOT: and what did you see ?

Exclude: question

Line 1551. Keyword: when

*MOT: well # what were those big things you saw ?

*CHI: what big things ?

*MOT: **you know Saturday when we saw some children on the water # and you saw some dogs # and squirrels and what else ?**

*CHI: (a)nother squirrel .

*MOT: another squirrel # and what else ?

Coded as: 0

Line 1698. Keyword: when

*CHI: come # Mommy .

*MOT: well # you have to be careful not to get hit and not to get hurt .

*MOT: **you have to be careful when you play .**

*CHI: why not me careful ?

*MOT: well # you should [!!] be careful .

Coded as: -P

Line 1761. Keyword: when
 *MOT: yes # but you shouldn't hit that # should you ?
 *MOT: come on # just a little more .
 *MOT: (be)cause your rocking chair walks when you rock .
 *CHI: what you doing ?
 *URS: I'm just going to sit back .
 Coded as: -P

Adam 18

 Line 304. Keyword: before
 *CHI: apple juice .
 *CHI: need some .
 *MOT: what kind of juice did you have before ?
 *CHI: cranberry .
 *CHI: roll it up .
 Exclude: adverb

Line 497. Keyword: when
 *CHI: what happened to horse ?
 *CHI: d(o) you want brush him ?
 *MOT: what happens when you brush him ?
 *CHI: walk .
 *CHI: d(o) you want he walk ?
 Coded as: -P

Line 501. Keyword: when
 *CHI: walk .
 *CHI: d(o) you want he walk ?
 *MOT: he rocks when you brush him ?
 *CHI: walk .
 *CHI: <d(o) you want> [//] <do want> [//] d(o) you want +...
 Coded as: -P

Line 814. Keyword: before
 *CHI: dat # Urs(u)la-'s # dirty .
 *MOT: oh # the other one .
 *MOT: you gave him one before .
 *CHI: blow it .
 *CHI: you blow it .
 Exclude: adverb

Line 881. Keyword: when
 *MOT: was it weeks ?
 *CHI: week .
 *MOT: what does she look like when she puts this on ?
 *CHI: look like boy .
 *MOT: like a boy .
 Coded as: -P

Line 949. Keyword: when
 *MOT: there's a little air in there # see ?
 *CHI: blow it .
 *MOT: you cannot blow it when there's a knot # see ?
 *CHI: take out .
 *CHI: see # a knot .
 Coded as: -P

Line 1834. Keyword: when
 *URS: press the button and what ?
 *CHI: xxx .
 *MOT: what happens when you press the button ?
 *CHI: light # come on .
 *MOT: the light comes on ?
 Coded as: -P

Adam 19

Line 659. Keyword: when

*MOT: I think it's resting now .
*CHI: why it's resting now ?
*MOT: **so when the fire alarm rings it will be ready to go to the fire .**
*CHI: why dey going to fire ?
*CHI: why dey ?
Coded as: +P

Line 747. Keyword: when

*MOT: and let the birds eat it ?
*CHI: yeah .
*MOT: **remember when you fed the pigeons # you didn't have to put it in a dish .**
*CHI: I going put it outside # give it to fish .
*MOT: to the fish ?
Coded as: 0

Line 1086. Keyword: while

*CHI: circus .
*MOT: circus what ?
*MOT: **no # no dear # don't hit while she had it on .**
*CHI: d(o) you wan(t) me knock it down ?
*MOT: no # no # you take it off very gently .

Line 1375. Keyword: when

*CHI: xxx sleep on dat one ?
*CHI: dat pillow .
*MOT: **what did Bengy see the seals doing when he went to the zoo ?**
*CHI: I don't know .
*MOT: what were they doing ?
Coded as: -P

Adam 20

Line 333. Keyword: when

*CHI: you want me cross the [?] street ?
*MOT: yes .
*MOT: **what d(o) you have to do when you cross the street ?**
*CHI: look both ways .
*MOT: that's right # you look both ways .
Coded as: -P

Line 464. Keyword: when

*MOT: yes .
*CHI: no .
*MOT: **don't you think Robin has to look both ways when he crosses the street ?**
*CHI: no # I don't wan(t) (t)a look both ways .
*CHI: I don't want to look both ways .
Coded as: -P

Line 634. Keyword: when

*CHI: put dat in .
*CHI: Mommy # put it on .
*MOT: **when you take it off it doesn't go back so well # because some of the glue comes off .**
*CHI: glue ?
*CHI: Mommy # make another one .
Coded as: +P

Line 699. Keyword: when

*CHI: coat .
*CHI: how d(o) you know ?
*MOT: **and he had to wear it when it was +...**
*CHI: +, raining .
*MOT: and he had +...
Coded as: -P

Line 920. Keyword: when

*CHI: Mommy .
 *MOT: that's right .
 *MOT: **don't you look in the mirror when you shave ?**
 *CHI: dat me .
 *CHI: ooh # dat too much .
 Coded as: -P

Line 1002. Keyword: when

*MOT: well # use your paper towel and take it off your finger .
 *CHI: on a shirt [?] .
 *MOT: **what's your Daddy going to say when he finds shaving cream behind your ears ?**
 *CHI: oh dear # I look pretty .
 *CHI: I look pretty .
 Coded as: -P

Line 1645. Keyword: when

*MOT: a treasure chest .
 *CHI: what dat do treasure chest ?
 *MOT: **remember when Twinkles found a treasure chest with jewels and money in it ?**
 *CHI: and money in it ?
 *CHI: an(d) jewels .
 Coded as: 0

Adam 33

 Line 335. Keyword: when

*MOT: xxx .
 *CHI: why it keep falling off ?
 *MOT: **I guess when it hits the floor # it hits so hard that it falls off .**
 *CHI: why it hits the floor <so that> [//] # and it falls off ?
 *CHI: the tail can't +...
 Coded as: +P

Line 377. Keyword: when

*CHI: and hurts me like dis .
 *CHI: like dat .
 *MOT: **oh # yes # when it snaps .**
 *CHI: it snaps me .
 *CHI: it hurt me .
 Coded as: no MC

Line 595. Keyword: after

*CHI: dere dey are .
 *MOT: yes .
 *MOT: **you weren't such a magician after all # were you ?**
 *CHI: yes .
 *CHI: no # don't make a +...

Line 610. Keyword: while

*MOT: he has blocks too # you know .
 *MOT: here # Paul .
 *MOT: **let him have one block # while you build your building .**
 *CHI: I don't want to build my building .
 *CHI: and I want to make a small one .

Line 973. Keyword: after

*CHI: I gon turn it eight+o'thirty@c .
 *CHI: eight+thirty+one .
 *MOT: **that's five minutes after five .**
 *CHI: does that mean for breakfast ?
 *MOT: no # that's dinner time .

Adam 34

 Line 343. Keyword: when
 *CHI: let's try again .
 *CHI: I got +...
 *MOT: Adam wanted to know # the other day # where the sun went when night
 came and why the rain was wet .
 *CHI: dis yours .
 *CHI: mines#n .
 Coded as: -P

Adam 35

 Line 229. Keyword: before
 *MOT: what did you say ?
 *CHI: Italy .
 *MOT: I know you said Italy # but what did you say before you said Italy .
 *MOT: injure me or something ?
 *CHI: I used to be # in Italy .
 Coded as: -P

Line 233. Keyword: when
 *MOT: injure me or something ?
 *CHI: I used to be # in Italy .
 *MOT: oh # when you used to be in Italy .
 *MOT: oh # when did you go to Italy ?
 *CHI: I don't know .
 Coded as: no MC

Line 234. Keyword: when
 *CHI: I used to be # in Italy .
 *MOT: oh # when you used to be in Italy .
 *MOT: oh # when did you go to Italy ?
 *CHI: I don't know .
 *MOT: what did you see in Italy ?
 Exclude: question

Line 402. Keyword: when
 *CHI: cars doesn't get on tracks .
 *MOT: well # yes they do .
 *MOT: when there's a train track across a street you have to cross part of
 the train track .
 *CHI: upsidaisy .
 *CHI: get on .
 Coded as: +P

Line 745. Keyword: when
 *CHI: dig dig shovel and dig .
 *CHI: dig dig shovel and dig .
 *MOT: Adam # what did the lady say when she told you that story .
 *CHI: what story ?
 *MOT: story about George Washington .
 Coded as: -P

Line 878. Keyword: when
 *CHI: upsidaisy .
 *CHI: I got a wrong place # in Italy .
 *MOT: why d(o) you think that's the wrong place in Italy when you're not
 in Italy ?
 *CHI: I am not in Italy # Mommy .
 *CHI: upsidaisy .
 Exclude: contrastive use

Line 966. Keyword: before
 *URS: it's called a t+square .
 *CHI: what is dis ?
 *MOT: does it look like anything you've seen before ?
 *CHI: what d(o) you call dis ?
 *CHI: dis is broken .
 Exclude: adverb

Line 1075. Keyword: when

*CHI: I don't see my cutter .

*CHI: why these things cut ?

*MOT: **look at the edge and you see something like teeth and when you pull them back and forth they cut the wood .**

*CHI: dey have long ones to cut the wood .

*MOT: here's a nail # would you like to try ?

Coded as: +P

Line 1135. Keyword: while

*MOT: you do .

*MOT: you're always turning my beater .

*MOT: **I'll hold it while you turn .**

*CHI: it's wan(t) (t)a [?] move .

*MOT: it won't move .

Line 1210. Keyword: while

*CHI: how does it +...

*MOT: why don't you write with it first ?

*MOT: **I'll hold this while you draw a straight line .**

*CHI: make another line like this .

*MOT: but you have to hold your pencil against there .

Line 1315. Keyword: while

*CHI: you do it .

*MOT: no dear .

*MOT: **I can't use that while you're there .**

*MOT: turn that .

*CHI: aw it's [?] a cold hole .

Line 1318. Keyword: when

*MOT: turn that .

*CHI: aw it's [?] a cold hole .

*MOT: **how can it be an old hole when you just made it ?**

*MOT: that has to be a new hole .

*CHI: I can't [=? can] open de door .

Exclude: contrastive use

Adam 36

Line 73. Keyword: when

*CHI: I better keep dem back in .

*CHI: when [?] the hammer knock me down .

*MOT: **when the hammer knocked you down .**

*MOT: what hammer ?

*CHI: knock myself with a hammer .

Exclude: imitation

Line 207. Keyword: when

*CHI: I don't know .

*MOT: you've got one .

*MOT: **and when you throw it up in the air what happens ?**

*CHI: it stays up in the air .

*CHI: where is mine ?

Coded as: +P

Line 302. Keyword: before

*MOT: you're taking yourself to the hospital ?

*CHI: I taking myself back to the hospital .

*MOT: **I don't think you've ever seen that before .**

*CHI: it's a pine tree .

*MOT: it's cactus .

Exclude: adverb

Line 816. Keyword: when

*MOT: well # it takes practice .
 *CHI: I gonna blow it .
 *MOT: **what happens when you laugh ?**
 *CHI: it's like a whistle .
 *MOT: blow .

Coded as: -P

Line 1416. Keyword: when

*CHI: blow .
 *CHI: did all the air went in the other balloons ?
 *MOT: **I guess I put all the air in Bobo's when I blew him up yesterday'.**
 *CHI: I got big air in it .
 *MOT: you have ?

Coded as: -P

Adam 49

 Line 174. Keyword: after

*MOT: you have to come back .
 *CHI: oh no # I'm gonna punch dis out .
 *MOT: **we have to go one after another .**
 *MOT: put it in from the back .
 *CHI: I'm gonna punch de holes out .

Line 616. Keyword: when

*MOT: you're making a mess there .
 *MOT: now that's not the way you play # is it ?
 *MOT: **you have a funnel that let's you know when you have enough in the bottle .**
 *CHI: is that mines?n ?
 *CHI: whose is dis ?

Coded as: 0

Line 995. Keyword: when

*CHI: oh dey just fly # I didn't blow the whistle quick .
 *CHI: I'm gonna blow it right now .
 *MOT: **what happens when you blow the whistle ?**
 *CHI: I'm gonna start blowing .
 *CHI: you gonna have to beat me when I blow de whistle .

Coded as: -P

Line 1312. Keyword: when

*CHI: come on .
 *CHI: Mommy # look # dese animals are going walking .
 *MOT: **what are they doing walking when they're on the truck ?**
 *CHI: the truck's not moving .
 *CHI: the truck's shaking .

Coded as: -P

Adam 50

 Line 579. Keyword: while

*CHI: here we go .
 *CHI: I wan(t) (t)a play with dis after I finish .
 *MOT: **well # why don't you let Paul play with it while you're doing that ?**
 *CHI: I'm finished now .
 *MOT: well # you give me the scissors and I'll let Paul cut some .

Line 940. Keyword: after

*URS: this is the man who wrote the book .
 *CHI: I don't want dis # Mommy .
 *MOT: **after the glamour of yesterday # nothing is quite good enough .**
 *CHI: I want a paper .
 *URS: there's a punch in the bag .

Line 1037. Keyword: while

*CHI: where you going ?
 *MOT: no place .
 *MOT: I just came out here for a little while .
 *MOT: alright ?
 *CHI: yeah .
 Exclude: noun

Line 1041. Keyword: when

*MOT: alright ?
 *CHI: yeah .
 *MOT: when you want me # you call me .
 *CHI: don't forget de juice .
 *CHI: dese are play checks .
 Coded as: +P

Adam 51

Line 196. Keyword: when

*CHI: now where's dat nurse hat ?
 *MOT: see # Robin can read .
 *MOT: when you start going to school you can read too .
 *CHI: I can read my own self .
 *CHI: what is dis pilot thing for ?
 Coded as: +P

Line 1112. Keywords: when, when

*CHI: why ?
 *CHI: what might happen ?
 *MOT: because when you turn it off you cut the current off and then you
 won't get hurt when you unplug it .
 *CHI: does dis make hurt ?
 *MOT: it could .
 Coded as: +P, -P

Line 1117. Keyword: when

*MOT: it could .
 *CHI: ow ow .
 *MOT: not when it's off .
 *CHI: if you play with cords # dat's very dangerous # if you play # with
 cords .
 *MOT: that's a very nice boy # Adam .
 Coded as: no MC

Adam 52

Line 89. Keyword: when

*CHI: what d(o) you mean # one day ?
 *CHI: I want it now .
 *MOT: when you're a little older and a little bigger .
 *CHI: I'm a little bigger .
 *CHI: how ?
 Coded as: no MC

Line 1109. Keyword: when

*CHI: watch !
 *CHI: hi # David .
 *MOT: when you talk # you have to press the button .
 *CHI: hi # David .
 *CHI: hi # David # I said .
 Coded as: +P

Line 1145. Keyword: when

*CHI: I'm not gonna break it .
 *CHI: I wish I could have one .
 *MOT: well # maybe when you get a little bigger .
 *CHI: David isn't a little bigger .
 *CHI: how big is he ?
 Coded as: no MC

Line 1714. Keyword: when

*CHI: these are bombs # I just drop them .

*MOT: these are bombs ?

*MOT: **what happens when you drop a bomb ?**

*CHI: you throw a bomb .

*CHI: see a bomb ?

Coded as: -P

Line 1765. Keyword: when

*MOT: I think I'll sit down .

*CHI: I like that song .

*MOT: **how can I play when you're playing ?**

*CHI: now let me play .

*CHI: hey # this is the drum .

Coded as: -P

Line 1815. Keyword: while

*MOT: why don't you write this time ?

*CHI: no # you write this time .

*MOT: **are you going to pick the blocks up while I'm making what I want to make ?**

*CHI: and then give it to me when you finish and then I'm gonna make minesën .

*CHI: there # now .

APPENDIX I: ADAM CORPUS

URSULA

Adam 1

 No instances of *before*, *after*, *when*, or *while*.

Adam 2

 Line 1481. Keyword: *when*
 *MOT: what fell down ?
 *CHI: Adam fell down .
 *URS: **when did Adam fall down ?**
 *CHI: put hot [?] .
 *CHI: beep beep .
Exclude: question

Adam 3-18

 No instances of *before*, *after*, *when*, or *while*.

Adam 19

 Line 1178. Keyword: *when*
 *URS: Adam # did you hear a lion roar ?
 *CHI: yeah .
 *URS: **when you were at the zoo ?**
 *CHI: no .
 *URS: when ?
Exclude: question

Line 1181. Keyword: *when*
 *URS: when you were at the zoo ?
 *CHI: no .
 *URS: **when ?**
 *CHI: Thursday .
 *CHI: nineteen # fourteen .
Exclude: question

Adam 20

 Line 988. Keyword: *when*
 *CHI: dere Dumbo .
 *CHI: I used to shave # just like Daddy .
 *URS: **when did you shave just like Daddy ?**
 *CHI: Mommy # put some # in dat one .
 *MOT: oh no # that's where your razor was .
Exclude: question

Adam 33-35

 No instances of *before*, *after*, *when*, or *while*.

