Wishes before ifs: mapping "fake" past tense to counterfactuality in wishes and conditionals

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Abstract: Counterfactuals express alternatives that are contrary to the actual situation. In English, counterfactuality is conveyed through conditionals ("If pigs had wings, they could fly") and *wish*-constructions ("I wish pigs had wings"), where the past tense morpheme marks non-actuality rather than past temporal orientation. This temporal mismatch seemingly complicates the already challenging task of mapping abstract counterfactual meaning onto these linguistic expressions during first language acquisition. In this paper, we investigated the role of linguistic transparency on the acquisition of different counterfactual constructions with a corpus study on the spontaneous production of English-speaking children between the ages of 2-to-6. We extracted *wish*-utterances from 52 corpora available on CHILDES to compare children's wish productions with those of adults, and additionally extracted counterfactual conditional utterances for 6 children to provide a comparative longitudinal overview of counterfactual wishes and conditionals. Our results support the idea that complexity of form-to-meaning mapping influences the emergence of counterfactual language. First, we observed a substantial number of productive errors in children's speech, where they produce counterfactuals with present tense marking instead of past. These errors are consistent with a stage where children have yet to figure out that the past tense is an obligatory component of English counterfactual constructions signaling a present non-actuality, rather than a past event on the timeline. Second, our results show that *wish*-constructions, which are linguistically more transparent than counterfactual conditionals, generally emerge before counterfactual conditionals in children's speech. This suggests that in English, counterfactual wishes might be easier to acquire than counterfactual conditionals.

Keywords: corpus, counterfactuals, form-to-meaning mapping, first language acquisition, English

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Introduction

Counterfactual reasoning encompasses our ability to think about alternative ways the world could be or could have been. With counterfactual expressions such as "If pigs had wings, they could fly" or "I wish pigs could fly" we express situations that are contrary to the actual state of affairs (pigs do not have wings) and imagine what the world would look like if they were true. In language development, the acquisition of counterfactuality is dependent on both cognitive and linguistic development. On one hand, children need to acquire the ability to postulate the non-actual alternative in conjunction with the actual state of affairs, which is typically thought to be a cognitively demanding task (Beck et al., 2009; Byrne, 2007). On the other hand, children need to acquire the linguistic structures that express counterfactuality in their language, and map counterfactual meaning onto these linguistic expressions. While various studies have investigated the acquisition of counterfactuality in production (e.g., Bowerman, 1986; Kuczaj & Daly, 1979; Reilly, 1982) and comprehension (e.g., Nyhout & Ganea, 2019; Rafetseder et al., 2010; Riggs et al., 1998; Robinson & Beck, 2000), we know little about the interaction of cognitive complexity, linguistic complexity, and form-to-meaning mapping in children's development of counterfactual reasoning.

The complexity of the form-to-meaning mapping of abstract concepts, is often thought to be dependent on input availability and the transparency of the linguistic cues that signal abstract meaning (Slobin, 1973, p. 178; Weist et al., 1997). Linguistic constructions that are transparent or dedicated in their expression of a complex concept are thought to facilitate language acquisition. In this paper, we explore this hypothesis by investigating the emergence of counterfactual language in the spontaneous production of English-speaking children between the ages 2-to-6. Specifically, we consider the influence of potentially misleading cues (the counterfactual's "fake" past tense) and the role of construction transparency (whether an expression is dedicated to expressing counterfactuality or not) on the acquisition of counterfactual constructions. Before we get more into the details of our study, we will first discuss the definition of counterfactuality and counterfactual reasoning, and provide background on children's acquisition of counterfactuality.

Defining Counterfactuality, Counterfactual Reasoning, Imagination and Desire

The Expression of Counterfactuality

Counterfactuality is a grammatical category used for linguistic expressions that imagine situations that are contrary to fact and different from the current or past situation (Iatridou, 2000). In English, counterfactuality can be expressed through

counterfactual (CF) conditionals (1) and wishes (2), making reference to an alternative present (1a/2a) or past (1b/2b). Crucially, the utterances in (1a-2b) all discuss an imagined car possession, while implicitly asserting that the speaker did not own a car at the reference time.

(1a) If I **had** a car right now, I would drive. PRESENT CF CONDITIONAL
(1b) If I **had** had a car back then, I would have driven. PAST CF CONDITIONAL

(2a) I wish I **had** a car right now. PRESENT CF WISH
(2b) I wish I **had** had a car back then. PAST CF WISH

Closely related to the present and past counterfactual, there is the future "counterfactual" or 'future less vivid' (FLV) (Iatridou, 2000). This construction (3) can strictly not be called counterfactual, as it refers to the future and is in principle still realizable[1]. In counterfactual conditionals (3a), the future reading is the result of the eventive main verb in the *if*-clause (e.g., *went)*. In wishes, the future reading comes from the inclusion of the verb *would* (3b). Like the present and past counterfactual, the future less vivid indicates the speaker believes the opposite to be most likely true (e.g., the utterances in (3) can be used when someone is scheduled to leave next week instead).

(3a) If he **went** tomorrow, he would get there next week. FUTURE LESS VIVID (FLV)
(3b) I wish he **would** go tomorrow. (Iatridou, 2000, 28)

The counterfactual and FLV utterances above, have in common that they all include past tense marking (indicated in bold). Usually, past tense inflection indicates an actual past, and can only combine with a temporal adverb that matches this temporal orientation, like *yesterday* (4).

(4) I **had** a car (*right now/*tomorrow/yesterday).

[1]However, Iatridou (2000, p.235) raises the question of whether we should be considering it a real counterfactual after all, as it patterns alike with the other constructions. In wishes, future temporal orientation seems to indicate a desire to change a future that the speaker believes to be unlikely or impossible to change, e.g., because it's planned or determined.

However, in counterfactual constructions the past morpheme gives rise to a non-actual interpretation instead (Iatridou, 2000; Ippolito, 2006; Karawani & Zeijlstra, 2013; Ogihara, 2000; Romero, 2014). This mismatch between the counterfactual's morphological tense marking (past) and temporal orientation (dubbed "fake" past tense by Iatridou, 2000), becomes evident when the "fake" past is combined with the present temporal adverb *right now* (1a/2a) or future temporal adverb *tomorrow* (3). In order to express true past temporal orientation (1b/2b), counterfactuals require double past marking (both "fake" and actual past) in the form of the 'past perfect'.

The occurrence of a "fake" past tense in counterfactual utterances is fairly prevalent across distinct language families (Bjorkman & Halpert, 2017; Iatridou, 2000; James, 1982; von Prince, 2017, p.6 and references therein). For this reason, it is often theorized that the "fake" past plays an important function in the linguistic expression of counterfactuality. There are two main approaches to analyzing the semantic role of the counterfactual's past tense morpheme. Past-as-past (or 'back-shifting') approaches argue that the counterfactual's past tense morpheme fulfills the function of shifting back in time (e.g., Dudman, 1983; Ippolito, 2006; Ippolito & Keyser, 2013; Ogihara, 2000; Romero, 2014), while past-as-modal ('remoteness-based') approaches believe the counterfactual's past is "fake" in the sense that the morpheme does not make any temporal reference (Bjorkman & Halpert, 2017; Iatridou, 2000; Karawani, 2014; Karawani & Zeijlstra, 2013; Ritter & Wiltschko, 2014; Schulz, 2014). For example, Iatridou (2000) argues that the past tense morpheme is the realization of an 'exclusion' feature, that either scopes over times (excluding the present, resulting in a past tense reading) or over worlds (excluding worlds, resulting in a counterfactual reading). For our purposes, we are not committed to a specific semantic analysis. Instead, we hope to have illustrated that the expression of counterfactuality is a linguistically complex phenomenon, that requires figuring out the non-transparent mapping of counterfactuality to a morpheme that usually expresses past temporal orientation and learning the semantic operations supporting this counterfactual interpretation.

Counterfactual Reasoning

Besides the linguistic complexity of expressing counterfactuality, the cognitive processes underlying counterfactual thought are complex as well. Counterfactual reasoning refers to the cognitive ability to imagine counterfactual situations. In a narrow sense, this only includes thoughts about "what might have been", which are thoughts about alternatives to specific elements of the actual world (Beck, 2016). Such counterfactual reasoning is thought to involve the ability to hold multiple possibilities in mind, while temporarily considering a false possibility as true (Beck et al., 2009; Byrne, 2007). While the linguistic concept of counterfactuality includes both the

imagination of alternative states in the present and past, developmental psychologists often define counterfactual reasoning more strictly as 'undoing a past event, action or state', requiring the consideration of two alternative representations of the same past time (Byrne, 2007; Rafetseder et al., 2010; Rafetseder & Perner, 2012; Robinson & Beck, 2000). However, it is important to note that counterfactuals expressing alternative present states (1a/2a) involve the same core processes of counterfactual reasoning, namely keeping in mind two conflicting representations and temporarily undoing what is known to be true about the actual state. For this reason, we will use the term 'counterfactual reasoning' to include the undoing of actions, states and events in the past, as well as the undoing of present states. By including present counterfactuality in the consideration of the development of counterfactual reasoning, we can isolate the mental operation of counterfactual reasoning. That said, past counterfactuality is arguably more cognitively demanding than just reasoning counterfactually about the now, because it requires the child to combine the mental operation of counterfactual reasoning with mental time travelling.

Pretend Play and Counterfactual Reasoning: Where to Draw the Line?