Adam 36

 Line 213. Keyword: *when*
 *MOT: I don't know where you put it .
 *CHI: let's talk [?] .
 *URS: **Adam # when it opens it looks like this .**
 *CHI: a parachute .
 *MOT: yes .
Coded as: +P

Adam 49

 No instances of *before*, *after*, *when*, or *while*.

Adam 50

Line 49. Keyword: when

*URS: yes .

*CHI: what is dese stamps for ?

*URS: **those are stamps you use when you want to send a letter to Italy .**

*CHI: Italy .

*URS: or England .

Coded as: 0

Line 384. Keyword: when

*URS: I haven't seen her since she was a puppy .

*CHI: a puppy ?

*URS: **I saw her when she was a puppy but not since then .**

*CHI: you saw her when she was a little puppy ?

*URS: yes .

Coded as: -P

Line 1061. Keyword: when

*CHI: yesterday was yesterday .

*CHI: tomorrow is tomorrow .

*URS: **how d(o) you know when it's tomorrow ?**

*CHI: it's tomorrow ?

*CHI: yesterday yesterday .

Coded as: -P

Line 1067. Keyword: when

*CHI: yesterday yesterday .

*CHI: (to)morrow (to)morrow .

*URS: **Adam # how d(o) you know when it's tomorrow ?**

*CHI: because I look at de clock .

*CHI: I don't look at de clock but I know what time .

Exclude: repetition

Line 1080. Keyword: when

*CHI: eleven+fifteen means lunchtime # right ?

*URS: nearly .

*URS: **how do you know when it's morning or afternoon ?**

*CHI: I know it's morning because I got a watch .

*CHI: I lost a ring .

Coded as: 0

Line 1212. Keyword: when

*URS: how can you tell ?

*CHI: because I hear him # don't you ?

*URS: **but does he only cry when he's naughty ?**

*URS: doesn't he cry other times ?

*CHI: no [?] .

Coded as: 0

Line 1308. Keyword: when

*CHI: how +...

*CHI: that's a gun shooter .

*URS: **when you want to shoot # you first pull this and then pull this .**

*CHI: how d(o) you shoot it ?

*CHI: which way you try ?

Coded as: +P

Adam 51

Line 775. Keyword: before

*URS: d(o) you want to see where they bump their heads ?

*CHI: why did they bump their heads ?

*URS: **they both are bowing before her and they bumped their heads .**

*URS: they're both pulling her .

*CHI: because they want her .

Adam 52-----
Line 1420. Keyword: when

*CHI: Ursula # you can <knock> [//] # even knock my sword apart .

*URS: do you have a building finished ?

*URS: **put it up here when it's finished .**

*CHI: it is [!!] finished .

*URS: put it back there .

Coded as: -P

APPENDIX II: Shem Corpus

SHEM

Shem 1

 Line 515. Keyword: after
 *INV: and then what do you do with it ?
 *INV: after you open it ?
 *SHE: after opuh it .
 *INV: you have to go potty ?
 *SHE: no .
 Coded as: no MC

Shem 2

 Line 247. Keyword: when
 *SHE: yeah .
 *INV: why do you think the baby's crying ?
 *SHE: when they hold uh <baby> [/] holds uh baby # <mommy> [/] when they
 go holduh an(d) crying . (exclude first when: it is retraced)
 *INV: when mommy holds the baby she's crying ?
 *SHE: yeah .
 Coded as: +P

Shem 3

 Line 669. Keyword: when
 *SHE: yeah .
 *INV: oh # that-'s nice .
 *SHE: n go when <uh> [/] when uh back seat gonna
 whoops ! (exclude first when: retraced)
 *INV: what ?
 *SHE: n when <go> [/] when <i-'m> [?] go in uh back seat goin(g) uh
 whoops !
 Coded as: 0

Line 671. Keyword: when
 *SHE: n go when <uh> [/] when uh back seat gonna whoops !
 *INV: what ?
 *SHE: n when <go> [/] when <i-'m> [?] go in uh back seat goin(g) uh
 whoops ! (exclude first when: retraced)
 *SHE: yeah .
 *INV: do you have a special seat ?
 Coded as: 0

Line 675. Keyword: when
 *SHE: yeah .
 *INV: do you have a special seat ?
 *SHE: yeah # when uh mommy sit there i can do it .
 *INV: what ?
 *SHE: when <i don't> [?] sit do(wn) there i can do the belt .
 Coded as: +P

Line 677. Keyword: when
 *SHE: yeah # when uh mommy sit there i can do it .
 *INV: what ?
 *SHE: when <i don't> [?] sit do(wn) there i can do the belt .
 *INV: you can-'nt do the what ?
 *SHE: i can do the back .
 Coded as: +P

Line 890. Keyword: when
 *SHE: yeah # like that .
 *INV: when do you use it ?
 *SHE: (th)is uh bed when i go uh sleepy .
 *INV: oh .
 *SHE: i come uh see you .
 Coded as: -P

Shem 4

Line 739. Keyword: when

*SHE: burp !
 *INV: there's a little burp .
 *SHE: <ya(wn)> [/] when uh go uh yaw(n) .
 *SHE: <go> [/] whoa !
 *MOT: yawn # can you yawn ?

Coded as: 0

Line 1096. Keyword: when

*SHE: uh spoon <uh> [/] an(d) uh boy # have his spoon uh mash ?
 *INV: yeah # the boy +...
 *SHE: n people when is dinner no room for uh chairs go an(d) no more room
 an(d) no more room an(d) no room for peoples go an(d) smash .
 *INV: right # some of these people do-'nt have any room for their chairs .
 *INV: see this little boy ?

Coded as: +P

Line 1171. Keyword: when

*SHE: yeah .
 *INV: how come ?
 *SHE: n <uh> [/] an(d) uh <baby> [/] an(d) <baby> [/] an(d) baby+sister
 when just go down an(d) go goook !
 *INV: why does little baby sisters and little baby dogs fall down ?
 *INV: (be)cause they-'re too little to stand up ?

Coded as: no MC

Shem 15

Line 513. Keyword: after

*INV: <carol hates commuting to san jose> [?] .
 *INV: xxx .
 *SHE: you can run way after the car .
 *INV: yeah # he's jogging .
 *SHE: he going after duh car # he going duh ot(h)er one .

Line 516. Keyword: after

*SHE: you can run way after the car .
 *INV: yeah # he's jogging .
 *SHE: he going after duh car # he going duh ot(h)er one .
 *INV: yeah # he's going the way that the car is # but some of the cars are
 following him .
 *SHE: dere's anutter car # you know what is ?

Shem 16

Line 1283. Keyword: when

*SHE: yeah # and she's very little .
 *MOT: mm-hm # sometime she-'ll be able to walk though and then she-'ll go
 get it .
 *SHE: some day when can walk # i will show you the sons walk an(d) get it .
 *MOT: kay .
 *SHE: like this # like that .

Coded as: 0

Shem 17

Line 120. Keyword: after

*SHE: yeah .
 *INV: yeah .
 *SHE: <pa> [/] read this one after .
 *INV: this one first ?
 *SHE: yeah .

Line 340. Keyword: after

*SHE: yeah # stars !
 *INV: stars are on the bottom .
 *SHE: yeah # dat one an(d) after dis one .
 *INV: okay .
 *SHE: okay ?

Line 588. Keywords: when, when

*SHE: you got to go li(ke) this +...
 *INV: yeah ?
 *SHE: cause go like dis when you do <dis> [/] when you do li(ke) dis .
 (exclude second when: repetition)
 *INV: yeah .
 *SHE: go li(ke) dis .
 Coded as: -P

Line 611. Keyword: after

*SHE: <an(d)> [/] an(d) <you> [/] wa(tch) <uh> [/] i wanta watch you make
 a tortilla for me an(d) you .
 *INV: okay .
 *SHE: an for ana after lunch .
 *INV: well # come in here .
 *SHE: okay # dat's duh stove # where's duh pots ?

Line 1037. Keyword: when

*SHE: i want tuh do it in here .
 *INV: okay # well first let's finish this book # okay ?
 *SHE: i wan(t) [/] i want uh put string on it # den it will [/] it will
 fly # in duh sky later when [/] when i(t)'s [/] when i(t)'s
 night+time # when i(t)'s night+time . (code as 1 when, others are repetitions)
 *INV: well # wait # we have to do it during the day .
 *SHE: i wan(t) [/] i wan(t) uh (kite) to go to sleep #a #a #a an an(d)
 den i wake up an den # #an an(d) i wanna put string on it in the
 store .

Coded as: 0

Line 1050. Keyword: when

*SHE: in duh sky .
 *INV: tomorrow # yeah # (be)cause tomorrow's sunday and he does-'nt have
 to go to work .
 *SHE: <uh> [/] <uh> [/] i want to go in duh store an(d) buy some string
 later when <i(t)'s> [/] when i(t)'s daytime . (exclude first when: repetition)
 *INV: right # okay # well # i-'ll put it back up here since it's night and
 then we'll finish our book # okay ?
 *SHE: no # <uh> [/] <uh> [/] i wan(t) it # i wan(t) i(t) night+time .

Coded as: 0

Line 1056. Keyword: when

*SHE: no # <uh> [/] <uh> [/] i wan(t) it # i wan(t) i(t) night+time .
 *INV: you want a night+time ?
 *SHE: i [/] i want it day+time #an #a an(d) get some string an(d) fly it
 in the [/] in uh sky later when [/] when it's night+time . (first when retraced)
 *INV: oh # but you can-'nt even see it if it's night+time .
 *SHE: <uh> [/] <uh> [/] <an> [/] <uh> [/] an(d) when it's day+time .
 Exclude: repetition

Line 1059. Keyword: when

*SHE: i [/] i want it day+time #an #a an(d) get some string an(d) fly it
 in the [/] in uh sky later when [/] when it's night+time .
 *INV: oh # but you can-'nt even see it if it's night+time .
 *SHE: <uh> [/] <uh> [/] <an> [/] <uh> [/] an(d) when it's day+time .
 *INV: rght # when it's day+time # c'mere .
 *SHE: when it's day+time .
 Exclude: repetition

Line 1061. Keyword: when

*SHE: <uh> [/] <uh> [/] <an> [/] <uh> [/] an(d) when it's day+time .
 *INV: rght # when it's day+time # c'mere .
 *SHE: **when it's day+time** .
 *INV: sit here # next to me .
 *SHE: i <wanna> [/] da(t)'s my shovel to pu(t) [/] to pu(t) [/] to put
 dirt in it # <in> [/] in my <new> [/] in <my> [/] <in> [/] in my
 <new> [/] <in> [/] in my new wheel+barrow .

Exclude: repetition

Shem 18

Line 70. Keyword: when

*SHE: no # we going to your house .
 *INV: oh # but see # we can-'nt go to my house because they-'re cleaning
 it everything's being cleaned so you can-'nt walk on the floors
 (be)cause they-'re all wet # and <uh> [/] it's just being cleaned #
 but maybe next week we can go to my house # okay ?
 *SHE: <vhe> [/] **when it's dirty** .
 *INV: <when> [/] yeah # when it's <the> [/] when it's okay to go there #
 see # right now +...
 *SHE: yeah .
Coded as: no MC

Line 152. Keyword: when

*SHE: i(t)'s day+time .
 *INV: yeah # it's day+time .
 *SHE: **but it's not dark <when> [/] when we sleep** . (exclude first when: retraced)
 *INV: but it's not dark what ?
 *SHE: when we <sleep> [/] when uh kid sleeps # de(n) # <i(t)> [/] it will
 be dark # when you stand up # the car will stop .
Coded as: -P

Line 154. Keyword: when

*SHE: but it's not dark <when> [/] when we sleep .
 *INV: but it's not dark what ?
 *SHE: **when we <sleep> [/] when uh kid sleeps # de(n) # <i(t)> [/] it will
 be dark # when you stand up # the car will stop** .
 (exclude second when: repetition)
 *INV: yeah .
 *SHE: yeah # an(d) i will stand up when the car stops # <uh> [/] an(d)
 when duh gween light goes turn # <i(t)> [/] <uh> [/] duh car moves .
Coded as: +P, +P

Line 157. Keyword: when

*SHE: when we <sleep> [/] when uh kid sleeps # de(n) # <i(t)> [/] it will
 be dark # when you stand up # the car will stop .
 *INV: yeah .
 *SHE: **yeah # an(d) i will stand up when the car stops # <uh> [/] an(d)
 when duh gween light goes turn # <i(t)> [/] <uh> [/] duh car moves** .
 *INV: right .
 *SHE: yeah # and so will buses and motor+cycles .
Coded as: -P, +P

Line 181. Keyword: when

*SHE: that <means> [/] dat <means> [/] <duh> [/] <tuh> [/] also trees it
 and houses # to go in .
 *INV: uhh+huhh .
 *SHE: **yeah # where duh door is # knock (th)ere # go in 6a an(d) when duh
 door is closed # duh windy goes an(d) duh <wind> [/] an(d) wind goes
 # <an(d)> [/] an(d) duh door goes skvunk # into duh wall # an i(t)
 goes skvooo # bang** .
 *SHE: hit duh door+wall [= wall where the door closes] bang # swha <is>
 [/] <wha> [/] where your paper go bang for ?
 *INV: because it was up here and then the wind blew it down .
Coded as: +P

Line 195. Keyword: when

*INV: there .
 *SHE: we <at> [/] <a> [/] <at> [/] at <your> [/] at your house # whee !
 *SHE: when it falls down # an(d) your house &gon getsuh all dirty # gonna
 get all dirty .
 *INV: uhh+huhh .
 *SHE: whee+zhee+zhee+zhee # eee+zhee # yeah an(d) i fell way out .
 Coded as: +P

Line 307. Keyword: after

*SHE: mark # mark .
 *INV: yeah # it's a marker .
 *SHE: d(o) you know what <we> [/] we do after dis mark ?
 *SHE: we draw on paper to make (th)at fing # see ?
 Line 765. Keywords: when, when
 *SHE: do it again .
 *INV: no # it hurt # ow !
 *SHE: <whe when <you> [/] when you do it again so it <von't> [/] <vuh> [/]
 so it <von't> [/] it won't go ow ! (exclude first when)
 *INV: yeah # i-'ll do it again the right way .
 *SHE: yeah # again .
 Coded as: +P

Shem 35

Line 84. Keyword: after

*SHE: yeah .
 *INV: but you take things like the chairs an(d) the tables an(d) you put
 (th)em in the truck # right ?
 *SHE: yeah # an(d) dan after our truck <will> [?] give dem back to
 Marianne .
 *INV: you [//] what do you gi [//] you give [//] you give +...
 *SHE: dis house .

Line 1474. Keyword: when

*SHE: an(d) see # dis goes aroun(d) .
 *INV: um+hm .
 *SHE: yeah # dat goes aroun(d) when it [//] when it's going . (exclude first when)
 *SHE: i g [//] i'd better do it again .
 *SHE: here is duh cookie+dough .
 Coded as: -P

Shem 36

Line 109. Keyword: when

*INV: here # let's put it up here on your little bureau here .
 *INV: okay ?
 *SHE: &da dat's my [//] dat's [//] dat's [//] &da dat's where i [//] my
 fings go when i wanna take one off # like dat's my mess .
 *INV: oh # this is your mess .
 *INV: it sure is .
 Coded as: -P

Shem 37

Line 79. Keyword: when

*INV: oh # an(d) look !
 *INV: it has those same kinds of little people that you have .
 *SHE: yes # but when dere's people dere # yuh hafta [//] yuh hafta drive
 gently [//] um [//] gently because when you [//] when you [//] like
 that [//] eh [//] the people all fall down . (exclude 2nd and 3rd when: retraced)
 *INV: yeah .
 *INV: yeah # so you gotta keep it going on a straight line # right ?
 Coded as: +P

Line 669. Keyword: when

*INV: it's right over there .
 *SHE: i hafta xxx .
 *SHE: when i go to duh wrong house # it's [//] 6a [//] an(d) i go to duh
 <rich> [?] house dat [//] dat's <real> [?] for duh [//] for duh geese
 # i haf to get <through> [?] dis .
 *SHE: voom # voom # voom !
 *SHE: i found dem .
 Coded as: +P

Line 860. Keyword: when

*SHE: yep # it runs # like [//] like that .
 *SHE: see ?
 *SHE: dat's [//] dat's [//] see # when you turn dis +...
 *INV: yeah ?
 *SHE: +, it makes dat squeak .
 Coded as: +P

Line 1110. Keywords: when, when

*SHE: <now> [?] yuh haft [//] hey [//] hey # what do you said ?
 *INV: huhh ?
 *SHE: you said when [//] when i was starting to [//] to cook .
 (exclude first when: retraced)
 *INV: oh # i said you hafta [//] put all these animals up next to the
 table .
 *SHE: oh # yeah !
 Coded as: no MC

Shem 38

Line 176. Keyword: when

*INV: take out the play+dough ?
 *INV: yeah # i bet we could do that # if we cleared away a little room .
 *SHE: yep # <duh when> [?] it's so messy # my daddy and mommy do it .
 *INV: oh # well # we can help them a little bit # right ?
 *SHE: yeah .
 Coded as: +P

Line 209. Keyword: when

*SHE: no # dey-'re not .
 *INV: yeah # it say [//] it says right here # see # it says boopits .
 *SHE: oh # an(d) when [//] when i [//] it has dis on it # it say exit too !
 *INV: axit ?
 *SHE: yeah .
 Exclude: retraced

Line 219. Keyword: when

*SHE: yeah .
 *INV: okay # now we-'ll put these guys +...
 *SHE: then we can get them when [//] when we-'re playing with the
 play+dough .
 *INV: right .
 *SHE: right .
 Coded as: -P

Line 240. Keyword: when

*SHE: two [//] two people an(d) uh lion # (o)kay ?
 *INV: okay # hey # what's that you-'re doing ?
 *SHE: dat's [//] i wanna make finger+pwints so i c [//] i can (re)member
 when [//] when [//] when we can make [//] buy some finger+pwints .
 *INV: fingerprints ?
 *SHE: we have some finger+paints [//] uhh [//] we have some pink
 finger+pwints an(d) [//] some [//] some [//] some [//] paint for
 finger+pwints .
 Coded as: 0

Line 589. Keyword: when

*INV: oh !
 *INV: what do you do when you find the street # play+dough Shem ?
 *SHE: um # when you [//] when you go out in duh street <you> [?] hafta g
 [//] go on bicycles (a)n(d) [//] or in tracks or in motorcycles or in
 cars . (exclude first when: retrace)
 *INV: what about buses ?
 *SHE: yeah # when you go to school .
 Coded as: +P

Line 593. Keyword: when

*SHE: um # when you [//] when you go out in duh street <you> [?] hafta-g
 [//] go on bicycles (a)n(d) [//] or in tracks or in motorcycles or in
 cars .
 *INV: what about buses ?
 *SHE: yeah # when you go to school .
 *INV: but you can-'nt go on your feet ?
 *INV: you can-'nt just walk out into the street ?
 Coded as: no MC

Line 673. Keyword: after

*INV: okay # can-'nt he hear you chewing those potato chips ?
 *INV: okay .
 *SHE: an(d) (th)en we haf to [//] after dat we have to smash him all up .
 *INV: why do we have to do that ?
 *SHE: &bec because i wanna make another fing .