Besides the narrow definition of counterfactuality discussed above, some researchers use the term 'counterfactual reasoning' to include all types of 'unreal' thinking, including pretense, future thinking and reasoning about fictional worlds, as well as counterfactual reasoning in the narrow sense (Beck, 2016). Specifically, pretend play and counterfactual reasoning are thought to rely on the same cognitive abilities. Both types of thinking involve disengaging with current reality, postulating and reasoning about an alternative reality, and keeping the alternative possibility separate from reality (Walker & Gopnik, 2013; Weisberg & Gopnik, 2016). For this reason, it has been suggested that pretend play might be an important precursor to imagining possible worlds (Francis & Gibson, 2021; Gopnik & Walker, 2013). Supporting this view, some studies have found a correlation between children's performance on reasoning tasks that involve pretending and tasks that involve counterfactual reasoning (Buchsbaum et al., 2012; Francis & Gibson, 2021). In fact, Walker and Gopnik (2013) argue that pretending is a form of counterfactual reasoning, and that pretend play provides early opportunities to learn and develop this skill. However, this inclusion of pretense into the definition of counterfactuality seems to be too generous. Beck (2016) argues that pretend play and counterfactual reasoning are quantitively different in their relationship with reality and the cognitive demands they make. Beck (2016) points out that real-world counterfactuals are closely tied to reality while pretend play is decoupled from reality, and therefore does not make the same cognitive demands. In other words, pretend play is achieved by temporarily shifting into an alternative here-and-now, while counterfactual reasoning requires the postulation and comparison of

possible worlds incompatible with the actual one (Tulling, 2022, p. 175). In this paper we therefore use the definition of counterfactuality as discussed above.

The Difference between Wishing and Desiring

As discussed earlier, counterfactuality can be expressed in English using both counterfactual conditionals and wishes. While counterfactual conditionals involve causal reasoning ("If…then…"), counterfactual wishes involve the expression of desire. In English, counterfactual desire is expressed by the verb *wish* embedding a finite sentence, representing a full proposition, e.g., "I wish [I had a dog]". Note that while the verb *wish* sometimes occurs with other complements, like a Noun Phrases (NP) ("I wish you a happy birthday"), Verb Phrases (VP) ("I wish to sleep") or Prepositional Phrases (PP) ("I wish for more presents"), these uses are not counterfactual and are structurally distinguishable from propositional embedding *wish* (Iatridou, 2000, p. 241). Not all languages have a word that specializes in expressing counterfactual desire, and languages like Dutch or Greek for example use the regular desire verb *want* for this purpose. In English, both *wish* and *want* express desire, and occur with multiple different complement types, however they are distinct in both their structure and their meaning. Propositional embedding *wish* selects for a counterfactual complement and can only express desires that are non-actual and thought to be out of reach. The verb *want* selects for verbal complements with a future orientation. The desire expressed by *want* may or may not be fulfilled in the future, and can be either achievable (e.g., "I want to eat an apple") or impossible (e.g., "I want to grow wings"). The counterfactual component of the propositional *wish*-construction in contrast to a regular desire becomes obvious when we try to combine desires with their outcomes. You can *want* things you already have (5a), but it is impossible to wish for things you already have (5b).

(5a) I live in Bolivia because I want to live in Bolivia. (Iatridou, 2000, 38)
(5b) *I live in Bolivia because I wish I lived in Bolivia. (Iatridou, 2000, 40)

Acquiring the counterfactual *wish*-construction thus requires the child to learn that the verb *wish* differs from desire verbs like *want* in its counterfactual implication and can only be used when the desire is believed to be unfulfilled. We discuss the challenges to mapping counterfactuality onto linguistic expressions in more detail later. Before this, now that we have all relevant definitions in place, we provide an overview on prior research on children's acquisition of counterfactuality.

Background: Children's Development of Counterfactuality

Prior research shows that children generally start producing and comprehending counterfactual conditionals around age 4, after they have developed the ability to refer to hypothetical future events (such as "If it rains tomorrow, we will play inside"), which already seem to be in place by age 3 (Bowerman, 1986; Guajardo et al., 2009; Nyhout & Ganea, 2019; Reilly, 1982; Riggs et al., 1998; Robinson & Beck, 2000). This asymmetry between the acquisition onset of the hypothetical future and counterfactual has mainly been attributed to the additional cognitive load demanded by counterfactual reasoning, which depends not only on holding multiple possibilities in mind, but also requires temporarily considering a false possibility as true (Beck et al., 2009; Byrne, 2007). Reilly (1982) used longitudinal recordings and diary entries about one child (Kate), and various elicitation tasks with children between age 2-to-8 to investigate their acquisition of conditionals. She found that most children produce hypothetical conditionals by age 3 but did not yet fully comprehend hypothetical conditionals by this age and did not seem to understand counterfactuals. In fact, when asked counterfactual "what if" questions, many 2-year-olds and quite some 3-year-olds denied the counterfactuals or responded to them as if they were about reality, see (6a) and (6b):

(6a) Adult: What if a snake had eaten your daddy? (Reilly, 1982, ex. 37 p.107)
Cate (2;8): No! / Can't eat my daddy

(6b) Adult: What if you were a snake? (Reilly, 1982, ex. 57 p.116)
Janine (3;0): I'm not a snake / I'm Janine.

At age 4, Reilly (1982) found that children demonstrated comprehension of both hypotheticals and counterfactuals. They no longer denied the possibility of a situation or gave realist replies to counterfactual utterances. They also produced clear spontaneous present counterfactual conditionals (7).

(7) 4-yo: If they put a goldfish in there and they ate it, they would die.
(Reilly, 1982, ex. 68, p.121)

Kuczaj & Daly (1979) investigated the longitudinal development of Abe and did a cross-sectional study of 14 other children. They similarly found that future hypothetical conditionals seem to be acquired before counterfactual conditionals and reported that Abe used his first past counterfactual conditional at the end of age 3 (3;11).

The age at which children start producing counterfactual conditionals thus seems to align with when they are found to start understanding these constructions, around age 4. However, in a corpus study of three children, Bowerman (1986) noted some surprising instances of (present) counterfactual conditionals at age 2 (8a,b), and also noticed children using counterfactual *wish* at this age as well (9).

(8a) <Just having crossed a narrow street when a car goes by> (Bowerman, 1986, 43)
Christy (2;4): That car [will/would?] hit me if I was in a street

(8b) <Child is tired during long wait in doctor's office> (Bowerman, 1986, 44)
Eve (2;11): If we (didn't?) have to wait for so long
we would have be gone a long time

(9) Christy (2;1): I *wish* Christy have a car (Bowerman, 1986, 10)
I *wish* me have a airplane

While prior corpus studies mostly focused on the acquisition of past counterfactual conditionals, simpler counterfactual constructions such as the present counterfactual conditional (lacking the past perfect) or counterfactual *wish*-construction (dedicated counterfactual construction) might thus be available to children at an earlier age. This would be in correspondence with findings about spontaneous modal productions, where the linguistically less complex modal adverbs were found to be acquired before modal auxiliaries for inferential meanings (Cournane, 2021). Notably, the *wish*-utterances in (9) lack the obligatory "fake" past tense and use the present tense verb 'have' instead. This suggests that the "fake" past is a complex feature of counterfactuality, one that children initially may struggle with. In the next section, we discuss how the linguistic complexity of the "fake" past and the transparency of different constructions may influence the acquisition of counterfactual constructions.

Mapping Challenge: Attributing Counterfactual Meaning to the "Fake" Past Tense

Besides developing the cognitive mechanisms and conceptual structures necessary to support counterfactual reasoning, the acquisition of counterfactuality also requires mapping counterfactual meaning onto linguistic expressions. Children have to derive from their input which structures in their language(s) express counterfactual meaning and acquire the linguistic mechanisms that support the expression of counterfactuality (Clark, 1987; Slobin, 1973; Weist, 2018). As for this form-to-meaning mapping, there are three properties of counterfactual constructions that make this mapping particularly challenging. First, it is not obvious how children learn to map meaning onto linguistic forms when the expressed meaning is not perceptually observable

(Gleitman et al., 2005; Landau & Gleitman, 1985). In the case of counterfactual constructions (e.g., "I wish we had a dog"), this is particularly true, as by definition the proposition expressed by the counterfactual is not true in the actual world, and thus cannot be observed. Second, there is no one-to-one correspondence between form and counterfactual meaning (Clark, 1987). Counterfactuality can be mapped onto different types of linguistic expressions, such as counterfactual conditionals or wishes and also involves attributing more than one abstract meaning, past temporal orientation and the counterfactual "fake" past, to the same morpheme. Third, the counterfactual meaning of the past tense morpheme is less common, and more restricted in its environment than the regular past temporal orientation meaning. In their acquisition of counterfactuality, children thus have to learn in exactly what contexts the past tense morpheme, which predominantly expresses past temporal orientation, is "fake" and fulfills a counterfactual function instead. How do children figure this out?

Recurrent exposure to counterfactual situations described by counterfactual utterances should allow a child to pick up on the linguistic devices used to express counterfactuality. If a construction is dedicated to express counterfactual meaning, in other words it only expresses counterfactuality, it should be easier to detect from the input and link to the counterfactual situation than expressions that are used in a wider range of situations. In English, it therefore seems that counterfactual wishes should be easier to detect than counterfactual conditionals. As discussed before, the *wish*-construction is a dedicated construction in English. Whenever the verb *wish* embeds a propositional complement, this proposition is interpreted counterfactually (10a). Because of the *wish*-construction's dedication to counterfactuality, which requires usage of the "fake" past, *wish* cannot co-occur with a present tense complement in standard varieties of English (10b). This is in contrast with conditionals, where the complementizer *if* can introduce both hypothetical conditionals (11a/b) and counterfactual conditionals (11c) and co-occurs with both present and past inflected verbs.