Line 790. Keyword: when

*SHE: i [//] it vams all duh room ups [//] all the water up [//] u +...
 *INV: it vams all the water up ?
 *SHE: yeah # when [//] when it has a bi [//] be [//] be [//] big mess your
 pen # fr [//] from duh pen an(d) ink .
 *INV: from the pen an(d) ink when it gets all messy ?
 *SHE: yeah .
 Coded as: no MC

Line 839. Keyword: when

*INV: it's a cowboy+hat ?
 *INV: an(d) what's this thing ?
 *SHE: &da dat's so [//] so duh cowboy+hat wo-'nt fall off when duh horse
 is running .
 *INV: oh # and how do you do it ?
 *SHE: you hafta put dis <dere> [?] .
 Coded as: -P

Line 879. Keyword: when

*SHE: it goes up an(d) down .
 *INV: oh # it goes up an(d) down .
 *SHE: when you want it down you hafta take it off .
 *INV: oh .
 *SHE: but you do-'n(t) have one .
 Coded as: +P

Line 896. Keyword: when

*SHE: i fall on duh grass .
 *INV: does it hurt ?
 *SHE: no # duh grass # when you fall on grass sometime it hurts # <but>
 [?] when you fall on grass i(t) [//] sometime &i it has some green
 an(d) it [//] an(d) [//] an(d) <it> [?] has green [//] um [//] things
 an(d) den you fall off and # it does-'nt hurt .
 *INV: oh # when it's green ?
 *SHE: yeah .
 Coded as: +P, +P

APPENDIX III: SHEM CORPUS

MOTHER

Shem 1

 Line 456. Keyword: after
 *MOT: can you take it out there ?
 *SHE: yeah .
 *MOT: **come back and get the furniture too after .**
 *SHE: uh house # there xxx open it ?
 *SHE: open it .
Exclude: adverb

Shem 2

 Line 329. Keyword: when
 *MOT: what kind do you like ?
 *INV: think this is nice ?
 *MOT: **you used to wear that when you were a baby # that same one .**
 *SHE: (I)-'m uh lawn+mower # okay ?
 *INV: hunh ?
Coded as: -P

Line 628. Keyword: when
 *INV: bandaid # you know like you put on your hand when you have a cut ?
 *SHE: no hurting # hurt .
 *MOT: **like when you have a hurt # that's right .**
 *SHE: uh pin !
 *INV: a pin # that's for the diapers .
Coded as: no MC

Line 644. Keyword: when
 *INV: yeah # she stopped .
 *SHE: stop crying !
 *MOT: **she likes it when you hold her # i guess we-'ll be holding her a lot .**
 *INV: hi little baby # touch her real softly .
 *INV: she's so little .
Coded as: -P

Line 672. Keyword: while
 *MOT: think she wants the lion ?
 *SHE: yeah .
 *MOT: **she-'ll look at it for a while # she's looking at it .**
 *SHE: xxx xxx wants some's uh lion # there .
 *INV: she's too little to hold it pretty much # she can only just barely hold it .
Exclude: noun

Shem 3

 Line 883. Keyword: when
 *MOT: we-'re gonna get a wading+pool .
 *INV: yeah .
 *MOT: **when we get xxx xxx # everything will be +...**
 *SHE: xxx .
 *INV: what-'s this # shem # in your mouth ?
Coded as: +P

Shem 4

 Line 743. Keyword: when
 *SHE: <go> [/] whoa !
 *MOT: yawn # can you yawn ?
 *MOT: **show me how you can yawn # what do you do when you-'re tired ?**
 *MOT: it's easy to do .
 *SHE: (I)-'m go like that .
Coded as: -P

Line 774. Keyword: when

*SHE: smili(ng) ?
 *INV: she's smiling # it's (be)cause she's getting food .
 *MOT: **that's how you smile when you eat a lot of rice # you smile like that .**
 *MOT: or a lot of juice .
 *SHE: i want some juice an(d) uh rice .
 Coded as: -P

Line 1031. Keyword: before

*MOT: where did it come from ?
 *SHE: an it come from in the bathroom .
 *MOT: **in the bathroom # but where was it before that ?**
 *SHE: an it get <uh> [/] go get it (a)n uh bathroom an(d) uh read uh book # an(d) tuh read uh book .
 *MOT: oh # you read a book # okay .
 Exclude: adverb

Shem 15

 No instances of *before*, *after*, *when*, or *while*.

Shem 16

 Line 114. Keyword: when

*MOT: in the baby+carriage .
 *SHE: yeah .
 *MOT: **what does the mommy say # when they all wake up ?**
 *SHE: now !
 *MOT: what's she say when they wake up ?
 Coded as: -P

Line 116. Keyword: when

*MOT: what does the mommy say # when they all wake up ?
 *SHE: now !
 *MOT: **what's she say when they wake up ?**
 *SHE: now !
 *MOT: now # you woke up my babies # and here they go again .
 Exclude: repetition

Line 149. Keyword: after

*MOT: a bunny lady took it to the check+out counter # she said .
 *MOT: gcin(g) on here ?
 *MOT: **dudley rushed there but the bunny lady did-'nt have sam+potatoes # mother bunny was saying to grocer dog # i have decided not to buy any food today after all .**
 *MOT: grocer Dog replied # but that's what you say every day # madam .
 *MOT: dudley took a closer look +...

Line 159. Keyword: when

*MOT: which one is madam ?
 *SHE: das is madam .
 *MOT: **madam is baby bunny # that's what you call a woman when you do-'nt know her name # can you say madam ?**
 *SHE: yeah .
 *MOT: mm+hm .
 Coded as: -P

Line 216. Keyword: after

*MOT: uhh+hm .
 *SHE: no(th)er page .
 *MOT: **kay down into the lower part of town # down where all the robbers lived # black+finger wolf rolled into his robber's den # dudley rolled after him .**
 *MOT: there they go right into a trap .
 *MOT: whose trap ?

Line 342. Keyword: after

*FAT: xxx .
 *MOT: so # who's in the tunnel ?
 *MOT: **sam and dudley needed a new car to chase after the robbers .**
 *MOT: how come ?
 *MOT: because they got squashed in the tunnel with their old car .

Line 390. Keyword: before

*SHE: torn pants .
 *MOT: the thieves !
 *MOT: **before sam and dudley could do anything # horace wolf threw the ..**
tablecloth over their heads .
 *SHE: yeah .
 *MOT: what's this ?

Line 400. Keyword: while

*MOT: who's underneath ?
 *MOT: who's underneath the tablecloth ?
 *MOT: **while sam and dudley struggled to get out of the tablecloth # the**
thieves ran away # they jumped onto a trolley car that was passing
by .
 *MOT: dudley caught the trolley car just in time # sam caught dudley just
 in time .
 *SHE: <yeah> [/] <uh> [/] yeah # they fall out ?

Line 569. Keyword: when

*SHE: and <he's> [/] so he's washing him at duh <doc> [/] he's washing him
 at duh doctor .
 *MOT: at the doctor's ?
 *MOT: **well # if he got hurt when he fell into the pie # huhh ?**
 *SHE: yeah .
 *MOT: well # but # fortunately ma dog had another big pie to give them to
 take home # that one is not broken .

Coded as: -P

Line 1143. Keyword: when

*SHE: do-'nt step on there please # ana # hi ana .
 *SHE: <wan(d)> [/] <wanna> [/] i can go cross dis tape+recorder # i can go
 cross .
 *MOT: **when you cross it # will you go very carefully ?**
 *SHE: yeah # like da(t) .
 *SHE: hi ana # i <can> [/] can do dis &a little place # ha ?

Coded as: +P

Shem 17

 No instances of *before*, *after*, *when*, or *while*.

Shem 18

 Line 963. Keyword: while
 *INV: i guess she's talking to Janet .
 *SHE: Janet .
 *MOT: **for one hour while i +...**
 *INV: mm+hm .
 *MOT: interview some domestics +...

Shem 35-36

 No instances of *before*, *after*, *when*, or *while*.

Shem 37

 Line 494. Keyword: after
 *MOT: no # it doesn't .
 *INV: <yeah> [?] # it looks nice .
 *MOT: **our friend's not taking this place after all .**
 *INV: oh .
 *MOT: if you know anybody who needs a house +...

Shem 38

No instances of *before*, *after*, *when*, or *while*.

..

APPENDIX III: SHEM CORPUS

INVESTIGATOR

Shem 1

 Line 30. Keyword: when

*INV: is that the sound the dog makes ?

*SHE: yeah # ruff ruff .

*INV: **when does the dog say that ?**

*INV: we're going to have some tea # oh # what did mommy bring ? ..

*SHE: the juice # that's orange juice .

Exclude: question

Line 57. Keyword: after

*INV: uhh oh .

*SHE: uhh oh # uhh oh .

*INV: **do you have these crackers every day after your nap ?**

*INV: want my juice ?

*SHE: want some juice .

Line 514. Keyword: after

*SHE: (I)-'m <uh> [/] i wantuh (try) uh open it .

*INV: **and then what do you do with it ?**

*INV: **after you open it ?** (continuation of previous line)

*SHE: after opuh it .

*INV: you have to go potty ?

Line 643. Keyword: when

*INV: mommy can go to work ?

*SHE: yeah .

*INV: **when does she go to work ?**

*SHE: to work .

*INV: to home ?

Exclude: question

Line 1129. Keyword: while

*MOT: want some clean pants ?

*SHE: no # no # you do it .

*INV: **okay # well # while i do this you can put on your clean pants .**

*SHE: xxx xxx i want uh piece .

*INV: you want to turn it to the white side ?

Shem 2

 Line 81. Keyword: while

*INV: what's he doing ?

*SHE: n uh wooo woooo # going like that # uh wooo wooo # like that .

*INV: **let's put the tape recorder over here so we can look at it while
 we're playing # now show me how you do the puzzle .**

*SHE: here .

*INV: oh # that was good # what +...

Line 149. Keyword: before

*SHE: where kitty+cat ?

*INV: oh # there he is now .

*INV: **before he went away # do you know what this is ?**

*INV: it's a horsie # there go the kitty cats .

*INV: let's cover up the little boy .

Line 249. Keyword: when

*INV: why do you think the baby's crying ?

*SHE: when they hold uh <baby> [/] holds uh baby # <mommy> [/] when they
 go holduh an(d) crying .

*INV: **when mommy holds the baby she's crying ?**

*SHE: yeah .

*INV: well # that's okay # new babies cry .

Exclude: question

Line 343. Keyword: when

*INV: they-'re shems ?
 *SHE: yeah .
 *INV: when did they take these ?
 *SHE: s uh taking home .
 *INV: you-'re gonna take (th)em home ?

Exclude: question

Line 348. Keyword: when

*INV: you took (th)em home ?
 *SHE: oh # yeah .
 *INV: when # when did you take these ? (exclude first when: retraced) ..
 *SHE: xxx xxx xxx uh shem's going uh water .
 *INV: what ?

Exclude: question

Line 449. Keyword: when

*INV: yeah # have you ever been to a circus ?
 *SHE: um # yeah .
 *INV: when ?
 *SHE: (I)-'m turning uh turning &n turning round .
 *INV: what ?

Exclude: question

Line 456. Keyword: when

*SHE: xxx .
 *INV: what ?
 *INV: when you went to the circus # what happened ?
 *SHE: yeah .
 *INV: you saw the clowns ?

Coded as: +P

Line 608. Keyword: when

*INV: you-'re gonna go get the baby ?
 *SHE: yeah .
 *INV: no # wait # come here # i-'ve gotta tell you something # the baby
 has to stay # has to go to sleep so she wo-'nt be crabby # so she-'ll
 be all fresh when she wakes up .
 *SHE: no .
 *INV: no ?

Coded as: -P

Line 626. Keyword: when

*INV: that s a bandaid # a bandaid+paper .
 *SHE: bandaid+paper ?
 *INV: bandaid # you know like you put on your hand when you have a cut ?
 *SHE: no hurting # hurt .
 *MOT: like when you have a hurt # that's right .

Coded as: -P

Line 1225. Keyword: when

*FAT: i have to take all the groceries out of the car # it-'ll be awhile
 okay ?
 *FAT: why do-'nt you wait with cindy ?
 *INV: we-'ll wait inside # we-'ll mow the lawn # when daddy comes in #
 he's going to bring in all the groceries # so we-'ll just wait inside
 and let's mow the lawn a little bit # so it-'ll be all cleaned up #
 okay ?
 *INV: and maybe we should put together back the puzzle # wanta do that ?
 *INV: oh # that's good # he-'ll like that # shem # do you mow the lawn
 every day ?

Coded as: -P

Shem 3

Line 663. Keyword: when

*INV: here-'s another window in the back seat .
*SHE: back seat .
*INV: **do you sit in the back seat or the front seat when you go in the car**
 # shem ?
*SHE: back seat .
*INV: you sit in the back seat ?
Coded as: -P

Line 889. Keyword: when

*INV: what-'s this # shem # in your mouth ?
*SHE: yeah # like that .
*INV: **when do you use it ?**
*SHE: (th)is uh bed when i go uh sleepy .
*INV: oh .

Exclude: question

Shem 4

Line 27. Keyword: when

*INV: on the bottom # yeah # that's what makes it go .
*SHE: oh .
*INV: **so when you pull it # it can go .**
*SHE: yeah .
*INV: is this your drawer ?
Coded as: +P

Line 68. Keyword: while

*SHE: i wanna hear uh my record .
*INV: wanna hear your record ?
*INV: **okay # maybe we can put the shirt on in a little while .**
*SHE: i dump it out .
*SHE: that one ?

Exclude: noun

Line 160. Keyword: when

*INV: said to take this ?
*SHE: yeah # an(d) boat uh home # we goin(g) in <uh> [/] we go in a store
 and buy uh food the mans # thank you .
*INV: **and what did you buy when you went to the store ?**
*SHE: food .
*INV: you bought food ?
Coded as: -P

Line 230. Keyword: before

*SHE: whoop # ow .
*INV: oh # here +...
*INV: **here # vanna put on your cookie+monster+shirt before we play with**
 the plane ?
*SHE: no .
*INV: lift up your arms # there .