(10a) I wish I **had** a car.
(10b) *I wish I **have** a car. (Iatridou, 2000, 25)

(11a) If he **has** time to bake cookies, he will bring some. PRES. CONDITIONAL
(11b) If he **had** time to bake cookies, he will bring some. PAST CONDITIONAL
(11c) If he **had** time to bake cookies, he would make some. PRES. COUNTERFACTUAL

The consistent usage of the "fake" past tense in the *wish*-clause, even when there is a salient mismatch between the temporal orientation and morphological past marking of the *wish*-complement (10b), may cue the child to realize its role in expressing counterfactual meaning. Conditionals that can appear with present (11a), real past (11b)

and "fake" past tense (11c) in their antecedent, render the input less transparent to discover that the counterfactual conditional's past tense does not simply indicate a true past temporal orientation. In order to know the past in (11c) is "fake", one has to link the first clause with the second containing *would*, which requires keeping in mind and causally relating two clauses (c.f. Reilly, 1982; Bowerman, 1986). The *wish*-construction lacks such causal dependency. Combined with the fact that proposition-embedding *wish* is a dedicated counterfactual marker and consistently appears with the "fake" past in the child's input, the form-to-meaning mapping of this construction can be considered less complex than that of counterfactual conditional constructions.

Aims and Hypotheses

As we have seen so far, children appear to acquire counterfactual past conditionals relatively late compared to future hypothetical constructions (e.g., Bowerman, 1986; Reilly, 1982; Riggs et al., 1998; Robinson & Beck, 2000). What makes counterfactuals more complex? In order to acquire an abstract linguistic construction involving complex reasoning, two criteria need to be fulfilled: 1) the child must have developed the cognitive ability to support the mental operations involved in representing the meaning of the utterance, and 2) the child must figure out which linguistic forms are used to express such meanings in their target language(s) (Clark, 2001; Reilly, 1982). As for the cognitive factors underlying counterfactual reasoning, an immature development of executive functions like working memory, attention switching and inhibition have been linked to the late acquisition of counterfactuality (Beck et al., 2009; Beck, Riggs, et al., 2011, p. 20; Byrne, 2007; Guajardo et al., 2009; Robinson & Beck, 2000). A cognitive leap around the age of 4 would allow children to start reason counterfactually. While this generally aligns with the age children have been found to start producing past counterfactual conditionals (Bowerman, 1986; Kuczaj & Daly, 1979; Reilly, 1982), there have been some examples of children using simpler present counterfactual conditionals and wishes at age 2, sometimes lacking the "fake" past tense (Bowerman, 1986). However, it is not certain whether these findings are exceptional, or part of a more widespread pattern in development. In this paper, we investigate the emergence of counterfactual language with a corpus study on the spontaneous production of English-speaking children between the ages of 2-to-6. Specifically, we aim to explore the role of form-to-meaning mapping in the acquisition of counterfactuality by investigating linguistic transparency from two angles.

First, we investigate the role of the counterfactual's "fake" past tense in the acquisition of counterfactual constructions. In English, counterfactual utterances contain past tense marking, even if the utterance is about the present. The fact that counterfactuality maps to the same morpheme as past temporal orientation is not only

opaque, but also potentially misleading as children might initially hypothesize that the counterfactual's past tense marking indicates past tense meaning. When do children realize the counterfactual past expresses counterfactuality rather than past temporal orientation and is a necessary component of counterfactual utterances? To investigate this question, we will examine children's spontaneous productions of counterfactual wishes. Unlike conditionals, *wish*-constructions in standard varieties of English cannot take on present tense in their complements. This means that the child's input will always contain utterances such as "I wish I *had* a dog" and not "*I wish I *have* a dog". If children mimic their input, or immediately realize the past tense morpheme belongs to the expression of counterfactuality, we expect children to match their input in their own productions. That is, when expressing a desire about the present, they will use the *wish* + "fake" past construction. However, if children go through a stage where the mapping between the "fake" past tense and counterfactuality is not yet clear, they might initially mistake the counterfactual's past in their input as referring to past situations. In this scenario, their underlying representation of the *wish*-construction would not include the "fake" past as an obligatory component, and we expect that they would mark their own spontaneous wishes just like they would in other contexts: using past tense to express desires about the past and using present tense to express desires about the present. We therefore predict children to produce non-adultlike utterances, such as "I wish I *have* a dog".

If they do, then a secondary question is whether their non-adultlike constructions are used in adultlike counterfactual contexts. Is realizing the counterfactual function of the past morpheme a necessary prerequisite for expressing counterfactuality? If it is, tense errors are expected to indicate a non-adult like use of the counterfactual *wish*-construction. For example, if a child produces "I wish I have a dog", this use of *wish* with a present-marked or bare verb complement could indicate a simple desire, in line with non-counterfactual desire verbs like *want* or *hope*. Alternatively, it could be that the "fake" past is not a necessary component of the *wish*-construction, and that children map counterfactuality only to the word *wish* inside this construction. In this case, we expect that non-adult like utterances such as "I wish I have a dog" can be used in adult-like counterfactual contexts. To find an answer to these two questions, we extract all children's *wish* usages and code for present-for-past tense errors as well as the linguistic and situational context of counterfactual usage. To gain more insight into the overall properties of children's *wish*-productions, we also compare their productions against the adult input and provide an overview of various semantic and syntactic variables.

Second, we investigate the role transparency and dedication to counterfactuality plays in the acquisition of counterfactuality. It is generally thought, that linguistic

expressions that are dedicated to expressing some type of complex abstract meaning are easier to acquire than more opaque constructions expressing that same meaning with more complex form-to-meaning mapping (Rett & Hyams, 2014; Slobin, 1973; Weist et al., 1997). As laid out in the previous section, in English, wishes are dedicated counterfactual constructions, while conditionals are not. Does this then mean that counterfactual wishes are easier to acquire than counterfactual conditionals? If it does, we expect children to start producing counterfactual wishes before counterfactual conditionals, as the form-to-meaning mapping task for this construction is more straightforward and transparent. Such a finding would indicate that it is not just conceptual development that determines the onset of counterfactual constructions in children's productions, but that linguistic factors influence the onset of different constructions. If on the other hand, children start producing both constructions around the same time, or produce counterfactual conditionals before their wish counterparts, it suggests that linguistic transparency does not play as big of a role in the acquisition of these counterfactual constructions, and that any onset differences may be the result of other cognitive factors at play. In order to address this question, we look at the longitudinal counterfactual development of six children and compare the onset of counterfactual conditionals and *wish*-constructions.

Methodology

Part 1: Children's and Adult's Wishes and the "Fake" Past Tense

Selection Criteria & Preprocessing

We looked at natural child productions of counterfactual constructions by searching through English corpora of transcribed children's speech available on CHILDES (MacWhinney, 2000) using the database 'childes-db' (Sanchez et al., 2019), accessed through the statistical software environment R (R Core Team, 2021). All operations involving corpus extraction were performed using the analysis package 'childesr' (db version = "2020.1"). We selected corpora that contained data from typically developing monolingual children between 2;5-6;0, yielding 57 corpora (48 from Northern America, 11 from the United Kingdom) including data from 585 children in total. In Appendix S1 you can find an overview of all corpora used.

For these corpora, we extracted all utterances and calculated the amount of child and adult utterances. For this calculation, speakers with the speaker roles "Target Child", "Child", "Sister", "Brother", "Friend", "Playmate", "Girl" and "Sibling" were included in the child category, while all other roles we treated as adults. We noticed that a small proportion of the data (77551 utterances, 3.5%) across 15 different corpora (partially)

lacked age information for the children in the output of the 'get_utterances( )' function. Most missing age data (2.5%) could be recovered from a participant overview extracted with the function 'get_participants( )', and for the remaining 13 corpora that still (partially) lacked target child age information we manually recovered the information where available by retrieving it from the CHILDES Talkbank corpus description pages on https://childes.talkbank.org/access/. For two corpora (MacWhinney and Gathercole) age information was displayed incorrectly (based on the metadata available in the corpus descriptions), so this was manually corrected by extracting the info from the corpus description pages (Gathercole) or recalculating the children's ages based on the transcript file name (which was based on the age of the child 'Ross', so in order to calculate the age of his younger sibling 'Mark' we subtracted 01;10;25). We then filtered the data set to only include utterances from children who were within our age-range of interest 2;0-6;0 and proceeded to extract all child utterances containing the word *wish*. In total, 40 of the searched corpora contained child wishes. For these 40 corpora we also extracted all adult utterances (child-directed speech and speech addressed to other adults within the child's hearing), so we could compare *wish* usage between children and adults.

Exclusions

To get an idea of the proportion of *wishes* present in spoken child and child-directed speech, we calculated the percentage of *wish* utterances for the child and adult corpora. We extracted 478 child utterances containing *wish* (0.02% of 2,247,665 total utterances) coming from 40 different corpora, and 841 adult *wish*-utterances (0.03% of 2,934,114 total utterances). To make a fair comparison between the *wish*-productions of children and their input (child-directed or overheard adult *wish*-utterances), we only analyzed adult data from the 40 corpora we found child wishes in. For the adult utterances, we thus proceeded to exclude 70 utterances that came from corpora that did not yield any child wishes. For the child utterances, we excluded 10 child wishes for which the target child's age was unknown. For the remaining 468 child and 771 adult *wish*-utterances, we first excluded all utterances in which *wish* was used as a noun (e.g., "Do you want to make a wish?"), which resulted in 29 exclusions for child utterances and 129 for adults. Since the verb *wish* is counterfactual only if its complement is a full proposition (Iatridou, 2000, p.241), we then excluded utterances where *wish* did not embed a proposition. For children, this resulted in 58 exclusions (2 VP complements, e.g., "not wish to play"; 17 NP complements, e.g., "I wish you a happy birthday"; 5 PP complements, e.g., "I wish for daddy to come home" and 34 instances where there was no complement, e.g., "yeah I wish"). For adults we excluded 142 non-propositional complements (11 VP, 69 NP, 13 PP and 49 missing embeddings). Lastly, we excluded an additional 32 child wishes and 15 adult wishes for being a repetition

of either themselves or someone else. This means that in total 349 child wishes and 485 adult wishes remained for further analysis.