Line 283. Keyword: when

*INV: people and bells ?
*INV: and you can make them work ?
*INV: **what do they do when you push (th)em ?**
*SHE: an (th)ey gonna go xxx <uh> [/] <uh> [/] an(d) bells come out .
*INV: they-'re gonna go in and the bells come out ?
Coded as: -P

Line 620. Keyword: before

*INV: bug ?
*SHE: yeah .
*INV: **i do-'nt know # he was over there before .**
*SHE: there the bug .
*INV: mmm # that's a little flower # oh # there's a bug .
Exclude: adverb

Line 832. Keyword: when

*INV: here ?
 *SHE: yeah .
 *INV: see # sometimes when you get a splinter # if you take the splinter
 out you have to wait for a little while # it hurts for just a little
 while but then it goes away # okay ? (exclude both while: nouns)
 *INV: so let's eat some rice and then it won't hurt anymore .
 *SHE: kay .
 Coded as: 0

Line 964. Keyword: before

*INV: want your rice ?
 *SHE: uhh oh # uh spoon .
 *INV: a spoon in the rice # here # we'll turn this off now # shem # would
 you like some more apple+juice before i put it away ?
 *SHE: yeah .
 *INV: okay # here .

Line 1049. Keyword: when

*INV: you know what this is ?
 *SHE: uh uhn uhn uh turning uh that wine .
 *INV: yes # that's a bottle+opener # you turn it when you open the wine .
 *INV: wanna read # a hole is to dig ?
 *SHE: yeah .
 Coded as: -P

Line 1210. Keyword: when

*SHE: de little kids an(d) go jumping like that .
 *INV: jumping like that holding hands ?
 *INV: do you hold hands when you go to school ?
 *SHE: yeah .
 *INV: you hold hands with the other kids ?
 Coded as: -P

Line 1242. Keyword: when

*INV: did you ever go to a party ?
 *SHE: yep .
 *INV: when ?
 *SHE: an <uh> [/] an(d) uh home .
 Exclude: question

Shem 15

Line 70. Keyword: when

*INV: you turn it on # oh # it turned on .
 *SHE: oh .
 *INV: but nothing happens when you press the buttons # though .
 *SHE: yeah # <yook> [/] look # oh .
 *SHE: yoo(k) # what do (th)ia(t) happen ?
 Coded as: -P

Line 353. Keyword: when

*INV: to iron the clothes with .
 *SHE: oh # wha's dat ?
 *INV: oh # that's <a> [/] <um> [/] something that you use to plug it in #
 when you have to plug in the record+player .
 *SHE: use duh plug .
 *INV: oh # oh # careful .
 Coded as: -P

Line 362. Keyword: when

*INV: wo-'nt work # so we put this # we should put this one away # over
 here # see # i do-'nt think this really works .
 *SHE: oh .
 *INV: cause <when> [/] when you try to turn it on +... (exclude first when: retrace)
 *SHE: yeah .
 *INV: it's not like yours # if i turn the power on # nothing happens .
 Coded as: no MC

Line 865. Keyword: when

*INV: oh # i took those away .

*SHE: oh .

*INV: **this is a different one # those are the keys i could-'nt find # remember when i said i could-'nt find my car keys ?**

*SHE: yeah .

*INV: those are the ones xxx .

Coded as: 0

Shem 16

No instances of *before*, *after*, *when*, or *while*.

Shem 17

Line 7. Keyword: when

*INV: **when did you get your hair cut ?**

*INV: huhh ?

*SHE: from my dad .

Exclude: question

Line 41. Keyword: when

*SHE: read uh pancake+book .

*INV: okay .

*INV: **well the paint matches which is one good thing but when you get up close +...**

*SHE: ++ read uh pancake+book .

*INV: **you can see the brush+strokes .** (continuation)

Coded as: +P

Line 88. Keyword: when

*SHE: no .

*INV: mo # they just ran out .

*INV: **and when you record and they run out # it goes # er+rr+un .**

*SHE: then it goes # clunk !

*INV: right # does-'nt work any more .

Coded as: +P

Line 247. Keyword: when

*INV: the donkey ?

*SHE: yeah .

*INV: **yeah then when they get there what are they gonna do with the flour ?**

*INV: oh # little baby # do you want to lie down like this ?

*INV: she's crying .

Coded as: +P

Line 251. Keyword: when

*INV: she's crying .

*SHE: because she wants mommy and daddy .

*INV: **well # we-'ll just have to tell her that when she goes to sleep and then she wakes up # they-'ll be home again # some xxx so we can leave it for now # (ana) do-'nt worry .**

*SHE: read it .

*INV: okay .

Coded as: +P

Line 457. Keyword: while

*SHE: <this> [/] this one .

*INV: did you want sitting in a little chair ana ?

*INV: **will you be quiet while we-'re reading ?**

*SHE: he taking da(t) snake away .

*INV: ah # yeah # so you-'ve read this book ?

Line 526. Keyword: when

*SHE: yeah .

*INV: ah !

*INV: **madame beaudeaux screamed when she opened it what's in it ?**

*SHE: uh snake +...

*INV: that her son had sent her for her birthday would you give your mommy a snake for her birthday ?

Coded as: -P

Line 548. Keyword: before

*INV: but # then # as it got bigger +...

*SHE: yeah # yeah .

*INV: she bought palm trees so it would be just like where he lived before .

*INV: he would feel at home (I)-'m gonna take ana to bed again # okay ?

*SHE: huhh .

Exclude: adverb

Line 678. Keyword: while

*SHE: again # again .

*SHE: again # again .

*INV: we-'ve gotta put it away for a while .

*SHE: oh .

*INV: so we can read this book .

Exclude: adverb

Line 690. Keyword: when

*SHE: yeah .

*INV: the old lady bought palm trees so that critter would feel like he was at home .

*INV: do you know what dogs do when they-'re happy ?

*SHE: yeah .

*INV: what ?

Coded as: -P

Line 726. Keyword: when

*INV: she's seeing how long he is .

*SHE: yeah .

*INV: the boa followed his mistress when she went shopping # everyone was astonished .

*SHE: yeah # where's everyone astonish ?

*SHE: where ?

Coded as: -P

Line 745. Keyword: when

*INV: well # <we> [/] he slides into it # there's a hole down here so he goes errroomp .

*SHE: oh .

*INV: just like when you put on a sweater .

*SHE: just like dis is uh sweater .

*INV: right .

Coded as: 0

Line 1045. Keyword: when

*SHE: i wan(t) [/] i wan(t) uh (kite) to go to sleep &a &a &a &an an(d) den i wake up an den # &an an(d) i wanna put string on it in the store .

*INV: in the store ?

*INV: okay # well # maybe tomorrow when you wake up # you and daddy can go fly the kite # (be)cause +...

*SHE: in duh sky .

*INV: tomorrow # yeah # (be)cause tomorrow's sunday and he does-'nt have to go to work .

Coded as: 0

Line 1060. Keyword: when

*INV: oh # but you can-'nt even see it if it's night+time .

*SHE: <uh> [/] <uh> [/] <an> [/] <uh> [/] an(d) when it's day+time .

*INV: right # when it's day+time # c'mere .

*SHE: when it's day+time .

*INV: sit here # next to me .

Coded as: no MC

Line 1106. Keyword: when

*INV: +, so i told him to get off .
 *SHE: ah # i want to go and see .
 *INV: wait # first # gotta get pajamas on # so you-'ll have something to
 cover your feet when you go on the floor # see # it's got feetsy in
 (th)em .
 *SHE: <i> [/] i <wan> [/] i <wan> [/] want my top .
 *INV: you want your top ?
 Coded as: -P

Line 1172. Keyword: before

*INV: you don't ?
 *SHE: no .
 *INV: well # maybe we can look at one more book before you go to bed .
 *SHE: no read one more book uh my shelf .
 *INV: what ?

Shem 18

Line 41. Keyword: when

*INV: that's not very loud # now we can back up .
 *SHE: going back up .
 *INV: when we see that car move out .
 *SHE: dat's your back seat # that's your back seat .
 *INV: yeah # that's a back seat .
 Coded as: -P

Line 53. Keywords: before, when

*INV: sure is bumpy here .
 *SHE: yeah # bump # ba # ba # bump !
 *INV: ba bump # your mommy called me just before i came here and she said
 oh # i forgot to put Shem's car seat with him this morning # so when
 you bring him home # he-'ll just have to sit in the car regularly #
 with the normal seat+belt # and i said # well # that's how he always
 sits in the car # (be)cause remember last time you were in my car ?
 *INV: you just had on a seat+belt # you were-'nt in a car+seat # remember
 that ?
 *SHE: yeah .
 Coded as: +P

Line 73. Keyword: when

*INV: oh # but see # we can-'nt go to my house because they-'re cleaning
 it everything's being cleaned so you can-'nt walk on the floors
 (be)cause they-'re all wet # and <uh> [/] it's just being cleaned #
 but maybe next week we can go to my house # okay ?
 *SHE: <whe> [/] when it's dirty . (exclude first when: retrace)
 *INV: <when> [/] yeah # when it's <the> [/] when it's okay to go there #
 see # right now +...
 *SHE: yeah .
 *INV: everybody's really busy .
 Coded as: no MC

Line 127. Keywords: when, when

*SHE: yeah .
 *INV: because whenever you make a noise # if it's a loud noise # then that
 little needle picks it up # it goes back and forth .
 *INV: that can hear what you-'re saying # so when you talk it moves and
 when you do-'nt talk # it doesn't .
 *SHE: so that's why it goes back and forth ?
 *INV: yeah .
 Coded as: +P, +P

Line 148. Keyword: when

*INV: <you> [/] you see your mommy go to work ?
 *SHE: and you # <a> [/] and my dad .
 *INV: oh yeah # well # your daddy went to work today but your mommy
 did-'nt go to work # so she's gonna be at home when we get there .
 *SHE: i(t)'s day+time .
 *INV: yeah # it's day+time .
 Coded as: -P

Shem 35

 Line 722. Keyword: when

*SHE: tfff !
 *SHE: like that .
 *INV: oh # you look like you-'re swimming when you do that .
 *SHE: yeah .
 *INV: you look like blah+blame+blah+blame+blah+blame +...
 Coded as: -P

Line 985. Keyword: while

*INV: you-'re really excited .
 *SHE: <wind all up> {?} .
 *INV: shall we give it a load of wood # while it's here ?
 *SHE: yeah .
 *SHE: no no # you have &t [/] yuh hafta stay over here # because dat's
 not where d [/] where duh truck goes .

Line 1033. Keyword: when

*INV: up !
 *INV: only two an(d) a quarter .
 *INV: see # it didn't go as far when the engine was behind .
 *SHE: ah !
 *SHE: look he run .
 Coded as: -P

Line 1122. Keyword: when

*SHE: ummmmm [/] i had one wif Robin only .
 *INV: oh # you had a birthday party w [/] only with Robin ?
 *INV: an(d) when did you have it [/] that one ?
 *SHE: an(d) [/] an(d) y [/] you didn't come to the birthday .
 *INV: i know # not the one with Robin .
 Exclude: question

Line 1138. Keyword: after

*INV: n+no # i wasn't .
 *INV: i went to a party that afternoon .
 *INV: somebody invited me to something called a wine+tasting # so i went
 to a party that afternoon # right after i left your house .
 *SHE: mm .
 *INV: so when did you have your p [/] your birthday party with Robin ?

Line 1141. Keyword: when

*INV: somebody invited me to something called a wine+tasting # so i went
 to a party that afternoon # right after i left your house .
 *SHE: mm .
 *INV: so when did you have your p [/] your birthday party with Robin ?
 *SHE: um [/] he bringed some groceries .
 *INV: uhh+huhh .
 Exclude: question

Line 1211. Keyword: when

*SHE: no # it goes right in my closet # here .
 *INV: okay .
 *INV: so did you have a birthday+cake when you an(d) Robin had a
 birthday+party ?
 *SHE: i fink i will have another one +...
 *INV: okay .
 Coded as: -P

Shem 36

 Line 9. Keyword: while

*SHE: xxx .
 *INV: but you-'re not on the swing yet .
 *INV: first we have to talk for a while # okay ?
 *SHE: oh .
 *INV: so you come over here .
 Exclude: noun

Line 13. Keyword: when

*INV: so you come over here .
 *SHE: talk (a)bout us ?
 *INV: **now can you tell me about when you an(d) mommy an(d) Madia came to my house ?**
 *INV: how did you find my house ?
 *SHE: we [//] we swen [//] we w [//] well # first we [//] we wanted to go to duh bank an(d) den we said # i wanna go [//] i wanna go an(d) knock on the [//] Cindy's door # an(d) den we walked up duh stairs an(d) den poom !

Coded as: 0

Line 20. Keyword: when

*INV: how did you find my house ?
 *SHE: we [//] we swen [//] we w [//] well # first we [//] we wanted to go to duh bank an(d) den we said # i wanna go [//] i wanna go an(d) knock on the [//] Cindy's door # an(d) den we walked up duh stairs an(d) den poom !
 *INV: **what did you do when you were in my room ?**
 *SHE: i shooted uh monster # go faa !
 *INV: you [//] you shut the what ?

Coded as: -P

Line 126. Keyword: when

*SHE: so i get up like dis .
 *SHE: an(d) den get up like dis .
 *INV: **so what do you do when you climb up here ?**
 *SHE: i [//] i wait till dere's uh monster coming so i take xxx out my pocket and say # <chop #i down # chop down> [?] !
 *SHE: like (th)at .

Coded as: -P

Line 368. Keyword: when

*SHE: yeah .
 *INV: oh .
 *INV: **when you go to your new house are you gonna have moving+men help you ?**
 *SHE: brooom+brrroom # broommm+broom .
 *SHE: now dey-'re at duh new house !

Coded as: +P

Line 670. Keyword: when

*INV: you helped him move his toys ?
 *SHE: yeah .
 *INV: **when he moved to his new house ?**
 *SHE: yeah # <an(d)> [?] +...
 *INV: how did you do it ?

Exclude: question

Line 875. Keyword: when

*INV: okay # so are they there now ?
 *SHE: no .
 *INV: **ha [//] when are they gonna be there ?**
 *SHE: bout forty+eight so se [//] dey need to get in a truck # dough # to go .
 *INV: a truck ?

Exclude: question

Line 1036. Keyword: when

*SHE: Wwy you haf to do it wif his tail #a [//] an(d) +...
 *INV: because his legs are too fat to reach .
 *INV: **i-'m gonna put these in the box so that they won't be in our way when we-'re playing with play+dough # okay ?**
 *SHE: yeah .
 *SHE: an(d) dis time dey won't have any party .

Coded as: -P

Shem 37

 Line 42. Keyword: when
 *INV: oh # i turned it on .
 *INV: it's recording already .
 *INV: **but # it plays when i get done recording .**
 *JEM: <what> [?] dese buttons for ?
 *INV: oh # these are to make it louder or softer .
 Coded as: -P

Line 566. Keyword: when
 *SHE: dat's duh [///] dat's [///] dat's of duh [///] duh sky .
 *SHE: i got uh hat on so i won't hurt my head .
 *INV: **yeah # when it falls down ?**
 *SHE: yeah .
 *INV: oh .
 Exclude: question

Line 609. Keyword: when
 *INV: <it> [?] might not be a good idea .
 *INV: hey # Shem .
 *INV: **when you go to your new house # what-'re you gonna do with all that lettuce ?**
 *SHE: we [///] we-'re gonna [///] uhh [///] um [///] Blake is gonna k [///] Bake is gonna live here .
 *INV: who's Bake ?
 Coded as: +P

Line 927. Keyword: when
 *INV: for what ?
 *SHE: for me .
 *INV: **when do you wear it ?**
 *SHE: we made it # wif Nadia .
 *SHE: xxx +...
 Exclude: question

Shem 38

 Line 387. Keyword: when
 *INV: oh # lying down # you mean ?
 *SHE: yeah .
 *INV: **oh # that's just (be)cause when i was making hin # i made him lying down # now he's standing up # do we wanna give him a face ?**
 *SHE: yeah .
 *INV: okay .
 Coded as: +P

Line 588. Keyword: when
 *SHE: ah # dere is duh street !
 *INV: oh !
 *INV: **what do you do when you find the street # play+dough Shem ?**
 *SHE: um # when you [///] when you go out in duh street <you> [?] hafta g [///] go on bicycles (a)n(d) [///] or in tracks or in motorcycles or in cars .
 *INV: what about buses ?
 Coded as: -P

Line 792. Keyword: when
 *INV: it vams all the water up ?
 *SHE: yeah # when [///] when it has a bi [///] be [///] be [///] big mess your pen # fr [///] from duh pen an(d) ink .
 *INV: **from the pen an(d) ink when it gets all messy ?**
 *SHE: yeah .
 *INV: what vams the water up ?
 Exclude: ambiguous

Line 823. Keyword: while

*INV: what ?
 *SHE: once in uh while we have some an(d) we buy it .
 *INV: **once in a while you buy potato chips ?**
 *SHE: yeah .
 *INV: but you do-'nt have (th)em very often ?
Exclude: noun

Line 847. Keywords: when, when

*INV: what's that called ?
 *SHE: dat's so [//] so it wo-'nt [//] so [//] so da [//] so [//] so duh
 hat wo-'nt fall off .
 *INV: **oh # and what is it called when you do that # when you go like this ?**
 *SHE: sda dat's [//] dat's so [//] so it [//] so it [//] so [//] so [//]
 so +...
 *INV: i see # so it wo-'nt fall off .
Coded as: -P, -P

Line 870. Keyword: when

*INV: do you have +...
 *SHE: +, fall on duh grass da sda sda sda duh hor(se) [//] dat duh
 horse <are> [?] [//] dat duh horse is running on .
 *INV: **oh # i see # what [//] so do you have a name for this when you go
 like this ?**
 *SHE: yeah .
 *INV: what is that doing ?
Coded as: -P

Line 876. Keyword: when

*SHE: no # no # no # no .
 *SHE: no # no # not that .
 *INV: **what is that doing when you do this ?**
 *SHE: it goes up an(d) down .
 *INV: oh # it goes up an(d) down .
Coded as: -P

Line 900. Keyword: when

*INV: does it hurt ?
 *SHE: no # duh grass # when you fall on grass sometime it hurts # <but>
 [?] when you fall on grass i(t) [//] sometime si it has some green
 an(d) it [//] an(d) [//] an(d) <it> [?] has green [//] um [//] things
 an(d) den you fall off and # it does-'nt hurt .
 *INV: **oh # when it's green ?**
 *SHE: yeah .
 *INV: (be)cause [//] that's (be)cause it's soft # right ?
Exclude: question

APPENDIX III: SETH CORPUS

SETH

Seth 24_0-28_2

 No instances of *before*, *after*, *when*, or *while*.

Seth 29_0

 Line 378. Keyword: while

*FAT: that'(i)s right . [% bang]
 *CHI: can you find a red .
 *CHI: **can you find a red for little while ?**
 *CHI: let'us see you find a red .
 *CHI: oh good knock'them .
Exclude: noun

Line 508. Keyword: when

*CHI: we're miss-ing [/] xxx [/] we're miss-ing some block-s .
 *CHI: we're miss-ing some block-s , Bird .
 *CHI: **when we build'6 up the red .**
 *FAT: make it real [% ^reeeal] high .
 *CHI: make it real+ly [/] make it real high on the yellow .
Coded as: no MC

Seth 29_2

 No instances of *before*, *after*, *when*, or *while*.

Seth 30_0

 Line 245. Keyword: after

*FAT: h(e) told&ed the monkey the whole story .
 *FAT: the monkey +/.
 *CHI: **crocodile [?] friend-s ever after .**
 *FAT: the monkey said&ed ### <that'(i)s> [%] +/.
 *CHI: <is'ok> [%] .
Exclude: adverb

Line 311. Keyword: after

*CHI: crocodile .
 *FAT: crocodile +/.
 *CHI: **ever after .**
 *FAT: friend-s for+ever after .
Exclude: adverb

Line 489. Keyword: when

*CHI: <all 6 clothes go> [%] .
 *FAT: <where do [% da] all the old clothes go> [%] +/.
 *CHI: **<when they wear out> [%] .**
 *FAT: <when they wear out> [%] .
 *FAT: and the animal-s all said&ed +/.
Coded as: no MC

Line 624. Keyword: when

*CHI: <old clothes go> [%] -.
 *FAT: <when [>] they wear> [%] +/.
 *CHI: **+< <when wear out> [%] .**
 *FAT: but this time he said&ed , <I wonder why are all the little > [%]
 +/.
 *CHI: <clothes> [%] .
Coded as: no MC

Line 1103. Keyword: when
 *CHI: on the tree top .
 *FAT: on the tree top .
 *CHI: **when the bough break-es +/-**.
 *FAT: when the bough break-es +/-.
 *CHI: D6 cradle will fall .
Exclude: formulaic expression

Seth 35_0

 Line 87. Keyword: after
 *FAT: you ate&ed a WHOLE half gallon #6 .
 *CHI: I want'to play some+thing ?
 *CHI: **after breakfast I can play #7 .**
 *FAT: yes [% yeah] .
 *FAT: after breakfast you c(a)n play your tape +/-.

Seth 36_0

 Line 451. Keyword: when
 *CHI: I saw&ed the bear #5 .
 *CHI: xxx xxx .
 *CHI: **bear told&ed me about my [/] when I have # a house .**
 *FAT: where did&ed we go after school .
 *CHI: xxx ### .
Coded as: 0

Seth 38_1

 Line 560. Keyword: when
 *CHI: yes .
 *FAT: when you step back+wards on [/] push back+wards on the pedal , it
 [/] it'(i)s a brake #6 .
 *CHI: **and [/] and when you ## push ## forwards , it'is the accelerate+or .**
 *FAT: yes .
 *FAT: yes [% pleased that S really understood] #14 .
Coded as: +P

Seth 40_0

 Line 260. Keyword: when
 *CHI: here we go looby=lai .
 *CHI: here we go looby=day .
 *CHI: **when we xxx xxx xxx #10 .**
 *CHI: and we did&ed it [%] .
 *CHI: I put my whole # self in # [% singing] .
Exclude: insufficient context

Line 482. Keyword: when
 *CHI: it went&ed back down .
 *FAT: yes ?
 *CHI: and when the other went&ed back down , the other one went&ed back up.
 *FAT: yes .
 *FAT: what else are we gonna do tomorrow .
Coded as: +P

Line 491. Keyword: after
 *FAT: what else are we gonna do tomorrow .
 *FAT: we'(a)re gonna go t(o) th(e) beach , and after that ### .
 *CHI: **where we gonna go after the beach .**
 *FAT: yes .
 *FAT: where are we gonna go after the beach .

Line 612. Keyword: when
 *FAT: gonna be a cool night .
 *CHI: yes ## .
 *CHI: **better put a rain+coat on me when it'is rain-ing .**
 *FAT: yes .
 *CHI: do you have a (um)brella ?
Coded as: -P

Line 626. Keyword: when

*FAT: tan .
 *FAT: I have a [>] nice umbrella in my +/.
 *CHI: +< can [/] can I take picture-s of you when we wake up ?
 *FAT: we do'n(o)t have time .
 *FAT: we [>] do'n(o)t have time .

Coded as: -P

Line 684. Keyword: while

*CHI: do'you want'to catch crab-s by your+self ?
 *FAT: yes ?
 *CHI: will I [/] hold [/] while you hold them will I catch one ? ..
 *CHI: Dad , will you hold them will/while I catch one ?
 *FAT: yes ?

Coded as: +P

Line 686. Keyword: while

*FAT: yes ?
 *CHI: will I [/] hold [/] while you hold them will I catch one ?
 *CHI: Dad , will you hold them will/while I catch one ?
 *FAT: yes ?
 *FAT: you mean if you catch one would I hold it , is that what'you'(a)re ask-ing ?

Line 705. Keyword: when

*CHI: and what is the bank gonna do .
 *FAT: it just sit-es there .
 *CHI: and what do-es a bank do when it sit-es there .
 *FAT: how would I know , Bird ?
 *FAT: I do'n(o)t know what'you'(a)re talk-in(g) about !

Coded as: -P

Line 1147. Keyword: when

*FAT: +< some+time-s if you have a hard night , you can .
 *FAT: but most of the time I like you to [% ta] sleep in your own futon .
 *CHI: and in'the [/] when I wake up in the morning I can sleep in your bed.
 *FAT: some+time-s you c(a)n do that .
 *CHI: you fix me some oatmeal -.

Coded as: +P

Line 1199. Keyword: after

*CHI: and you can drink some water .
 *FAT: yes .
 *CHI: after that .
 *FAT: yes .
 *CHI: where can I get some water # out of .

Seth 41_3

 No instances of *before*, *after*, *when*, or *while*.

Seth 43_3

 Line 214. Keyword: when

*CHI: you do'not ever spank me all the time .
 *FAT: I do'n(o)t ever spank you all the time .
 *CHI: when didsed'you spank me .
 *FAT: oh ### week-s ago #5 .
 *FAT: let'(u)s look # .

Exclude: question

Line 402. Keyword: when

*CHI: were&ed they big one-s or little [>] one-s .
 *FAT: +< I think they were&ed big one-s .
 *CHI: and what [/] what did&ed they do when they can&ed-ed .
 *FAT: crunch-ed her !
 *CHI: [% sneezes] 0.

Coded as: -P

Line 638. Keyword: when

*FAT: (i)s'(th)at what it mean-es ?
 *CHI: yes .
 *CHI: when you turn light-s on that's what it mean-es .
 *CHI: but # Dad , I have'to go shishi .
 *FAT: well , let me help you get down .
 Coded as: +P

Line 702. Keyword: while

*CHI: and Dad , I want'you to do BIG kick+er-s .
 *CHI: and ## I have'to let go of you , .
 *CHI: while you're go-ing under water , . (continuation of previous utterance)
 *CHI: because can't do it , .
 *CHI: when I'am hold-ing on to you .

Line 706. Keyword: when

*CHI: while you're go-ing under water , .
 *CHI: because can't do it , .
 *CHI: when I'am hold-ing on to you .
 *CHI: because # Dad , I'do'not know how to go under water .
 *FAT: well , you'(a)re gonna find out .
 Coded as: no MC

Line 797. Keyword: when

*FAT: ok , I w(ill)'n(o)t .
 *FAT: I w(ill)'n(o)t scare you any more .
 *CHI: when we get to Montessori I'am go-ing tell my teach+er about that .
 *FAT: what are you gonna tell your teach+er .
 *CHI: that you scare-ed me . [% pouty]
 Coded as: +P

Seth 46_2

Line 60. Keyword: when

*FAT: tell me about those paint brush-s .
 *CHI: oh we paint the color-s .
 *CHI: and then # when +/.
 *FAT: come over here and tell me .
 *CHI: when +/.

Exclude: insufficient context

Line 63. Keyword: when

*CHI: and then # when +/.
 *FAT: come over here and tell me .
 *CHI: when +/.
 *FAT: come over here an(d) tell me .
 *FAT: come play close to [% ta] me .

Exclude: insufficient context

Line 66. Keyword: when

*FAT: come over here an(d) tell me .
 *FAT: come play close to [% ta] me .
 *CHI: when ## we went to bed , .
 *CHI: and woke-ed up , .
 *CHI: and had-ed breakfast , [% breath] .

Coded as: no MC

Line 191. Keyword: when

*CHI: xxx bar-s are gonna be red . [% cross bars of table]
 *FAT: yes [% yeah] .
 *CHI: and then when you're finish-ed with the other color , you put it
 right here on the floor so you can choose the next color .
 *CHI: I'am paint-ing my stool yellow .
 *CHI: now you put your paint brush right here , then you get another color.
 Coded as: +P

Line 298. Keyword: when

*CHI: yes !
 *CHI: I'am such a good paint .
 *CHI: **and # when you come home your table and stool will be ALL ready .**
 *CHI: that'is what'is gonna happen .
 *CHI: and when you come home your table is gonna be ALL ready .
Coded as: +P

Line 302. Keyword: when

*CHI: and # when you come home your table and stool will be ALL ready .
 *CHI: that'is what'is gonna happen .
 *CHI: **and when you come home your table is gonna be ALL ready .** ..
 *CHI: where'am I go-ing after bed . [% i .e ., when I wake up tomorrow]
 *FAT: what do you mean <after bed> ["] .
Exclude: repetition

Line 304. Keyword: after

*CHI: that'is what'is gonna happen .
 *CHI: and when you come home your table is gonna be ALL ready .
 *CHI: **where'am I go-ing after bed .** [% i .e ., when I wake up tomorrow]
 *FAT: what do you mean <after bed> ["] .
 *FAT: tomorrow morning [?] .

Line 340. Keyword: after

*FAT: go-in(g) to school .
 *FAT: you'(a)re not go-in(g) to Bubby-ss for a long time .
 *CHI: **take me to school after bed .**
 *CHI: (o)k Daddy ?
 *FAT: yes [% yeah] .

Line 430. Keyword: when

*CHI: want # .
 *FAT: +< oh , make'(th)em go , and then we'(wi)ll make'(th)em stop #5 .
 *CHI: **you'll tell me when to stop ?**
 *FAT: ok .
 *FAT: now stop .
Coded as: 0

Line 437. Keyword: when

*FAT: now stop .
 *CHI: now I'am gonna make the other one go .
 *CHI: **will you tell me when to stop ?**
 *FAT: no .
 *FAT: I might let you go for+ever .
Coded as: 0

Line 513. Keyword: when

*CHI: I need'to paint three color-s because we boughtsed three color-s at the store .
 *CHI: because I can use that paint .
 *CHI: **and when you come home , it'will be ALL ready for you , ok ?**
 *CHI: when you come home , your stool will be ALL ready for you ok ?
 *FAT: [% no response] 0.
Coded as: +P

Line 515. Keyword: when

*CHI: because I can use that paint .
 *CHI: and when you come home , it'will be ALL ready for you , ok ?
 *CHI: **when you come home , your stool will be ALL ready for you ok ?**
 *FAT: [% no response] 0.
 *CHI: ok Daddy ?
Exclude: repetition

Line 519. Keyword: when

*FAT: [% no response] 0.

*CHI: ok Daddy ?

*CHI: **when you come home , the stool and table will # be ALL ready for you , ok ?**

*FAT: I will like it so much . [% southern "so" intonation]

*CHI: xxx xxx .

Coded as: +P

Line 635. Keyword: when

*FAT: good .

*CHI: now I'am gonna cut your head [/] hair , .

*CHI: **and # when you go to school , .** (utterance continues onto next line)

*CHI: **everybody will say <oh your hair is red> ["] , .**

*CHI: and then you will say <oh I have a red head> ["] , .

Coded as: +P

Line 653. Keyword: when

*FAT: you'(a)re the one that'(i)s cut-ing my hair .

*CHI: but I'am not gonna be the barber .

*CHI: **when I say <I'am not gonna be the barber> , ["] say <ok then I'am not gonna be your friend> . ["]**

*CHI: I'am not gonna be the barber +/.

*CHI: when I say <I'am not gonna be the barber> ["] , say <ok I'am not gonna be your friend> . ["]

Coded as: +P

Line 862. Keyword: when

*CHI: when I say <I'am not gonna be the barber> , ["] say <ok then I'am not gonna be your friend> . ["]

*CHI: I'am not gonna be the barber +/.

*CHI: **when I say <I'am not gonna be the barber> ["] , say <ok I'am not gonna be your friend> . ["]**

*CHI: I'am not gonna be the barber +/. [% waiting for D to say his line]

*FAT: 0.

Exclude: repetition

Line 974. Keyword: when

*CHI: let'us pretend we'are a horse .

*CHI: and xxx .

*CHI: **when I run by , clap , ok ?**

*FAT: [% letting out long breath: ohhh] oh , wait a minute .

*CHI: when I run by , clap , ok ?

Coded as: +P

Line 978. Keyword: when

*CHI: when I run by , clap , ok ?

*FAT: [% letting out long breath: ohhh] oh , wait a minute .

*CHI: **when I run by , clap , ok ?**

*FAT: ok .

*FAT: yaaay !

Exclude: repetition

Line 983. Keyword: when

*FAT: ok .

*FAT: yaaay !

*CHI: **when I run in [/] into your room , clap , ok ?**

*FAT: I'(a)m gonna come in here an(d) sit and finish my supper , Bird .

*FAT: I'(a)m [/] I still have some salad to [% ta] eat here .

Coded as: +P

Seth 49_0

Line 292. Keywords: after

*CHI: I like this pumpkin !

*FAT: I'(a)m glad you like it , Bird .

*CHI: **after I eat I'll [/] after I use all these -.** (first after retraced)

*CHI: one [>] [% started counting but D interrupted] .

*FAT: +< what are we gonna do with those # quarter-s .

Line 419. Keyword: after

CHI: we uh eat them . []
 *FAT: when . [% not knowing whether that was past reference]
 *CHI: **after we take-ed them out we eat'them** . [*]
 *FAT: yes . [% yeah .]
 *CHI: when can we eat the seed-s Daddy ? [% singsong]

Line 423. Keyword: when

CHI: after we take-ed them out we eat'them . []
 *FAT: yes . [% yeah .]
 *CHI: **when can we eat the seed-s Daddy ?** [% singsong]
 *CHI: when do we eat seed-s ? [% mike noise at beg . of utterance]
 *FAT: we'(a)re not gonna eat OUR seed-s ## [% noise from mike] (be)cause I
 do'n(o)t know how to [% ta] cook'(th)em .
Exclude: question

Line 425. Keyword: when

*FAT: yes . [% yeah .]
 *CHI: when can we eat the seed-s Daddy ? [% singsong]
 *CHI: **when do we eat seed-s ?** [% mike noise at beg . of utterance]
 *FAT: we'(a)re not gonna eat OUR seed-s ## [% noise from mike] (be)cause I
 do'n(o)t know how to [% ta] cook'(th)em .
 *FAT: but when ## we cut th(e) pumpkin at'your school ## ?
Exclude: question

Line 461. Keyword: after

*CHI: they have'to roast them .
 *FAT: yes . [% yeah .]
 *CHI: **then you couldsed eat'them after we roast them ?**
 *CHI: (be)cause if you do'not roast them you will'not be able to eat'them
 *FAT: yes , I know , you can'(no)t eat'(th)em raw #17 .