Coding Conventions

All *wish*-utterances were manually coded for various structural and semantic linguistic variables. Structural linguistic variables included: person of the main subject, i.e., 'the wisher' (*I* and *we* = 1st person; *you* = 2nd person; *Mommy, he* and *the cat* etc. = 3rd person; no subject = omitted; inaudible subjects = unclear), person of the subject of the *wish*-embedding (same coding convention as main subject) and subjunctivity of singular 1st and 3rd person inflections of *to be*: (*was* = not subjunctive; *were* = subjunctive). We also coded for morphological tense-marking errors, i.e., tense inflections that diverge from the grammatical form used by adults in this structural context. Errors were separated into those that lack past-tense marking in the *wish*-complement, i.e., 'present-for-past' (e.g., "I wish I **have** a banjo") or 'other' tense errors (e.g., "I wish we have **gotted** some mail" or "I wish I **be** a sheep"). For all present-for-past errors, we coded whether they were compatible with a 'bare verb usage' which could signal children having dropped *would/could* (e.g., "I wish I <could> do that"). If a child used an auxiliary ("I wish we **can** eat") or other inflected form ("I wish I'**m** already at home") we marked the error as incompatible with bare verb usage. As a first semantic variable, we coded for the temporal orientation of the embedded clause (e.g., "I wish I had a train" = present; "I wish I had gone to the train" = past; "I wish I would have a train" = future; "I wish want a train" = unclear). Unlike adults, who use *would* in future wishes (e.g., "I wish you **would**n't do that"), children's utterances sometimes lack *would* in wishes with a future temporal orientation (e.g., "I wish you stop bug me"). Since lexical aspect contributes to the temporal orientation (Iatridou, 2000), wishes without *would* were coded as present when containing stative verbs (i.e., *had, was, knew*) and as future when containing eventive verbs (e.g., *go, stop, got*). The tests used to determine stative or eventive lexical aspect came from (Dowty, 1986).

When children use *wish*-constructions, it is not assured that they understand that the *wish* statement is a counterfactual utterance, and thus indicates desires outside one's reach. For this reason, we coded for the evidence we have available as coders to determine whether the wish is used counterfactually or not. We inspected the discourse and situational context as available in CHILDES transcripts, to determine whether the wish demonstrated 'clear' counterfactual reasoning. Counterfactual wishes were considered to contain clear counterfactual reasoning when lexical material within the utterance itself contrasted the actual world with a counterfactual one (e.g.,: "I wish I asked for toast **instead**" = lexical contrast, "I wish you did**n't** do that" = contrast induced by negation, "I wish I **had gone** to the station" = contrast induced by undoing

past event), when the wish desired some sort of existential change, i.e., was counteridentical (e.g.,: "I wish I was a monkey"), or when the utterance was in clear contrast with prior context (e.g.,: "I wish I had green eyes." = contextual contrast when used in a context where it is clear the speaker does not have green eyes). Wishes that were indistinguishable from a regular desire usage (e.g., "I wish I had that horse" or "I wish you'd stop") were marked as having no evidence for counterfactuality, and wishes that were transcribed without context were coded as "inconclusive". Different than for children, we did code adult *wish*-utterances expressing desires such as "I wish I had a kitty" or "I wish I could talk to her" as contextual counterfactuals (without investigating the context it was uttered in) assuming adults always use *wish* counterfactually.

All data was coded by the first author (a fluent non-native speaker). A random subset of 100 child wishes were double-coded, by a native speaker of English (both coders were trained in semantics). An inter-rater reliability analysis was performed to determine consistency among raters in coding for the described variables, using overall accuracy, Gwet's AC1 coefficient (Gwet, 2008) and Cohen's kappa statistic (Cohen, 1968) to describe agreement confidence. While Cohen's kappa statistic is often used as the default method to determine intercoder reliability, it can underestimate reliability in cases where there is high agreement in unbalanced distributions (Gwet, 2008). Since several of our coding variables are unbalanced (e.g., temporal orientation is overwhelmingly present), AC1 is likely a more stable measurement. The exact values for all three different statistics for our coding are displayed in Appendix S2. The AC1 values for all variables exceeded 0.85 (very good agreement) except for the coding indicating the available evidence for counterfactuality (percent agreement = 61%, AC1 = 0.52, $\kappa = 0.49$), which corresponds to moderate agreement (Landis & Koch, 1977). Since coding involves assessments of grammatical and situational contexts, coders discussed all disagreements and came to a consensus for items where either coder missed contextual or grammatical cues in their original rating. The first coder (who coded the entire dataset) was more accurate and conservative than coder two (who only coded the subset). 19 items were judged in favor of coder 1, and 7 items in favor of coder 2. Of the 7 items judged in favor of coder 2, only 1 item was changed from formerly being judged counterfactual to no evidence for counterfactuality. A subset of 13 disagreements remained where coders diverged and contextual cues could be interpreted in different ways. Again, coder 1 tended to code more conservatively, as 11 of these items were categorized as having no or unclear evidence for context-supported counterfactuality, while coder 2 was willing to consider these utterances as true counterfactuals. The intercoder reliability values for evidence of counterfactuality post-discussion corresponded to very good agreement (percent agreement = 87%, AC1 = 0.84, $\kappa = 0.83$). Altogether, this suggests that the coding of our dataset might error on the side of not categorizing potentially counterfactual wishes as

counterfactual, rather than overestimating the instances of wishes displaying counterfactual reasoning.

Data Analysis

For each coded syntactic and semantic variable, we calculated the total count and percentage of occurrences per condition for children and adults separately. We converted the error data into a binary variable coding for the presence or absence of a present-for-past substitution, and modeled the probability of making present-for-past tense errors with a generalized linear mixed-effect model (GLMM, Baayen et al., 2008). We used the glmer-function from the 'lme4' package available on R to perform our analysis (Bates et al., 2015; R Core Team, 2021). We ran two separate models, one over the complete dataset with the fixed effect of age group (child versus adult) to investigate whether children produced more tense errors than adults, and one over the child data with age in months as a fixed effect, to investigate whether children's age predicts their error rate. For both models, we included speaker identity as a random effect to include the variation found among speakers in the model estimates. Inclusion of a random slope or the addition of corpus identity as a random effect did not improve the fit of our models. The model fit (logit link) was estimated by maximum likelihood using the default setting of LaPlace approximation. To test the contribution of our fixed effects we performed a likelihood ratio test comparing our model and a nested model leaving out the variable of interest. We used the 'DHARMa' package (Hartig, 2022) to test the dispersion of our models, and found no indication of overdispersion, which means that the residual variance of our data was not larger than our fitted models assume.

Part 2: Individual Development of Counterfactual Utterances

Selection Criteria & Pre-processing

To gain more insight into the individual longitudinal development of children, we selected children that produced more than 15 wishes. From the complete dataset, six children fit this criterion: Abe - Kuczaj corpus (Kuczaj, 1977), Adam - Brown corpus (Brown, 1973), Laura - Braunwald corpus (Braunwald, 1971), Mark & Ross - MacWhinney corpus (MacWhinney, 1991) and Thomas - Thomas corpus (Lieven et al., 2009). For these 6 children, we searched for counterfactual conditionals by extracting utterances containing *if* in combination with *would, should* and *could*. We proceeded to compare the emergence and development of their first spontaneous counterfactual conditionals against the development of their *wish*-utterances.

Exclusions

The 6 children with longitudinal data were responsible for 175 of the wishes. For those 6 children, we also extracted 341 conditionals with *would, should* or *could*. We excluded 63 utterances where *if* was used like *whether* and not as an *if-then*-conditional (e.g., "see if you could throw two dinosaurs in"), and 93 utterances that did not contain past tense inflection in the *if*-clause. We did this to exclude (non-counterfactual) hypothetical conditionals such as "Maybe you shouldn't be there, if you scare Ellen" or "What would the toilet be like if you flush it?". A total of 185 conditionals remained. Because we were interested in the relative onset difference between counterfactual wishes and conditionals, we decided to be conservative in our inclusion criteria of what consists as a counterfactual. For this reason, we excluded all wishes and conditionals that have future temporal orientation, since their status as counterfactual is debated (strictly speaking, the future cannot be counter-to-fact, as it has not yet occurred). We excluded 26 wishes like "I wish that you stop talking" and 80 conditionals like "Mom what would happen if I taked this balloon". We were left with 104 counterfactual conditionals and 149 wishes with present or past temporal orientation.

Coding Conventions

For the conditionals, we coded for the same semantic variables as we did for the wishes. For temporal orientation this included the categories 'present' (e.g., "they could fly if they had wings") and 'past' (e.g., "what would have happened if they didn't invent houses"). For evidence for counterfactuality this again included clear lexical counterfactuals (e.g., lexical contrast: "only if Super Man was **real** he could do it", negated contrast: "but if I was**n't** a chair I wouldn't be a chair", or past contrast: "yeah it could have lived if I would **have gotten** enough food for all of them"), counteridenticals (e.g., "if I were you I would eat food") or contextual counterfactuals (e.g.,: "if there were four one would hafta wait his turn", when used in a context where there are less than four). Conditionals that were indistinguishable from a regular hypothetical by contextual cues (e.g., "if I could get my boots on I could go inside") or uttered out of context were marked as "inconclusive". Since we excluded all conditional utterances that had present tense marking in the *if*-clause, we could not code for possible present-for-past substitutions.

Control Comparison

We hypothesized that present-for-past substitutions in the *wish*-complement could indicate children have not yet figured out that counterfactual utterances require the "fake" past morphology. Alternatively, it could be the case that some children have

yet to develop the ability to use the past tense in appropriate contexts, and generally avoid using the past tense in any environment, including (but not limited to) counterfactual utterances. To investigate this possibility, we determined for each child the period in which they made present-for-past tense errors and extracted all utterances containing the word *yesterday* during this period, as well as all utterances containing a past tense morpheme. This yielded 29 utterances with *yesterday*, and 7033 utterances with past tense. We looked for signs of productive tense marking by indicating whether children correctly inflected the main verb of utterances containing the temporal adverb *yesterday* with past, and whether their other past utterances included any instances of overregularization (e.g., "I telled daddy something").

Data Analysis

For the coded semantic variables, we calculated the total count and percentage of occurrences per condition for all six children. We created a new variable for evidence of counterfactuality that grouped evidence into binary bins as either "clear" (lexical, counteridentical or contextual evidence) or "unclear" (inconclusive or no evidence). We then compared per child the onset of wishes and conditionals per category, and calculated the difference between the two. We then averaged over children to get an idea of the average difference between the onset of wishes and conditionals. Since we only had data for six children, we discuss these results descriptively and conducted no further statistical analysis.

Results

Part 1: Children's and Adult's Wishes and the "Fake" Past Tense

In total we found 349 *wish*-constructions (*wish* + proposition) in children between the ages of 2 and 6. The first instance of the *wish*-construction we found at 25 months (12a). Like most early wishes, this wish expresses a desire about something mentioned or in direct proximity, e.g., wishing for a horse when looking at horses (12b).

Early Wishes (Like Desires)

(12a) Laura (2;1): I wish I had sandals. (Braunwald, 1971)
(12b) Becky (2;7): I wish I had a horsie. (Manchester: Theakston et al., 2001)

From these early uses, it is not clear whether children know that *wish* can only be used counterfactually, i.e., the desire is unlikely to be fulfilled. So it could be that children initially use *wish* like the regular desire verb *want*. Consistent with this possibility, we

sometimes encounter clear non-counterfactual wishes, where parents comment on the incongruency (13a/b).

Non-Counterfactual Wishes

(13a) Emily (2;1): but I wish that my cold is better. (Nelson, 1989)
Father: yeah you had no cold at all everything's fine.

(13b) Laura (3;2): I wish you were my mommy. (Braunwald, 1971)
Mother: I am your mommy.

For this reason, we coded for the evidence we have available as researchers to believe that a child's wish is produced with a counterfactual meaning in mind. We separated the wishes into 5 categories: wishes that seem clearly counterfactual based on lexical information inside the utterance (14-16), i.e., contrasting the actual world against the postulated one through undoing the past, negation or a lexical contrast (n=43, 12% of total wishes); wishes that indicate an existential change (17), i.e., counteridenticals (n=27, 7.8%); wishes that are in clear contrast with reality as deduced from the discourse context (18) (n=96, 27.5%); wishes that provide no evidence for counterfactuality (n=69, 19.8%) and wishes that are not interpretable without more context and therefore provide inconclusive evidence (n=114, 32.7%).

Clear Evidence for Counterfactuality

Lexical Evidence: Undoing Past

(14) [hearing train in distance] (Thomas: Lieven et al., 2009)
Thomas (3;1): I wish **gone** Burnage Station watch that train.
<later in recording Thomas comments "I'm missing all the trains">

Lexical Evidence: Negation

(15) [mother about to braid child's hair] (Hall: Hall & Tirre, 1979)
Mia (4;9): I wish you did**n't** hafta braid it.

Lexical Evidence: Lexical Contrast

(16) [child pretends it's his birthday] (Thomas: Lieven et al., 2009)
Thomas (4;2): Oh I wish it was my birthday today **really**.

Counteridentical (Change of Identity)

(17) Ross (4;2) I wish humans were **not** humans. (MacWhinney, 1991)

Contextual Evidence

(18) Father: You don't see bumblebees in the dark at all.
Mark (5;10) I wish that the lights were on. (MacWhinney, 1991)

Most wishes uttered by two-year-olds lack clear evidence for counterfactuality. The first *wish*-constructions that we coded as having clear evidence for a counterfactual intended meaning start around 35 months, this is true for all three categories (lexical, counteridentical and contextual). This finding is visually displayed in Figure 1 below.

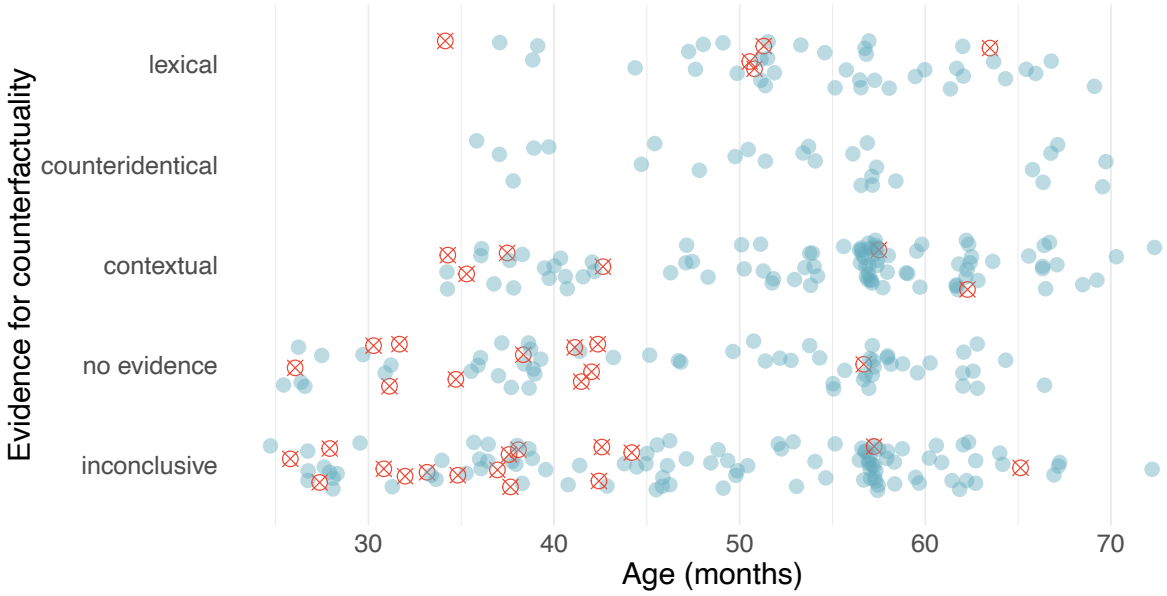

Figure 1. ***Breakdown of children's wishes. Plotted are all children's*** **wish-*productions (N=349) per evidence category for indicating counterfactuality (y-axis). Evidence that is lexical, counteridentical or contextual is considered to indicate clear counterfactuality, while no or inconclusive evidence indicates that it's unclear whether the utterance is used counterfactually. Red struck-through instances indicate the wish contained a present-for-past substitution (e.g., "I wish I have a horse"). The x-axis indicates the speaker's age in months.***

Do Children Produce Wish-Constructions Lacking the "Fake" Past Tense?

To investigate our first question about children's acquisition of the "fake" past tense, we analyzed the tense children used in the complement of the *wish*-constructions. The tense expression in the complement of children's produced wishes diverged from the adult-form in several ways. The most frequently occurring error (38 instances,

10.9% of total), was that of using present tense in the *wish*-complement rather than past tense. For adults, we only documented 4 instances where present tense was used inside the *wish*-complement (0.8% of the total amount of 465 adult wishes). Children are thus not matching their input when making these productive tense substitutions. We modeled the presence or absence of present-for-past errors with a generalized linear mixed-effects model (GLMM) including speaker identity as a random factor to investigate whether age group (child or adult) was a predictor of error rate. A likelihood ratio test comparing our model against a nested model without fixed effects, found that age group was a significant predictor of error rate ($\chi^2(2) = 4.75$, $p = .029$). The odds of making a present-for-past substitution increased for children compared to adults ($\beta = 17.5$, $z = 3.67$, CI = 3.79 - 80.7). Children's present-for-past errors are marked on Figure 1 with red crossed circles. For 15 of these errors, it is not entirely clear whether they are marking present tense or are the consequence of dropping 'would', since the present tense is indistinguishable from bare verb usage in these cases (19). For the remaining 26 errors it was clear that they indicated present tense, i.e., due to inflection (20a) or the choice of auxiliary (20b).

Present-for-Past Errors

(19) Adam (5;2): I wish I **have** a banjo like dis [this]. (Brown, 1973)

(20a) Sarah (3;6): I wish it'**s** valentine. (Brown, 1973)
(20b) Martin (3;6): I wish I **can** be on the tellie. (Wells, 1981)

Present-for-past errors are more common among younger children, especially those between age 2 and 3. With a second GLMM analysis considering speaker identity as a random effect, we confirmed that age in months is a predictor for children's error rate ($\chi^2(2) = 22.26$, $p < .001$). The odds of making a present-for-past mistake decreased with every month ($\beta = .911$, $z = -4.27$, CI = .088 - .951). When we group the present-for-past tense mistake counts by age group (per year) we observe indeed that most present-for-past substitutions occur before age four, and then drop off steeply. This decrease in error rate is displayed in Table 1.

Table 1. ***Count and percentage of present-for-past tense per age window***

Age Group	# children	# wishes	# errors	% of total
2-3	18	47	15	31.9
3-4	21	84	14	16.7
4-5	41	148	6	4.05
5-6	19	70	3	4.29
Total	99	349	38	10.9

Is Usage of the "Fake" Past a Prerequisite for Expressing Counterfactuality?

As can be observed in Figure 1, present-for-past errors were found in wishes for which we have no or inconclusive evidence that the wishes are used counterfactually (11 errors), as well as in wishes that were used in a context that was clearly counterfactual (27 errors). This suggests that the counterfactual's "fake" past is not a necessary component of the *wish*-construction.

Other Tense Errors

Besides making present-for-past errors, we also found that children sometimes express wishes about the past without using the past perfect (21a/b). A similar omission of the *had* auxiliary in the past perfect could be observed in example (14). Interestingly, we observed the same for adults (22).

(21a) Abe (4;4): Are we having pork chops for dinner? (Kuczaj, 1977)
Mother: Yes, that's what you asked for.
Abe (4;4): I wish I **asked** for toast instead.

(21b) [child did not have a nice time at his grandma's] (Thomas: Lieven et al., 2009)
Thomas (3;2): because I wish Mum **come** there.
Investigator: ah, did you miss your mum?