Line 801. Keyword: when

*CHI: this noise is gonna be real+ly funny , ok [>] ?
 *FAT: +< ok .
 *CHI: **laugh when it [/] the noise start-es** . [% drops quarter again]
 *FAT: oh ho ho .
 *CHI: didsed'you hear it ?
Coded as: -P

Line 883. Keyword: before

*CHI: she [/] she [/] she pound it .
 *CHI: she have-es'to pound it .
 *CHI: **just before ## she ## carve-es it** .
 *FAT: carve-es the mochi ? [% incredulous]
 *CHI: yes !

APPENDIX III: SETH CORPUS

SETH'S FATHER

Seth 24_0

Line 696. Keyword: after

*FAT: an(d) the monkey said~~ed~~ some+body ## stole~~ed~~ my heart .
 *FAT: an(d) the crocodile and the monkey were~~ed~~ friend-s for+ever after .
 *CHI: N tell story .
 Exclude: adverb

Line 1169. Keyword: before

*FAT: oh yes . [% yeah]
 *FAT: I under+stand .
 *FAT: d(o)'you got'to [/] oh , you'(a)re not gonna be eat-in(g) breakfast
 b(e)fore you go ?
 *DAN: xxx xxx xxx xxx xxx .
 *CHI: +< N xxx xxx go ?

Line 1210. Keyword: after

*CHI: [% SP] 0.
 *CHI: [% SP] 0.
 *FAT: you want'to go ahead an(d) eat an(d) I'(vi)ll come back here after
 school an(d) then you can get down there at # .
 *FAT: or do you want'to real+ly get down there early .
 *DAN: which would be easy+er for you .

Seth 24_2

Line 13. Keyword: while

*FAT: +< you know what ?
 *FAT: it'(i)s November ## third today .
 *FAT: we'(a)re gonna start tape-ing [/] we'(a)re gonna tape for just a
 little while tonight an(d) then we'(vi)ll tape some more tomorrow
 [% tomorra] ## what were~~ed~~ you talk-in(g) about doughnut-s ?
 *CHI: doughnut-s .
 *CHI: pick'you'up .
 Exclude: noun

Line 174. Keyword: before

*FAT: oh no !
 *FAT: chingao , Weener .
 *FAT: let Daddy pick up these crumb-s ## before the roach-s find'(th)em .
 *CHI: thank'you .
 *FAT: you'(a)re welcome .

Line 1435. Keyword: before

*FAT: an(d) egg an(d) cheese an(d) pea-s omelet .
 *FAT: how good !
 *FAT: take one bite before you drink that .
 *FAT: good #115 !
 *FAT: put that cup down and take a bite !

Line 1461. Keyword: before

*FAT: but I want'you to eat some omelet too .
 *FAT: eat some egg-s .
 *FAT: have a bite of egg-s before you drink the milk , have a bite of
 egg-s .
 *CHI: nice .
 *FAT: nice . [% imitating S]

Seth 25_0

 Line 329. Keyword: while
 *CHI: Grand+daddy [?] .
 *CHI: [% whines; moves away from microphone] 0.
 *FAT: **Daddy try-in(g) to get'you to say 6n6fin sin 6ner , like you didded a while ago .**
 *CHI: in there .
 *CHI: want'to hold'on the bowl .
Exclude: noun

Line 716. Keyword: when
 *CHI: +< sit on face !
 *FAT: I do'n(o)t want # no , I do'n(o)t want'you to do that .
 *FAT: **it hurt-es Daddy when you do that .**
 *FAT: do'n(o)t do that .
 *CHI: N sit face ?
Coded as: -P

Seth 25_2

 No instances of *before*, *after*, *when*, or *while*.

Seth 28_2

 Line 1495. Keyword: while
 *CHI: should make [/] should make two HB_hey-s ?
 *FAT: ok , I'(wi)ll make another one , right over here .
 *FAT: **make hay while the sun shine-es #7 !**
 *CHI: make a # .
 *CHI: should stand up .

Seth 29_0

 Line 54. Keyword: before
 *FAT: ok , Bird .
 *CHI: ok , Bird . [% said in background]
 *FAT: +< **Daddy should' (h)a(v)e record-ed you before we gotted home so we would'n(o)t have'to [% hafta] do this DAMN letter thing EVERY time .**
 *CHI: let'us do [/] let'us do Roman letter-s .
 *FAT: do'n(o)t [/] those are'n(ot) [/] oh , that'(i)s right .

Line 439. Keyword: when
 *FAT: ok [% mkay] , Bird .
 *CHI: I # want'to # build # tower .
 *FAT: **that'(i)s funny , when Daddy bang-es some+thin(g) it seem-es to [% ta] shut this mike down for a second . [% to himself]**
 *CHI: let [/] let'us -.
 *FAT: there'(i)s the record level . [% to self]
Coded as: +P

Line 868. Keyword: when
 *CHI: I do'not -.
 3eg: monolog
 *FAT: **godDAM , Bird , I can'n(o)t get'you to talk when that tape'(i)s on .**
 *FAT: you talk-ed so well in the car ### .
 *CHI: you talk-ed so well in the car -.
Coded as: -P

Seth 29_2

 Line 497. Keyword: when
 *FAT: put'your [% putcher] hand close .
 *FAT: we'(wi)ll make a SMALL shadow #4 .
 *FAT: **then when we get back , we could make a BIG shadow .**
 *CHI: it'is so dark !
 *FAT: it'(i)s SO DARK .
Coded as: +P

Line 679. Keyword: when

*FAT: I'(a)m gonna put it up here on the shelf , Bird .
 *FAT: right here [% knocks] see there ?
 *FAT: I'(a)m gonna put it by the little Hebrew book so that % you can find
 it when you want it .
 *FAT: come on .
 *FAT: you want'to [% wanna] sit in your high+chair ?
 Coded as: -P

Line 725. Keywords: after, while, after

*FAT: ok ?
 *CHI: I want plenty , Dad ?
 *FAT: well , Bird , after I get finish-ed wait-ing on you , you know , I
 can start make-in(g) oatmeal , an(d) that oatmeal'(i)s not gonna be
 ready % for a while after I start .
 *CHI: [% fusses] 0.
 *CHI: Daddy'is go-ing get plenty for you .
 Exclude while: noun

Line 1275. Keyword: after

*CHI: xxx .
 *FAT: +< you better enjoy her .
 *FAT: she'(wi)ll be gone+en after that but'you [% butchu] [/] we'(wi)ll
 see her all the time any+way .
 *FAT: now , let'(u)s % put the stop+er in place ?
 *FAT: and let'(u)s run the -.

Seth 30_0

Line 314. Keyword: after

*FAT: crocodile +/.
 *CHI: ever after .
 *FAT: friend-s for+ever after .
 @eg: story
 *CHI: xxx hyena ?
 Exclude: adverb

Line 492. Keyword: when

*FAT: <where do [% da] all the old clothes go> [%] +/.
 *CHI: <when they wear out> [%] .
 *FAT: <when they wear out> [%] .
 *FAT: and the animal-s all said+ed +/.
 *CHI: <KI_e KI_tii KI_thero> [%] .
 Coded as: no MC

Line 621. Keyword: when

*FAT: <why are all the ### big> [%] +/.
 *CHI: <old clothes go> [%] -.
 *FAT: <when [>] they wear> [%] +/.
 *CHI: +< <when wear out> [%] .
 *FAT: but this time he said+ed , <I wonder why are all the little > [%]
 +/.
 Coded as: No MC

Line 756. Keyword: when

*FAT: iydling@p . [% imitates S]
 *CHI: iydling@p .
 *FAT: close your mouth when y(ou) say <iydling@p> [%] .
 *CHI: +< xxx .
 *FAT: say <iydling@p , iydling@p > [%] .
 Coded as: -P

Line 1079. Keyword: when

*CHI: on the tree top .
 *FAT: +< in the tree top .
 *FAT: when +/.
 *CHI: bough break-es .
 *FAT: bough break-es +/.
 Exclude: insufficient context

Line 1106. Keyword: when

*FAT: on the tree top .
 *CHI: when the bough break-es +/.
 *FAT: **when the bough break-es +/.**
 *CHI: D6 cradle will fall .
 *FAT: the cradle will fall .

Exclude: formulaic expression

Line 1228. Keyword: when

*FAT: +< you do'n(o)t know that part .
 *FAT: **you always change the subject , do'n(o)t'you [t dontcha] .**
 *FAT: **when you do'n(o)t know some+thin(g) .** (continuation of previous utterance)
 *FAT: that'(i)s maybe a good idea .
 *CHI: Michael/muscle [?] .

Coded as: -P

Line 1248. Keyword: after

*CHI: hold hand-s and do the prayer ?
 *FAT: hold hand-s (a)n(d) do the prayer ?
 *FAT: **then after the meet+ing ?**
 *CHI: yes .
 *FAT: wha(t) '(d)id&ed we do .

Seth 35_0

Line 91. Keyword: after

*CHI: after breakfast I can play #7 .
 *FAT: yes [t yeah] .
 *FAT: **after breakfast you c(a)n play your tape +/.**
 *CHI: yes ### -.
 *FAT: or you c(a)n play th(e) guitar ?

Line 173. Keyword: when

*FAT: wha(t) do-es Miss Kawai say .
 *CHI: he say-es <put'your train away> . ["]
 *FAT: **when you see Miss Kawai today , ask her to [t ta] tell you some Chinese .**
 *FAT: Miss_Kawai know-es Chinese .
 *CHI: xxx Miss Kawai know-es .

Coded as: +P

Line 342. Keyword: after

*CHI: I'want'to go to Vern-ss tomorrow ?
 *FAT: we'(a)re gonna go to Vern-ss this After+noon .
 *FAT: **after school .**
 *FAT: after school today we'(a)re gonna go to Vern-ss #4 .
 *FAT: you like Vern-ss .

Line 343. Keyword: after

*FAT: we'(a)re gonna go to Vern-ss this After+noon .
 *FAT: after school .
 *FAT: **after school today we'(a)re gonna go to Vern-ss #4 .**
 *FAT: you like Vern-ss .
 *CHI: yes -.

Line 365. Keyword: when

*FAT: you gonna make <tallmen@c> ["] ?
 *CHI: yes -.
 *FAT: **I do'n(o)t under+stand what'you mean when you say that .**
 *FAT: tell me more .
 *CHI: to [?] all see the sight-s .

Coded as: -P

Line 414. Keyword: after

*CHI: mimi #5 -.
 *CHI: I'want'to use that napkin .
 *FAT: **there'(i)s not gonna be much left&ed of that napkin [t /n@kim/] after # I get through .**
 *CHI: is Daddy'is through ?
 *FAT: in fact it'(i)s # pretty bad already .

Line 579. Keyword: after

*FAT: I know .

*FAT: I know , you want'to sit (a)n(d) listen to that tape like a little zombie .

*FAT: hour after hour , (un)til you learn it all .

*CHI: I want'to learn all . [% cries]

*FAT: I know you do .

Exclude: formulaic expression

Line 1120. Keyword: when

*CHI: I do'not want'to talk to Daddy .

*FAT: well , see if you need to [% ta] make shishi you go right out the leg like that .

*FAT: just get'your mini out the [/] out the leg (a)n(d) you c(a)n go , but not right on the rug now but that'(i)s what # late+er on when you need to .

*FAT: that'(i)s the way you do it .

*CHI: I do'not need to .

Coded as: 0

Line 1129. Keywords: when

*CHI: I do'not need to .

*FAT: you do'n(o)t HAVE'to , Bird .

*FAT: goddam'it , just # when you [/] you know # late+er at school when you have'to [% hafta] go , then you do it .

*FAT: that'(i)s all .

*FAT: you do'n(o)t have to right now .

Coded as: +P

Seth 36_0

Line 45. Keyword: while

*FAT: yes [% yeah] .

*CHI: is it ni(ght)-night time ?

*FAT: no ## we'(a)re gonna stay up a while .

*CHI: I can do -. [% sound of S playing in bath water]

*CHI: I can stay up .

Exclude: noun

Line 114. Keyword: after

*FAT: yes [% yeah] ?

*CHI: then you put the butter in there ### ?

*FAT: an(d) after that +/.

*CHI: yes ?

*FAT: 0 [% silence] #6 .

Line 455. Keyword: after

*CHI: xxx xxx .

*CHI: bear toldied me about my [/] when I have # a house .

*FAT: where didied we go after school .

*CHI: xxx ### .

*FAT: hey !

Line 460. Keyword: after

*CHI: xxx ### .

*FAT: hey !

*FAT: where didied we go after school .

*CHI: we go to Doctor Wong .

*FAT: no . [>]

Line 604. Keyword: when

*FAT: yes , yes , [>] yes .

*CHI: +< [% laugh] 0.

*FAT: I know you do'n(o)t like it very much , but [>] it real+ly do-es [/] real+ly make-es your hair nice when we do it .

*CHI: +< I do'not like the hair dry+er .

*FAT: and [>] then you do'n(o)t have'to go to bed with your hair wet .

Coded as: -P

Line 624. Keyword: while

*FAT: you tired o(f) dry-in(g) your hair ?

*CHI: yes .

*FAT: oh , here let me # you got felt mark+er on your [% yer] chin , and
Daddy wash-ed it a while but it didsd'n(o)t get it quite off .

*FAT: it'(i)s STILL not # .

*CHI: [% fussing] 0.

Exclude: noun

Line 1349. Keyword: when

*FAT: FR_doigt .

*CHI: FR_doigt .

*FAT: Daddy was&ed touch-in(g) your finger when you said&ed it #6 .

*FAT: <FR_ton FR_doigt> [%] FR_veut FR_dire <your finger> [%] . [% your]

*CHI: FR_doigt [%] FR_veut [%] # FR_dire ?

Coded as: -P

Line 1465. Keyword: while

*CHI: yes -. [% coughs]

*CHI: is kitchen [%] light [%] [/] is 6 kitchen light is blink-ing ?

*FAT: it was&ed a while ago .

*FAT: a little while ago it blink-ed .

*CHI: the lamp [%] # was&ed blink-ing ?

Exclude: noun

Line 1466. Keyword: while

*CHI: is kitchen [%] light [%] [/] is 6 kitchen light is blink-ing ?

*FAT: it was&ed a while ago .

*FAT: a little while ago it blink-ed .

*CHI: the lamp [%] # was&ed blink-ing ?

*CHI: Mary had&ed a little lamb , little lamb -. [% singing]

Exclude: noun

Seth38_1

Line 141. Keyword: while

*FAT: yes .

*FAT: SE_bong , SE_bong .

*FAT: you know who Daddy talk-ed to on the phone a while ago ?

*CHI: yes ?

*FAT: Julie .

Exclude: noun

Line 337. Keyword: when

*CHI: yes .

*CHI: how come I make shishi on the bed ?

*FAT: when Daddy got&ed drunk and did&ed that , people talk-ed about him
for YEAR-S .

*CHI: how come swirrel@c-s live in the water .

*FAT: what live-es in the water ?

Exclude: +P

Line 547. Keyword: when

*FAT: oh , good .

*FAT: what wi(11) that [/] what is that gonna do ?

*FAT: what happen-es when you put'your [% cher] foot on the brake ?

*CHI: it stop-es .

*FAT: that'(i)s right .

Coded as: -P

Line 557. Keyword: when

*FAT: do you know that'your bicycle have-es a brake ?

*CHI: yes .

*FAT: when you stop back+wards on [/] push back+wards on the pedal , it
[/] it'(i)s a brake #6 .

*CHI: and [/] and when you ## push ## forwards , it'is the accelerate+or .

*FAT: yes .

Coded as: +P

Line 1017. Keyword: when

*CHI: yes .
 *CHI: and the Easter Bunny is gonna come to town .
 *FAT: when is he come-ing ?
 *CHI: he's come-ing on Friday .
 *FAT: no [% noo] , I do'n(o)t think so .

Exclude: question

Line 1250. Keyword: when

*FAT: take them peach-s out of my mouth .
 *CHI: why like [/] I whine-ed # like [/] I spitteed the peach-s out .
 *FAT: oh , you wereed **HAPPY** when you gotteed to [% ta] spit the peach-s out .
 *CHI: do'you want'to eat some peach-s ?
 *FAT: no [% nah] .

Coded as: -P

Seth 40_0

Line 301. Keyword: when

*FAT: my sweet little Bird .
 *CHI: what happen-ed to my night light .
 *FAT: oh, Daddy un+plug-ed it when Daddy wasteed hook-in(g) up the [/] tran(sformer) [/] the receive+er for the [/] cord+less mike .
 *CHI: oh no .
 *FAT: now we'(wi)ll plug it back in .

Coded as: -P

Line 441. Keyword: when

*FAT: yes , we use-ed to do that #5 .
 *CHI: can you tell me where we wenteed ?
 *FAT: ~~mmm~~ ### when .
 *CHI: the mall ?
 *FAT: the mall ?