(22a) Mother: oh don't we wish we **had** that three weeks ago
(22b) Mother: don't you wish you **had** them when you were little
(Dickinson & Tabors, 2001)

Comparing Children and Adult's *Wish*-utterances

To gain more insight into the overall properties of children's *wish*-productions compared to their input, we compared the syntactic and semantic properties of the 485 adult and 349 child wishes. The proportion of child wishes (0.02% of all utterances) was overall comparable to the proportion of adult wishes across all corpora (0.03%), and we found that children and adults used wishes in a comparable way (Figure 2). The lion's share of wishes are produced from a 1st person perspective, and children use 1st person main clause subjects (83.7%) even more than adults (76.8%) (Figure 2A). This is compatible with the intuition that young children mostly talk about themselves. Similarly, their wishes are mostly about themselves as well, i.e., the embedded subject is first person (49.3%). In contrast, the embedded subject of adult wishes is balanced for person: 1st (36.3%), 2nd (31.0%) or 3rd (32.3%) person (Figure 2B). As for temporal orientation, we see that both children and adults mostly wish about the

present (children: 76.2%, adults 62.6%), followed by the future (children: 11.7%, adults: 24.9%) or the past (children: 4.0%, adults: 12.3%) (Figure 2C). However, it is possible that the counts for children's past and future wishes are somewhat underestimated, as they sometimes left out the past perfect *had* and future *would* auxiliary (discussed in prior section), making them hard to distinguish from the present (e.g., "I wish I come"). Below you find examples of wishes with present (23), past (24) and future (25) temporal orientation produced by children and adults. Counterfactual wishes with a future orientation often indicated a desire to change a habit or a future event that that has already been planned or whose outcome is determined (23a). The counterfactuality in these cases is the implication that this desire is unattainable. For adults, most of the future-oriented wishes express indirect requests (23b).

Wishes with Present Temporal Orientation

(23a) Ross (5;7): I wish you were a little kid then you would understand. (MW, 1991)
(23b) Mother: I wish it was real money. (Thomas: Lieven et al., 2009)

Wishes with Past Temporal Orientation

(24a) Abe (4;3): I wish we haven't come here. (Kuczaj, 1977)
(24b) Father: Boy, I wish Dallas had won the football game. (Kuczaj, 1977)

Wishes with Future Temporal Orientation

(25a) Matthew(4;7): I wish they'd give ya a fork instead of a spoon. (Gathercole, 1980)
(25b) Father: I wish you'd stop hitting. (MacWhinney, 1991)

When we break down the type of available evidence for counterfactuality, we see that children and adults also pattern alike. Most wishes were judged to be clearly counterfactual based on contextual evidence (children: 27.5%, adults: 47.1%), followed by lexical evidence (children: 12.3%, adults: 19.8%) and counteridenticality (children: 7.7%, adults: 2.6%) (Figure 2D). The fact that we observe less contextual wishes for children than for adults could be a consequence of the fact that we conservatively coded for desire-like wishes in children (e.g., "I wish I had a horse" without clear supporting contextual evidence for counterfactuality was coded as having "no evidence") while we assumed that adults use these wishes as true counterfactuals. Last, we compared the counts of subjunctive usages, by looking at 1st or 3rd person singular conjugations of *to be* in both children (n=54) and adults (n= 67) and coded for whether these were marked with subjunctive (*were*) or not (*was*). We found that adults somewhat rarely used the subjunctive form (19.4%), and for children we observed only 3 instances (5.6%) (Figure 2E). For children, all subjunctive wishes came from the North American corpora. For adults, we found only 2 subjunctive wishes (2.9%) in the United Kingdom corpora. This difference could be due to the fact that our sample

from the North American collection was bigger and skews historically older than our UK-sample. Examples of wishes with and without subjunctive mood are provided below for children (26a/b) and adults (27a/b).

Child Wishes with and without Subjunctive

(26a) David (4;9): I wish I **were** in a car. (Hall: Hall & Tirre, 1979)

(26b) Joey (4;9): Yes, I wish I **was** a spoon. (Hall: Hall & Tirre, 1979)

Adult Wishes with and without Subjunctive

(27a) Father: I wish it **were** but it's not. (Clark, 1979)

(27b) Adult: I'll tell you I wish it **was**. (Hall: Hall & Tirre, 1979)

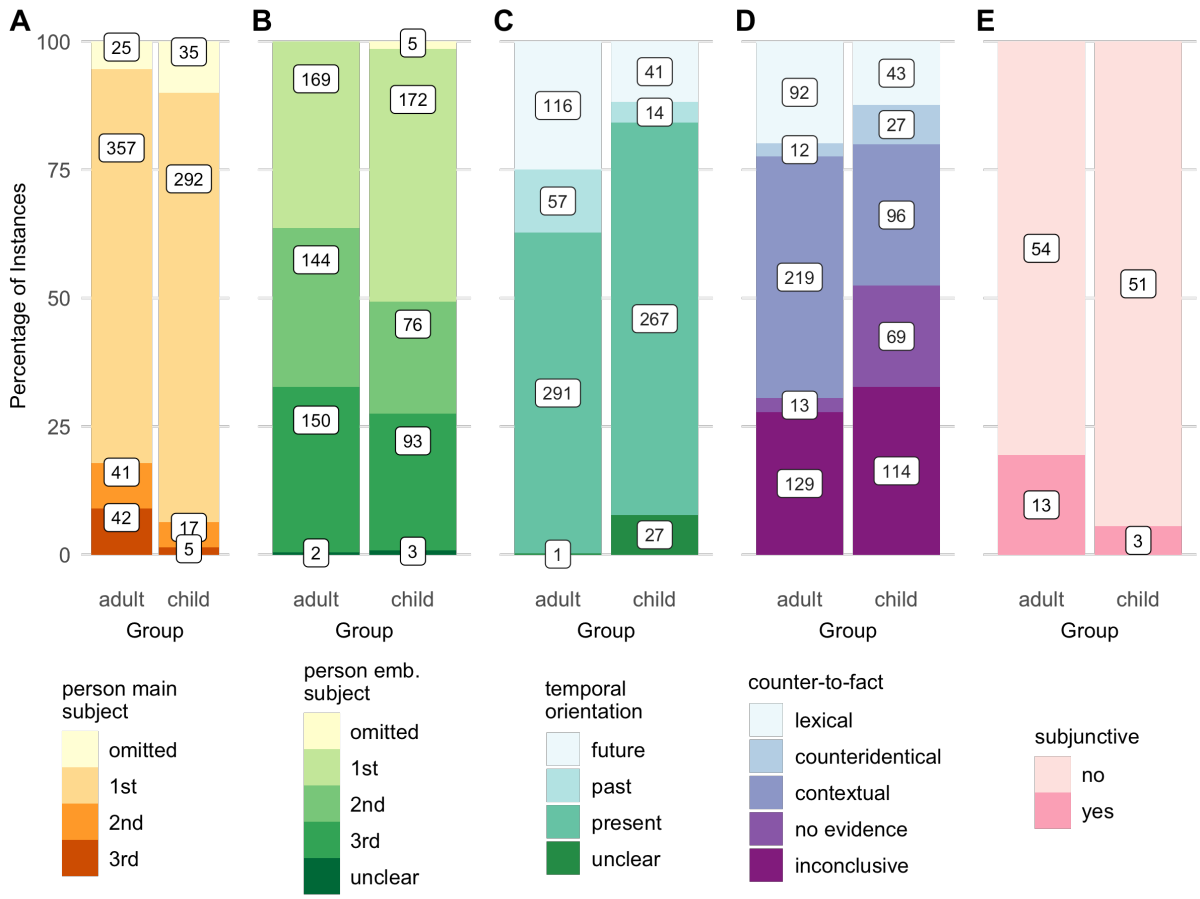

Figure 2. ***Overview of syntactic and semantic properties of child and adult* wish-*constructions. Count (total A-D = 465 for adults and 349 for children, E = 67 for adults and 63 for children) and Percentage (y-axis) of instances.***

Part 2: Individual Development of Counterfactual Utterances

To understand the developmental trajectory of individual children, we investigated the emergence of counterfactual wishes and conditionals in the output of the six children we had enough longitudinal observations for. We investigated both the clarity of the counterfactual (whether there is evidence that indicates the expression is used counterfactually) and whether the child made any present-for-past tense mistakes. The individual development of each child is displayed in Figure 3.

Are Counterfactual Wishes Produced before Counterfactual Conditionals?

The age at which the 6 children started to use the *wish*-construction varied from 2;01 (25 months) to 4;00 (48 months). The age of the first clear counterfactual wish usages fell within a later range between 2;10 (34 months) and 4;11 (59 months). For (both clear and unclear) counterfactual conditionals the onset range was 2;8 (32 months) – 4;4 (52 months). Examples of children's first counterfactual conditional constructions are provided in (28a/b). The onset of the first wish/conditional was often followed with subsequent usages of the constructions within as short period of time. Repeated uses of a new construction within a short period of time is considered to be a signal of productivity (Snyder, 2007; Stromswold, 1990). The first counterfactual wish with past temporal orientation was produced by Thomas at age 3 (29a) and the first counterfactual conditional with past temporal orientation by Abe at age 3;8 (29b). Half the children produced their first past counterfactual construction before the age of 4. All past counterfactual usages are indicated on Appendix Figure S3.

First Counterfactual Conditionals

(28a) Laura (2;8): If a really hole was in here, then I would cry for new pants. (Braunwald, 1971)

(28b) Mark (3;7): We could fly if we had wings well, we don't so we can't, but I know one way how you can fly (MacWhinney, 1991)

First Past Counterfactuals

(29a) Thomas (3): Your wish you gotten on this train. (Thomas: Lieven et al., 2009)

(29b) Abe (3;8): no he would have smelled really bad if he died (Kuczaj, 1977)

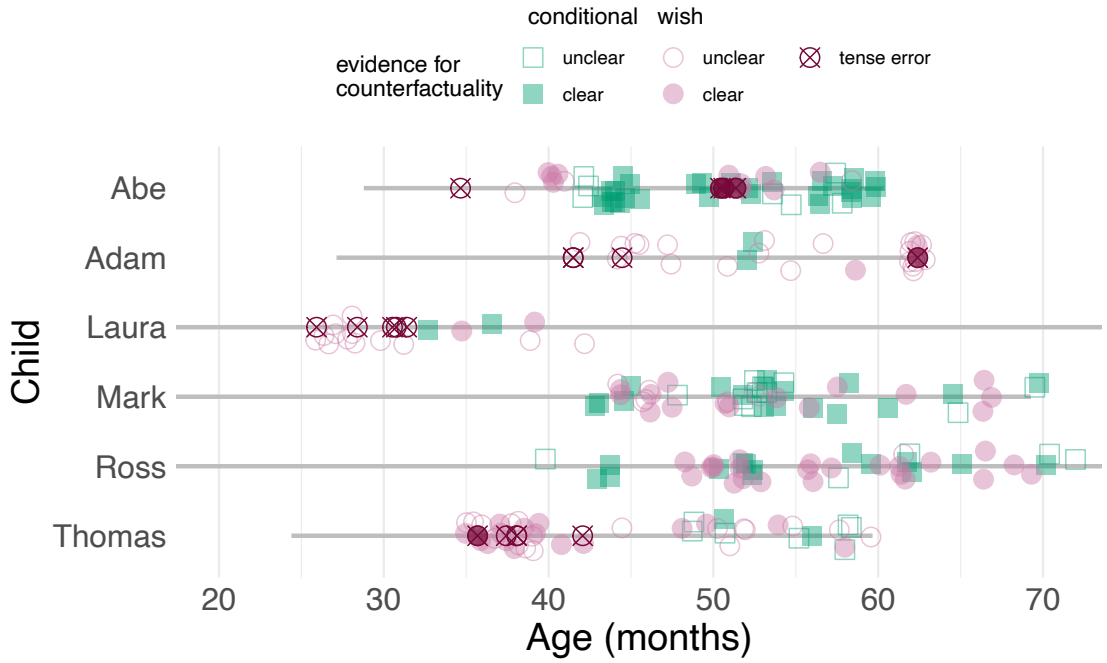

Figure 3. ***Counterfactual conditionals (green squares) and wishes (pink circles) for each child (y-axis) with age indicated in months on the x-axis. Filled shapes indicate that the evidence for counterfactuality is clear, empty shapes indicates the evidence is unclear. Struck-through wishes indicate they contained a tense error in the form of a present-for-past substitution. Grey line indicates recording span. See Appendix S3 shows which of these wishes were used with past temporal orientation.***

To quantify the average difference between the onset of wishes and conditionals for each child, we compared the onset per evidence category (unclear and clear) and calculated the average values. This numerical comparison is displayed in Table 2. On average, children started producing counterfactual wishes before conditionals, though the difference is more prominent if we consider unclear counterfactuals (4.7 months earlier) than if we compare the average onset of clearly counterfactual constructions (0.6 months earlier). However, there is a lot of individual variation in the presence and size of the gap between the onset of the two constructions. 4/6 children start using (unclear) counterfactual *wish*-constructions before they use conditional constructions (difference ranging from 6.6 – 13.6 months), Mark started using both constructions around the same time, and Ross was the only child who used counterfactual conditional constructions before wishes. Comparing clear counterfactual wishes and conditionals, we find that only 2 children (Abe and Thomas) start using wishes before conditionals (difference 3.6 and 15.6 months). For Mark and Laura they

emerge around the same time, and for the last 2 children it seems that clear counterfactual conditionals precede the onset of clear counterfactual wishes (for Adam by 6.4 months, and for Ross by 5.2 months).

Table 2. ***Overview of children's age (in months) at time of first (clear) counterfactual wishes and conditionals (cond.)***

Child	Age 1st wish	Age 1st cond.	Age 1st cond - wish	Age 1st clear wish	Age 1st clear cond.	Age 1st clear cond. - wish
Abe	34.7	42.1	7.4	39.9	43.5	3.6
Adam	41.5	52.4	10.9	58.8	52.4	-6.4
Laura	25.8	32.4	6.6	34.6	32.4	-2.2
Mark	44.6	42.8	-1.8	44.6	42.8	-1.8
Ross	48.3	39.9	-8.4	48.3	43.1	-5.2
Thomas	35.5	49.1	13.6	35.5	51.1	15.6
Average	38.4	43.1	4.7	43.6	44.2	0.6

Present-for-Past Errors

We observed that most present-for-past tense errors occur in the early stages of the emerging *wish*-construction, regardless of the age the child started using the construction. It should be noted again that we found present-for-past errors in both unclear (n= 13) and clear (n= 5) counterfactual wishes. Two children (the siblings Mark and Ross) never made a present-for-past substitution in their wishes, and two children (Laura and Thomas) made multiple present-for-past substitutions when they started using the *wish*-construction, and then stopped making them before their first counterfactual conditionals emerged. This means that for 4/6 children, present-for-past substitutions did not occur after the onset of the counterfactual conditional. Adam and Abe complicate this picture. Adam initially stopped making tense errors around 45 months (about 7 months before his first counterfactual conditional), but then slipped up at age 5;2 (62 months). Since this also marked the end of his recording period, it is unclear whether he made any more present-for-past substitutions after this occurrence. Abe is unique in making present-for-past substitutions when both his counterfactual wishes and conditionals are productive (at age 4;3, 51 months).

Productive Tense Marking

Lastly, we examined children's overall productive past tense usage during the period where they made present-for-past errors in counterfactual constructions. We did this to investigate whether their present usage in counterfactual contexts is due to a

variable or inconsistent use of past tense marking in general. For each child, we recorded the successful and unsuccessful instances of past tense marking in the context of the temporal adverb *yesterday*, and the period over which they exhibit overregularization. This is displayed in Figure 4. For all children, we found indications of productive past tense usage (both from overregularization and past tense usage with *yesterday*) outside counterfactual contexts during their error period. While Abe used present inflection once in a *yesterday* utterance at the onset of his error period, he later correctly started using past tense in this environment. For Laura we found multiple present tense errors with *yesterday* before 28 months. This indicates that some of Abe's and Laura's earliest errors could be due to a general immature use of the past tense.

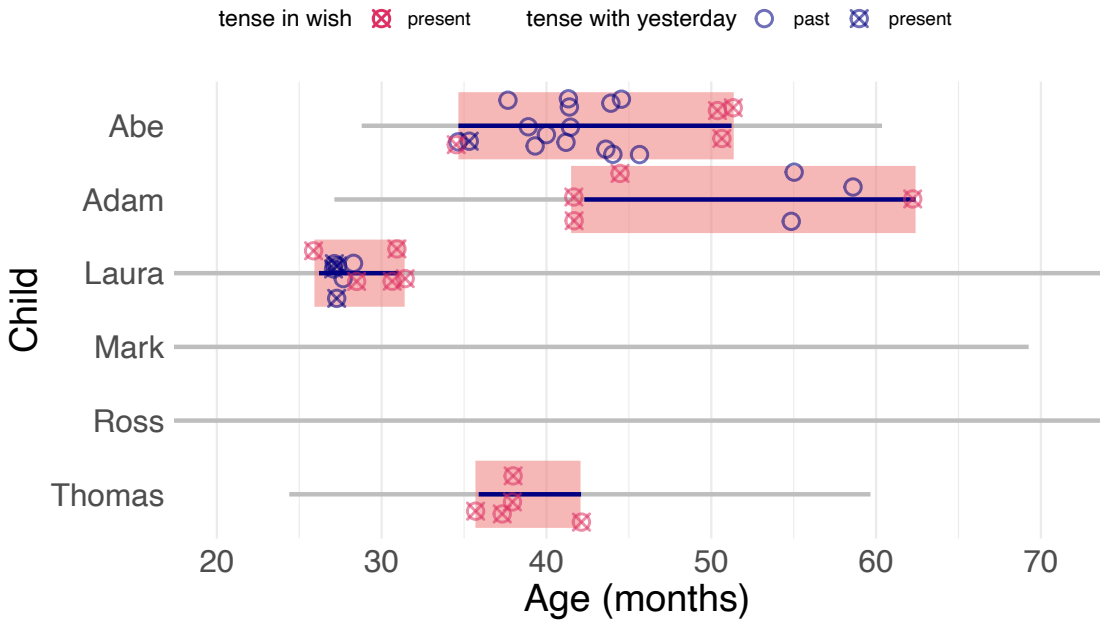

Figure 4. ***Overview of children's productivity with the past tense. Pink rectangles indicate the time span in which individual children (y-axis) produced wishes with tense errors. Each instance of a present-for-past error in wishes is displayed as a pink crossed circle. Within the error span, we plotted the tense of utterances with yesterday with blue circles (crossed means present tense was used). Blue lines within the error span indicate the time span over which we found instances of overregularization (e.g., "I putted"). Grey line indicates recording span. See Appendix S4 for corresponding numeric information in table format.***

Discussion

In this paper we examined the first language acquisition of counterfactual utterances, with our main focus on the development of children's wishes. We conducted corpus research that consisted of two parts. First, we extracted all child and adult utterances containing the word *wish* from eligible corpora on CHILDES and coded for various syntactic and semantic variables. We provided a detailed overview of children's *wish*-constructions and compared the properties of *wish*-utterances produced by children and adults. Second, we took a closer look at the longitudinal linguistic development of 6 children and investigated the maturation of their counterfactual language, comparing their usage of counterfactual wishes and conditionals. With this research we addressed two questions related to form-to-meaning mapping. First, we asked whether children go through a stage where they map the counterfactual's "fake" past morpheme to actual past temporal orientation, and consequently generate present tense inflected verbs in their own productions of present counterfactual constructions. Second, we asked whether linguistically more transparent counterfactual constructions (wishes) are acquired before the more complex counterfactual conditional. The combined results of our corpus work show there are indeed children that go through a stage where they productively use present tense in the complement of counterfactual wishes, diverging from their adult input. We also found that the average age children start using wishes is 3;2 (onset ranging between 2;1 and 4;0), which is before the average onset of counterfactual conditionals around age 3;7 (range between age 2;8 and 4;4). These general findings are compatible with the view that linguistic transparency plays a role in the acquisition of counterfactuality. However, the longitudinal data also illustrates that each child has a unique developmental trajectory, which leads to differences in when individual children start speaking counterfactually and which constructions they initially use. Below we discuss our questions and findings in more detail, as well as limitations to this work and suggestions for future research.