Exclude: insufficient context

Line 489. Keyword: after

*FAT: yes .
 *FAT: what else are we gonna do tomorrow .
 *FAT: we'(a)re gonna go t(o) th(e) beach , and after that ### .
 *CHI: where we gonna go after the beach .
 *FAT: yes .

Line 495. Keyword: after

*CHI: where we gonna go after the beach .
 *FAT: yes .
 *FAT: where are we gonna go after the beach .
 *CHI: to Pioneer Chicken .
 *FAT: what are we gonna buy there .

Line 577. Keyword: when

*CHI: what else can you do .
 *FAT: EVERY+thing #4 .
 *FAT: when I wasteed listen-in(g) to [% ta] th(e) tape record+er , I hearded you sing-in(g) a song in here .
 *FAT: I hearded you sing-in(g) lots'o(f) song-s .
 *CHI: yes .

Coded as: +P

Line 600. Keyword: before

*FAT: sanged London Bridge ?
 *CHI: yes ?
 *FAT: you sanged [>] ahh [/] another song that I didsed'n(o)t [/] have'n(o)t hearded before .
 *CHI: +< [% S chuckles] 0.
 *FAT: I forgotted all [/] I forgotted it now .

Exclude: adverb

Line 632. Keyword: when

*FAT: we [>] do'n(o)t have time .

*CHI: +< xxx # .

*FAT: we'(a)re gonna [/] we'(a)re gonna # when we wake up tomorrow
we'(a)re gonna be hurry-ing , (be)cause we want'to [% vanta] # get
all our stuff ready , and we want'to [% vanta] go to [% ta] th(e)
beach , and it'(i)s a holiday .

*FAT: we have'to [% hafta] get there # if we do'n(o)t get there by nine
oclock we may not get a park+in(g) place .

*CHI: I want'to sit on the towel and watch you swim .

Coded as: +P

Line 751. Keyword: while

*FAT: I do'n(o)t remember .

*FAT: they had'ded three name-s .

*FAT: there were'ded three guy-s , an(d) they had'ded three name-s , an(d) I
remember-ed'(th)em for just a little while , an(d) then I
forgot'ted'(th)em , Bird .

*CHI: what instrument-s did'ded they play .

*FAT: they had'ded ### two +/.

Exclude: noun

Line 871. Keyword: when

*FAT: no , he do-es'n(o)t pluck the string-s on the fiddle .

*FAT: he # he # play-es'(th)em with a bow .

*FAT: you'(wi)ll see when we get ours back .

*FAT: ours is # gonna be ready pretty soon , an(d) we'(wi)ll get it back
(a)n(d) you'(wi)ll see how it play-es .

*CHI: can you give'me a small one ?

Coded as: -P

Line 883. Keyword: after

*FAT: we'(a)re gonna have to get'you a small fiddle .

*FAT: we'(a)re gonna have to get'you a toy one first , so you c(a)n
practice hold-in(g) it under your neck .

*FAT: then we'(wi)ll ge(t) # then after that we'(wi)ll get'you a # a small
one .

*FAT: first we'(wi)ll have a toy one .

*CHI: do'you want'to get'your+self a one ?

Line 1039. Keyword: after

*CHI: the log ?

*FAT: the log ?

*FAT: and then after that what did'ded you do .

*CHI: I light it .

*FAT: yes ?

Line 1115. Keyword: when

*CHI: are you a wiggle+worm too ?

*FAT: no .

*FAT: Daddy go-es to sleep , an(d) Daddy lie-es down in one place , an(d)
when he wake-es up he'(i)s in the same place .

*FAT: unless Jenny stay-es over , an(d) then we lose all the cover-s .

*CHI: if you wake up and get in my bed at night what will I say .

Coded as: +P

Seth 41_3

Line 95. Keyword: when

*FAT: [% softly] I'(wi)ll play it easy .

*DJ: [% laughs] 0.

*FAT: see , when you put'your # fing(er) [/] you put'your OTHER finger
over here you c(a)n change the +/.

*DJ: funny . [% laughs]

*CHI: that make-es me cry [% some tunes do make him cry] #7 ?

Coded as: +P

Line 309. Keyword: when

*SNS: LT_H ?
 *CHI: but that's the one you push ?
 *FAT: and when you think you got it , you push that one ? [% ENTER]
 *FAT: and it say-es ### uh oh ## Seth , you BLEWied it for us .
 *SNS: spell WD_EXTRA .
 Coded as: +P

Line 323. Keyword: when

*SNS: LT_G ? [>]
 *SNS: LT_E ?
 *FAT: and then when you [<] think you got it , you push this one down in the corner .
 *SNS: WRONG .
 *FAT: an(d) it say-es [>] WRONG !
 Coded as: +P

Line 366. Keyword: when

*SNS: +< spell WD_OVEN .
 *CHI: what do'you want us to # oh xxx -.
 *FAT: I record , I record all the time when Seth talk-es , lots of the time .
 *CHI: where'is the CHANGE button .
 *CHI: where'is the CHANGE # button .
 Coded as: 0

Line 441. Keyword: when

*FAT: we # we wa(nt) # [>] .
 *SNS: +< LT_T ?
 *FAT: I push this one till it go-es to the orange , and then when I get it on orange [>1] I # [>2] make it do like that . [>3]
 *SNS: +< LT_R ?
 *SNS: +< beeeeee LT_Q ?
 Coded as: +P

Line 483. Keyword: when

*FAT: now how do you [% ya] # show me how you start again , now ?
 *SNS: LT_O ?
 *FAT: show me how you start it [//] when you want'to [% wanta] start over again , go down in this corner .
 *SNS: beeeeeebeep .
 *FAT: now , you c(a)n [>] make another one .
 Coded as: -P

Line 705. Keyword: when

*DJ: what is this for .
 *FAT: mmm , le(t)'me look at it and see .
 *FAT: oh , that'(i)s when you want'to [% vanna] change the game , and I do'n(o)t know how to play the other game-s .
 *FAT: you can get it where it'(wi)ll do some other thing-s , too , but I do'n(o)t know what they are .
 *CHI: now , my bunny need-es to get in now .
 Coded as: 0

Line 915. Keyword: while

*DJ: what'you do-ing , Bob .
 *FAT: I just hold it to record .
 *FAT: I'(wi)ll show you in a little while # [>] how we do it .
 *DJ: +< ok .
 *CHI: [% fusses] 0.
 Exclude: noun

Line 921. Keyword: when

*FAT: is that the [>] way you feed bird-s every time ?
 *DJ: +< do you xxx . [% laugh]
 *FAT: do you [% ya] cry every time when we feed bird-s ?
 *CHI: yes ?
 *FAT: oh , an(d) you'(a)re lie-in(g) out , hold-in(g) your hand out , to feed the bird-s .
 Coded as: -P

Seth 43_3

Line 285. Keyword: while

*CHI: Nikki ?

*CHI: Nikki ?

*FAT: **did&ed she hold'you while you took&ed your swim+in(g) lesson ?**

*CHI: yes -.

*CHI: she did&ed . [! picking up candy wrapper]

Line 397. Keyword: when

*CHI: yes .

*FAT: yes [! yeah] #6 .

*FAT: **that'(i)s what Mommy did&ed when you were&ed in Mommy-ss tummy .**

*FAT: she ate&ed good food , and she went&ed swim+in(g) in the wave-s .

*CHI: were&ed they big one-s or little [>] one-s .

Coded as: -P

Seth 46_2

Line 306. Keyword: after

*CHI: and when you come home your table is gonna be ALL ready .

*CHI: where'am I go-ing after bed . [! i .e ., when I wake up tomorrow]

*FAT: **what do you mean <after bed> [?] .**

*FAT: tomorrow morning [?] .

*CHI: yes -.

Line 995. Keyword: while

*FAT: NOT sour cream !

*CHI: are you gonna leave your violin out ?

*FAT: **yes , I'(a)m gonna play it in a little while .**

*CHI: ok .

*CHI: I want to xxx your-ss too .

Exclude: noun

Seth 49_0

Line 20. Keyword: when

*CHI: peanut butter jelly #15 .

*FAT: well , Doctor Bruder is a dentist .

*FAT: **that'(i)s th(e) kind of # person who # fix-es your teeth when some+thin(g)'(i)s wrong with'(th)em ## .**

*FAT: or he fix-es'(th)em when there'(i)s no+thin(g) wrong with'(th)em .

*FAT: and #5 he send-es out little news letter-s # to tell us how to take care of our teeth .

Coded as: -P

Line 24. Keyword: when

*FAT: well , Doctor Bruder is a dentist .

*FAT: **that'(i)s th(e) kind of # person who # fix-es your teeth when some+thin(g)'(i)s wrong with'(th)em ## .**

*FAT: **or he fix-es'(th)em when there'(i)s no+thin(g) wrong with'(th)em .**

*FAT: and #5 he send-es out little news letter-s # to tell us how to take care of our teeth .

*CHI: is this the rooster cup ?

Coded as: -P

Line 210. Keyword: when

*CHI: did&ed'you see that ? [! to the bear]

*CHI: you forgot&ed the leg-s too . [! to D]

*FAT: **Bird , you know , when you make a jackolantern you [! ya] only make a head .**

*FAT: you do'n(o)t make leg-s (a)n(d) arm-s (a)n(d) thing-s (be)cause you do'n(ot) have enough room to cut all those thing-s on it .

*FAT: so we only # make the thing-s that are on the head like nose , (a)n(d) eye-s , [>] (a)n(d) ear-s ### .

Coded as: +P

Line 255. Keyword: when

*CHI: then the lamp is on ### . [% away from mike]
 *CHI: [% inaudible in distance; starts sound play, changes to singing] 0.
 *FAT: well , I do'n(ot) know when he'(i)s come-in(g) back .
 *CHI: ### this shirt have-es stripe-s ?
 *FAT: what Bird ?
 Coded as: 0

Line 284. Keyword: when

*FAT: no , you wore~~ed~~'(th)em all day today .
 *FAT: we do'n(o)t wear clothes two day-s like that .
 *FAT: only when we just wear'(th)em at night to [% ta] go out for a little
 bit , then we wear'(th)em again th(e) next day .
 *CHI: oh , th(e) pumpkin is GREAT ! [% still away from mike]
 *CHI: I like this pumpkin !
 Coded as: +P

Line 369. Keyword: when

*CHI: and we , oh !
 *CHI: how +/ .
 *FAT: an(d) what happen-ed when he took~~ed~~ your picture-s up+stair-s .
 *CHI: um mummm~~u~~p . [% degenerates into sound play: /m6mm6m/]
 *CHI: he gave~~ed~~ me some+thing .
 Coded as: -P

Line 418. Keyword: when

*CHI: uh we # eat'them . [%]
 *CHI: we uh eat them . [%]
 *FAT: when . [% not knowing whether that was past reference]
 *CHI: after we take-ed them out we eat'them . [%]
 *FAT: yes . [% yeah .]
 Exclude: insufficient context

Line 431. Keyword: when

*CHI: when do we eat seed-s ? [% mike noise at beg . of utterance]
 *FAT: we'(a)re not gonna eat OUR seed-s ## [% noise from mike] (be)cause I
 do'n(o)t know how to [% ta] cook'(th)em .
 *FAT: but when ## we cut th(e) pumpkin at'your school ## ?
 *CHI: yes .
 *FAT: they'(a)re gonna roast the seed-s .
 Coded as: +P

APPENDIX IV: NAOMI CORPUS

NAOMI

Naomi 18-51

 No instances of *before*, *after*, *when*, or *while*.

Naomi 52

 Line 198. Keyword: when

*CHI: this xxx .
 *MOT: what is Daddy going to do to you **when he gets home** ?
 *CHI: **when he get** .
 *CHI: when he get home ?
 *MOT: what-'is he gonna [: going to] do to you # huh ?
Exclude: imitation

Line 199. Keyword: when

*MOT: what is Daddy going to do to you when he gets home ?
 *CHI: when he get .
 *CHI: **when he get home** ?
 *MOT: what-'is he gonna [: going to] do to you # huh ?
 *MOT: do you know ?
Exclude: question

Naomi 53-82

 No instances of *before*, *after*, *when*, or *while*.

Naomi 83

 Line 135. Keyword: while

*CHI: I do-'nt wanna [: want to] close it .
 *MOT: oh okay .
 *CHI: **do-'nt close it while I-'m putting my pants on** .
 *CHI: oh # my leg in bending .
 *MOT: yes I can see that .

Line 515. Keyword: when

*CHI: she gave them all her children a spanking .
 *MOT: it helps them sleep better # Naomi .
 *CHI: **you spank me when I do things on purpose and you spank me and that makes me sleepy too !**
 *MOT: yes .
 *CHI: that makes me go to sleep too # too .
Coded as: -P

Naomi 84

 Line 91. Keyword: when

*CHI: and all around town too .
 *MOT: say that again Naomi ?
 *CHI: **once in a while when you were little** . (*while* excluded: noun)
 *CHI: you like all these toys ?
 *CHI: when you were a little child # you liked all these toys ?
Coded as: no MC

Line 93. Keyword: when

*CHI: once in a while when you were little .
 *CHI: you like all these toys ?
 *CHI: **when you were a little child # you liked all these toys** ?
 *MOT: well # I did-'nt have those toys when I was a little child .
 *CHI: but I-'m having all these toys .
Coded as: +P

Line 219. Keyword: when
 *CHI: now .
 *CHI: let me get this dresser .
 *CHI: I do-'nt want to get this dress on me when I did-'nt .
 *CHI: I want to get this dresser .
 *CHI: this dresser looks like mine .
 Coded as: 0

Naomi 84

 Line 270. Keyword: after
 *CHI: getting crowded # see ?
 *CHI: I put all these dollies in see ?
 *CHI: it-'is getting crowded after I put these dollies in .
 *CHI: do-'nt say it now .
 *MOT: okay .

Line 331. Keyword: when
 *CHI: say um .
 *CHI: uppye .
 *CHI: when we do this .
 *CHI: let me hear Naomi talk .
 *CHI: let me hear Naomi do the xxx xxx again .
 Coded as: no MC

Naomi 90

 Line 110. Keyword: after
 *CHI: turn this all over .
 *MOT: would you say some things after me while you do that ?
 *CHI: no # after .
 *MOT: after you finish .
 *MOT: no # that-'is going to take a long time .
 Exclude: adverb

Line 520. Keyword: when
 *MOT: hmm ?
 *CHI: did you see the airport ?
 *CHI: when our airplane .
 *CHI: when we went under the station with our car ?
 *CHI: did you see how that airport was made ?
 Coded as: 0

Line 521. Keyword: when
 *CHI: did you see the airport ?
 *CHI: when our airplane .
 *CHI: when we went under the station with our car ?
 *CHI: did you see how that airport was made ?
 *MOT: no .
 Exclude: question

Naomi 91

 Line 126. Keyword: when
 *CHI: because I have to do what the teachers say I have to do and I do-'nt like to do that .
 *FAT: what sorts of things do-'nt you like to do ?
 *CHI: when they told me <go swimming>["] I have to go swimming and I can-'nt do something else (be)cause .
 *CHI: I-'m swimming .
 *FAT: mmhm .
 Coded as: +P

Line 161. Keyword: after
 *FAT: you walked slower@ ?
 *CHI: yes .
 *CHI: after I walked faster .
 *CHI: because I knew I could-'nt walk +...
 *CHI: I did-'nt know that I could-'nt run and I could-'nt walk fast but I could-'nt walk faster and I could-'nt run .

Line 169. Keyword: when

*FAT: it-'is on .
 *CHI: but sh +...
 *CHI: **when can I speak ?**
 *FAT: you can speak right now .
 *FAT: we-'ve been speaking into it all this time .

Exclude: question

Line 270. Keywords: when, when

*FAT: wallpaper fell off the pillow ?
 *CHI: wallpaper fell off the pillow and the candle fell on the pillow on the wallpaper pillow .
 *CHI: **but when it was all gone there was a big smudge and when they tried to wash it off it would-'nt come off .**
 *CHI: but then a man came and put meatballs on them .
 *FAT: put meatballs on them ?

Coded as: +P, +P

Line 291. Keyword: after

*CHI: that-'is a whole bunch of stories .
 *FAT: and it lived happily ever after ?
 *CHI: **and it lived happily ever after .**
 *CHI: pooping in the big xxx .
 *FAT: are you ready to get you hair washed now ?

Naomi 92

 Line 27. Keyword: when

*MOT: well # does that look better .
 *MOT: wow # I bet it does-'nt even hurt any more # does it ?
 *CHI: **yes # it does # when I scratch it # it does .**
 *MOT: oh # it looks much better .
 *MOT: it really does .

Coded as: 0

Line 80. Keyword: after

*MOT: hey # neat # Daddy made your lunch # Nomi .
 *CHI: oh # that-'is good .
 *CHI: **well # I can xxx after .**
 *CHI: how come you gave me xxx .
 *MOT: (be)cause you-'re going to wear this under this .

Exclude: adverb

Line 196. Keyword: while

*MOT: I think he-'is back getting dressed .
 *CHI: how come I can-'nt hold it .
 *CHI: **while I do it ?**
 *MOT: you want to hold the microphone ?
 *CHI: yes .

Lines 258 and 259. Keyword: when

*CHI: they +...
 *CHI: they +...
 *CHI: **when +...**
 *CHI: **when +...**
 *CHI: when we painted some over .

Exclude: lacks context

Line 260. Keyword: when

*CHI: when +...
 *CHI: when +...
 *CHI: **when we painted some over .**
 *MOT: mmhm .
 *CHI: we painted some over .

Coded as: MC missing

Line 567. Keyword: after

*CHI: okay # you can say Jack and Jill .
 *CHI: Jack and Jill went up the hill to fetch a pail of water .
 *CHI: Jack fell down and broke his crown and Jill came tumbling after .
 *CHI: okay # how was your vacation .
 *CHI: fine .

Exclude: formulaic expression

Line 595. Keyword: after

*CHI: xxx .
 *CHI: yyy Jack and Jill went up the hill to fetch a pail of water .
 *CHI: Jack fell down an(d) broke his crown an(d) Jill came tumbling after .
 *CHI: tow@ # bow # cow # low@ .
 *MOT: do-'nt use the microphone like that # honey # your lips are on the microphone .

Exclude: formulaic expression

Nsomi 93

 Line 851. Keyword: when

*CHI: and tonight I am yes .
 *CHI: she +...
 *CHI: when I babysitted@ for her she really liked it .
 *CHI: (be)cause I tickled her so much .
 *MOT: oh .

Coded as: +P

Line 996. Keyword: when

*MOT: how long is she going to stay in the hospital ?
 *CHI: oh # about three days .
 *CHI: um # we-'ll go home but when we go home we-'ll take her to her own house and she-'ll sleep at her own house .
 *MOT: oh # I see .
 *MOT: what was wrong with her ?

Coded as: +P

Line 1005. Keyword: while

*CHI: she had a earache # a tummy ache and she had also +...
 *CHI: oh # these are so bad .
 *CHI: I-'m gonna [: going to] stay with her a little while .
 *CHI: know why ?
 *MOT: why ?

Exclude: noun

Line 1101. Keyword: when

*MOT: ma ma ma ma .
 *CHI: here for two days .
 *CHI: when we go home we-'ll take you home # alright ?
 *CHI: just relax .
 *CHI: relax there awhile .

Coded as: +P

APPENDIX IV: NAOMI CORPUS

NAOMI'S MOTHER

Naomi 18-20

 No instances of *before*, *after*, *when*, or *while*.

Naomi 21

 Line 107. Keyword: when

*CHI: pushed that .

*MOT: no we do-'nt want to push that one down # Nomi .

*MOT: **it makes it go again Nomi when you pull it back up .**

*MOT: it makes it go .

*MOT: now it-'is going .

Coded as: -P

Naomi 51

 Line 87. Keyword: after

*CHI: sugar in that ?

*MOT: yeah .

*MOT: **it was nice that you slept for so long this morning after you came down Naomi .**

*MOT: you slept very nicely # did-'nt you # after you came down .

*MOT: until time for Mommy to get up .

Line 89. Keyword: after

*MOT: yeah .

*MOT: it was nice that you slept for so long this morning after you came down Nomi .

*MOT: **you slept very nicely # did-'nt you # after you came down .**

*MOT: until time for Mommy to get up .

*MOT: did you have bad dream ?

Line 176. Keyword: after

*CHI: uh@ want play with it .

*MOT: no .

*MOT: **not until after you-'ve finished your dinner darling .**

*MOT: you do-'nt want to get your sticky hands on it .

Line 272. Keyword: after

*CHI: (a)nother one .

*CHI: xxx .

*MOT: **well # after you-'re finished .**

*MOT: you can-'nt do it while you-'re eating your popsicle .

*MOT: you can-'nt do it while you-'re eating your popsicle .

Line 273. Keyword: while

*CHI: xxx .

*MOT: well # after you-'re finished .

*MOT: **you can-'nt do it while you-'re eating your popsicle .**

*MOT: you can-'nt do it while you-'re eating your popsicle .

*CHI: sticky .

Line 274. Keyword: while

*MOT: well # after you-'re finished .

*MOT: you can-'nt do it while you-'re eating your popsicle .

*MOT: **you can-'nt do it while you-'re eating your popsicle .**

*CHI: sticky .

*MOT: yeah xxx .

Exclude: repetition

Line 321. Keyword: when
 *CHI: xxx at the store .
 *MOT: at the store ?
 *MOT: who held you when you cried ?
 *CHI: I had gum .
 *MOT: you had gum at the store ?
 Coded as: -P

Line 325. Keyword: when
 *MOT: you had gum at the store ?
 *CHI: yup .
 *MOT: who held you when you cried # honey ?
 *MOT: who held you ?
 *MOT: hmm ?
 Exclude: repetition

Naomi 52

 Line 155. Keyword: when
 *MOT: that-'is Mommy-'s .
 *CHI: that-'is Daddy-'s ?
 *MOT: honey # what-'is Daddy gonna [: going to] do when he gets home
 tonight .
 *MOT: hmm ?
 *MOT: what-'is Daddy gonna [: going to] do ?
 Coded as: -P

Line 197. Keyword: when
 *MOT: helped Mommy .
 *CHI: this xxx .
 *MOT: what is Daddy going to do to you when he gets home ?
 *CHI: when he get .
 *CHI: when he get home ?
 Coded as: -P

Naomi 53

 Line 183. Keyword: when
 *CHI: why ?
 *CHI: why ?
 *MOT: because I want you to come when I call .
 *MOT: not run away .
 *MOT: no more running away .
 Coded as: -P

Naomi 54

 Line 136. Keyword: while
 *MOT: wet .
 *MOT: okay # well I do-'nt need to change you then right you then right
 away .
 *MOT: I-'ll change you in a little while .
 *CHI: could I sit down in chair ?
 *CHI: and read the catalogue ?
 Exclude: noun

Naomi 82

 Line 109. Keyword: when
 *CHI: why ?
 *MOT: because # that-'is one of those questions I can-'nt answer honey .
 *MOT: I can answer why when you ask me some things but +...
 *CHI: why not ?
 *MOT: other things are just very hard to answer that question .
 Coded as: -P

Naomi 83

 Line 80. Keyword: when
 *CHI: there she is .
 *MOT: oh # there she is .
 *MOT: hey # sweetheart # tell me what you did at nursery school this morning when you got there .
 *MOT: remember you were unhappy when I left you at nursery school this morning .
 *MOT: why were you unhappy then ?
 Coded as: 0

Line 82. Keyword: when
 *MOT: oh # there she is .
 *MOT: hey # sweetheart # tell me what you did at nursery school this morning when you got there .
 *MOT: remember you were unhappy when I left you at nursery school this morning .
 *MOT: why were you unhappy then ?
 *MOT: do you remember ?
 Coded as: -P

Line 102. Keyword: after
 *CHI: it-'is all bigger now .
 *MOT: yeah .
 *MOT: well did you feel better after I left Nomi ?
 *CHI: yeah .
 *CHI: I rided@ on the little horsie .

Line 280. Keyword: before
 *MOT: you-'re too close to see what it is .
 *MOT: what-'is this here ?
 *MOT: does it look like anything you-'ve ever seen before ?
 *CHI: I do-'nt know .
 *CHI: I do-'nt know .
 Exclude: adverb

Line 393. Keyword: before
 *MOT: no # Nomi # I meant why do you think he-'is jumping like that ?
 *CHI: he-'is pounding like this .
 *MOT: what was he doing before he was +...
 *CHI: he-'is pounding on that sand .
 *MOT: what that ?

Line 432. Keyword: when
 *CHI: he does .
 *MOT: let me see what it says here .
 *MOT: it says <that-'is amazing>["] it says <and how are we feeling this morning # reply when you hear beep>["] .
 *MOT: he-'is in the hospital # Nomi .
 *CHI: why ?
 Coded as: -P

Naomi 84

 Line 94. Keyword: when
 *CHI: you like all these toys ?
 *CHI: when you were a little child # you liked all these toys ?
 *MOT: well # I did-'nt have those toys when I was a little child .
 *CHI: but I-'m having all these toys .
 *CHI: now .
 Coded as: -P

Line 366. Keyword: after
 *MOT: Mommy and Daddy are going out tonight .
 *CHI: why ?
 *MOT: after you go to bed .
 *CHI: why ?
 *MOT: because some friends invited us over .

Naomi 85

 No instances of *before*, *after*, *when*, or *while*.

Naomi 90

 Line 30. Keyword: while

*MOT: I do-'nt know .
 *MOT: where did you ?
 *MOT: I saw it over there a little while ago .
 *MOT: did you find it ?
 *CHI: pick it up .
Exclude: noun

Line 100. Keyword: when

*CHI: hey .
 *CHI: puzzle sure does .
 *MOT: Nomi # do you ever look at the pictures when you-'re doing puzzles ?
 *MOT: or just the shape ?
 *CHI: this is elephant .
Coded as: -P

Line 107. Keyword: while

*CHI: this is a horse .
 *CHI: is this a horse ?
 *MOT: could you say some sentences while you-'re doing this ?
 *CHI: turn this all over .
 *MOT: would you say some things after me while you do that ?

Line 109. Keywords: after, while

*MOT: could you say some sentences while you-'re doing this ?
 *CHI: turn this all over .
 *MOT: would you say some things after me while you do that ?
 *CHI: no # after .
 *MOT: after you finish .

Line 111. Keyword: after

*MOT: would you say some things after me while you do that ?
 *CHI: no # after .
 *MOT: after you finish .
 *MOT: no # that-'is going to take a long time .
 *MOT: that-'is a pretty complicated puzzle .

Line 162. Keyword: before

*CHI: is-'nt that a funny nose ?
 *MOT: I never saw you draw a nose like that before .
 *MOT: hey can you a +/.
 *CHI: you know what ?
Exclude: adverb

Line 401. Keyword: after

*CHI: that-'is all cleaned up .
 *MOT: okay .
 *MOT: would you say some words after me ?
 *CHI: yyy .
 *CHI: know what ?

Line 540. Keyword: while

*MOT: okay .
 *MOT: okay .
 *MOT: I-'m going to go out for a little while honey .
 *MOT: and you can make an airport with these girls # okay # Nomi ?
 *MOT: I-'ll be back in a couple minutes .
Exclude: noun

Naomi 91

 No instances of *before*, *after*, *when*, or *while*.

Naomi 92

Line 163. Keyword: when

*CHI: watch # Mommy .

*MOT: what # why not get the shoe on first and then I-'ll watch you .

*MOT: **I like to finish doing something when I start it .**

*MOT: it-'is always a good idea .

*MOT: finish one thing .

Coded as: -P

Line 202. Keyword: when

*MOT: okay # you can hold it # just try not to move around too much . "

*MOT: now you want to say something special into it ?

*MOT: **is that what you did the other day at school when you recorded # did you hold the microphone ?**

*CHI: no .

*MOT: or was the microphone on the table ?

Coded as: 0

Line 215. Keyword: before

*CHI: no .

*MOT: no # oh that-'is good .

*MOT: **(be)cause you-'d met Louise before # huh ?**

*CHI: uhuh .

*MOT: remember meeting Louise at Hillel ?

Exclude: adverb

Line 225. Keyword: before

*MOT: that was Louise .

*MOT: do-'nt you remember that ?

*MOT: **yes # I thought you knew her from before .**

*CHI: but guess what .

*MOT: what # honey ?

Exclude: adverb

Line 242. Keyword: while

*CHI: (be)cause I heard you kick one .

*MOT: yeah # I know .

*MOT: **you-'re supposed to talk while you-'ve got it there you know .**

*CHI: know what ?

*MOT: what .

Line 365. Keyword: when

*MOT: I-'m not really watching .

*MOT: I-'m just waiting for the tape to be over .

*MOT: **do you feel inhibited when I-'m here ?**

*CHI: yeah .

*MOT: this is continuing from the other side .

Coded as: -P

Naomi 93

Line 594. Keyword: while

*MOT: okay .

*CHI: and I-'ll +...

*MOT: **and you talk for the baby while he-'is playing in his crib .**

*MOT: okay ?

*MOT: here the xxx can "be his crib .

APPENDIX IV: NAOMI CORPUS

NAOMI'S FATHER

Naomi 18-19

No instances of *before*, *after*, *when*, or *while*.

Naomi 20

Line 82. Keyword: while

*FAT: you want to come up and sit on my lap .
 *CHI: uh .
 *FAT: **you had better just rest a while .**
 *FAT: why do-'nt you talk while you-'re resting .
 *CHI: cow .
Exclude: noun

Line 83. Keyword: while

*CHI: uh .
 *FAT: you had better just rest a while .
 *FAT: **why do-'nt you talk while you-'re resting .**
 *CHI: cow .
 *CHI: cow .

Naomi 21-82

No instances of *before*, *after*, *when*, or *while*.

Naomi 83

Line 17. Keyword: when

*FAT: you heard Naomi-'s voice on the tape ?
 *CHI: yeah .
 *FAT: **what were you doing Nomi # when you were napping ?**
 *CHI: I do-'nt know .
 *FAT: how many other girls were there ?
Coded as: -P

Line 41. Keyword: when

*FAT: how come there are not three Erics all the time ?
 *CHI: because some [//] sometimes they-'re not all the time .
 *FAT: **but where is the third Eric when he-'is not at nursery school #**
Nomi ?
 *CHI: there-'is one Eric .
 *CHI: and two Erics .
Coded as: -P

Naomi 84-90

No instances of *before*, *after*, *when*, or *while*.

Naomi 91

Line 148. Keyword: when

*CHI: bounce .
 *CHI: bounce .
 *FAT: **what happened when your teachers yelled at you ?**
 *CHI: I paid no attention .
 *FAT: you did-'nt pay any attention to them ?
Coded as: -P

Line 174. Keyword: when

*CHI: no I have-'nt .
 *CHI: wanna [: want to] hold it .
 *FAT: oh # no # you can-'nt hold it Naomi # not when you-'re in the tub .
 *FAT: that-'is dangerous .
 *FAT: that can # Naomi # for the same reason # Naomi # that you can-'nt
 play with plugs .

Coded as: -P

Line 180. Keywords: before, when

*CHI: but where is my voice ?
 *CHI: I want my voice .
 *FAT: did-'nt you hear it before when we played it back ? (exclude before: adverb)
 *CHI: no .
 *FAT: okay .

Coded as: 0

Line 185. Keyword: while

*FAT: okay .
 *FAT: well # I-'m going to put some more hot water in the tub and we-'ll
 play it back .
 *FAT: and you can listen to your voice while the hot water runs into the
 tub .
 *FAT: okay .
 *FAT: I-'ve put the tape recorder on again .

Line 190. Keyword: when

*FAT: okay .
 *FAT: I-'ve put the tape recorder on again .
 *FAT: Nomi # tell me what happened on the way home today when you were
 riding in the car with Jacqueline # and there was somebody on a
 bicycle .
 *CHI: oh .
 *CHI: I just said # <if we went too close to it we would run over it
 xxx>["] .

Coded as: 0

Line 198. Keyword: when

*CHI: someone was riding on it .
 *FAT: do you remember how you said that ?
 *FAT: when you were in the car . (continuation of previous utterance)
 *CHI: um .
 *CHI: oh .

Coded as: 0

Line 207. Keyword: while

*FAT: we would have +...
 *FAT: oh # somebody-'is at the door .
 *FAT: you talk into the tape recorder for a minute while I get the door .
 *CHI: we would have done .
 *CHI: I can-'nt remember .

Line 248. Keyword: when

*FAT: it just listens .
 *FAT: sometimes it talks .
 *FAT: I guess when it plays back it talks # does-'nt it ?
 *CHI: maybe it-'is talking to us and not Naomi .
 *FAT: and what about Naomi ?

Coded as: +P

Line 290. Keyword: after

*CHI: and that-'is the end .
 *CHI: that-'is a whole bunch of stories .
 *FAT: and it lived happily ever after ?
 *CHI: and it lived happily ever after .
 *CHI: pooping in the big xxx .

Exclude: formulaic expression

Line 294. Keyword: while

*CHI: pooping in the big xxx .
 *FAT: are you ready to get you hair washed now ?
 *FAT: **we-'ll turn this off while you get your hair washed .**
 *FAT: what do you want to say now ?
 *CHI: a story .

Line 502. Keyword: when

*FAT: you can just leave the water in there and it-'ll come out .
 *CHI: how come it-'is in there ?
 *FAT: **when frogs get in the water @ Nomi @ they get water inside them .**
 *CHI: deee deee deee .
 *CHI: hop .
 Coded as: +P

Naomi 92

 No instances of *before*, *after*, *when*, or *while*.

Naomi 93

 Line 137. Keyword: before

*FAT: that was the kitty running away ?
 *CHI: uhhuh .
 *FAT: **and just before that it was the boy .**
 *FAT: what was the boy doing with the kitty ?
 *CHI: the boy squeezed the kitty .