Children's Counterfactuals Contain Present-for-past Errors

The first question addressed in this study was whether children go through a phase where they make tense-marking mistakes in the complement of counterfactuals. Acquiring counterfactual utterances requires discovering that the past tense in its complement/antecedent is "fake" and marks counterfactuality instead. This mapping between counterfactuality and the past tense morpheme is thought to require complex semantic operations (Iatridou, 2000; Karawani, 2014; Ritter & Wiltschko, 2014). Since children have to see through the "fakeness" of the past tense in order to learn this mapping, we hypothesized that children would productively form counterfactual

wishes that have a present tense (rather than past tense) marking on the embedded matrix verb, as this aligns with the temporal orientation of a present wish. Indeed, we found that children make a substantial amount of past tense errors (11% of total wishes), most of them between ages 2 and 4 (75.6%). We observed these errors both in wishes that were judged to have clear evidence for a true counterfactual usage, and in wishes that were less clearly adult-like for counterfactuality. The fact that we observed present tense in clear counterfactual wishes, suggests children do not need the "fake past" to express counterfactual meaning. Instead, it's possible they mapped counterfactual meaning directly to the verb *wish*. The fact that you can express counterfactual meaning without relying on the "fake" past is consistent with cross-linguistic typology for counterfactual constructions: there are languages that express counterfactuality without making use of tense-marking, e.g., Mandarin Chinese (Jiang, 2019; Yong, 2016). This is also consistent with the fact that we observed some past counterfactuals productions with only one layer of past marking (21/22).

One could wonder whether the tense errors found in the complement of *wish* could be due to children not yet having acquired the past tense form in general. This seems unlikely, as children generally have productive past tense usage before age 3 (Brown, 1973; de Villiers, 2000; Kuczaj, 1977). For example, Abe acquired past tense with a 90% success rate by age 2;9, right before his first counterfactual wishes occurred (Kuczaj, 1977). For three children, we showed that they display clear signs of productive tense marking during the period in which they make tense marking errors in counterfactual constructions. They use past tense in utterances with *yesterday* and overregularize the past tense morpheme to irregular verbs, showing productive usage. Only for the youngest *wish*-producer, Laura, do we find some tense marking errors outside counterfactual constructions, suggesting that her earliest errors (before 28 months) might be partially due to a general problem with applying past tense inflection. Another explanation for present-for-past tense errors could be that children actually use a bare verb construction (rather than present tense) because they treat *wish* analogously to the semantically related desire verb *want* (which selects for a non-finite complement). Or they may be omitting the auxiliary verb *would* in future wishes, which is plausible as it is often pronounced in reduced form. However, from the 41 errors only 15 (37%) are compatible with a bare verb/dropped *would* explanation, which suggests that this cannot be the sole reason for children's past tense errors. Most tense errors in wishes are thus due to productive present tense marking, counter to the examples children receive in their input.

Children's Start Producing Wishes before Conditionals

The second aim of this corpus study was to find out whether counterfactual wishes are acquired before counterfactual conditionals. Since *wish* is a dedicated marker of counterfactuality in English when it associates with propositional content, we hypothesized that counterfactual wishes would be easier to acquire than counterfactual conditional constructions. Indeed, we found that children generally produced the *wish*-construction either before or simultaneously with counterfactual conditionals. Counterfactual wishes mostly seem to emerge between age 2 and 4, while counterfactual conditionals emerge between age 2.5 and 4.5. However, it should be noted that there is a wide range of variation between children and the presence and size of the gap between the onset of wishes and conditionals. Some children acquire wishes before conditionals with an onset gap ranging from half a year to a year, while other children start using both constructions around the same time. We also indicated the need to be cautious not to equate using the *wish*-construction with having the ability to reason counterfactually about the world. Indeed, children's early wishes do not always seem adultlike. Especially children under age 3 seem to use the *wish*-construction to express direct desires (much like the verb *want*), and it is unclear whether they know *wish* can only be used when you believe this desire to be counterfactual. We start finding clear indication of wishes with unequivocal counterfactuality (based on contextual and lexical information) between age 2.5 and 5, and for counterfactual conditionals this range is 2.5 to 4.5. While some children's samples display a long gap between using clear counterfactual wishes and conditionals (ranging from 3-16 months), other children's samples use clear counterfactual conditionals before wishes (difference ranging from 2 to 6 months). However, it should be noted that the distinction of "clear" versus "unclear" completely relied on the coder's interpretation. As discussed before, the coding was done conservatively to reduce the chance of overinterpreting the counterfactuality of an utterance, which thus means we might be underestimating the counterfactuality of utterances we deemed "unclear". If we take our findings at face value, however, they suggest that the *wish*-construction is generally acquired before or simultaneous with the counterfactual conditional. While it's not clear whether children always use the construction in an adultlike way, at least some children also display this pattern in the onset of clear counterfactual wishes and conditionals.

Crucially, it is unlikely that the difference we observe between the acquisition of counterfactual wishes and conditionals is solely due to the difference in causal structure (i.e., the *if…then* relationship in conditionals). While intuitively, conditionals are harder to process because they rely on linking two clauses with a causal relation, we actually find that most children start producing the non-counterfactual conditional structure (e.g., hypothetical future) before age 3 (Kuczaj & Daly, 1979; Reilly, 1982).

Since most children start producing wishes after age 3, the difficulty of the conditional structure itself is not holding them back from acquiring the counterfactual conditional at that time. Another question that might arise is how accurate the ages of acquisition are that we found for the different constructions. Since corpus data is sampled and only includes a small proportion of the actual spoken input and output of the child, there is always the risk that we have missed earlier occurrences of either the wishes or conditionals. However, since the density of the used corpora was high (recording 1-5 times a month), the sample size of the observed constructions fairly similar (we observed 149 wishes and 104 conditionals) and the onset difference we observed quite large (6 to 12 months), we believe it to be unlikely that the onset differences we observed are solely due to unequal sampling.

Individual Variation

The development of counterfactual language depends on an interplay of different factors, including the development of specific grammatical structures (e.g., the past tense, conditional constructions and embedding), the development of counterfactual reasoning (e.g., thinking about possibilities and keeping in mind conflicting information), the transparency of different constructions and the consistency of children's input. Each of these factors can influence the onset of counterfactual constructions in children's speech, and individual variation between children is expected given these different forces that are at play. In this paper, we specifically focused on the role of linguistic transparency on the acquisition of counterfactuality, predicting that the complexity involved with acquiring the counterfactual's "fake" past tense may lead to present-for-past errors in children's early counterfactual productions, and that counterfactual wishes are easier to acquire than counterfactual conditionals. We found evidence supporting these ideas: from the six children we have longitudinal data for, four were found to make productive present-for-past errors and produce wishes before counterfactual conditionals. However, it is important to reflect on the fact that not all children did. In particular, the counterfactual development of the brothers Ross and Mark (MacWhinney, 1991) followed a strikingly similar trajectory to each other that was distinct from the developmental pattern we observed in the other children. Despite their age difference, both children started producing their first counterfactual constructions around age 3.5, both children almost immediately produced these counterfactual constructions in clear adult-like counterfactual situations, both children used counterfactual conditionals before or simultaneously with counterfactual wishes, and both children have not been found to make any present-for-past errors. Perhaps, this similarity can be attributed to their shared genetic make-up and/or the fact that they grew up under similar circumstances, e.g., receiving a comparable amount and quality of speech input. But how come the brothers'

counterfactual development differs from that of the other children in our sample? One possibility is, that Ross and Mark were somewhat precautious learners that only started using counterfactual constructions once they figured out the exact meaning and mapping (à la Snyder, 2007). Linguistic transparency may have played a role in their early counterfactual development behind the scenes, but any form-to-meaning mapping difficulties were resolved by the time they actually started using these constructions in their own speech. This could explain why the brothers started using counterfactual constructions fairly late compared to some other children, as well as why they immediately started using their counterfactual constructions with an appropriate use of the "fake" past tense in clear adult-like counterfactual contexts. Alternatively, it could be that the brother's input contained particularly salient examples of counterfactual constructions being used in counterfactual situations, facilitating the form-to-meaning mapping task from the beginning, or that cognitive factors were at play. Possibly, the brothers developed the cognitive ability to reason counterfactually after the linguistic mechanisms underlying counterfactual constructions were already in place, while other children developed counterfactual reasoning abilities before they fully acquired the linguistic structures supporting counterfactual language. In the next section we discuss the interplay between linguistic and cognitive complexity in some more detail.

Untangling Linguistic and Cognitive Complexity

As discussed thoroughly in the introduction, the acquisition of counterfactuality relies on both linguistic and cognitive development. On the one hand, children need to develop a concept of counterfactuality and the cognitive abilities to support counterfactual reasoning. On the other hand, children need to acquire the linguistic structures that express counterfactuality in their language, and map counterfactual meaning onto these linguistic expressions. Can we untangle the influence of cognitive complexity and linguistic complexity in the acquisition of counterfactuality? In this study, we showed that children start producing present counterfactual wishes and conditionals as early as age 2, which corresponds to early observations by Bowerman (1986). However, we also noted that children only start using these constructions in contextually salient counterfactual contexts around age 3, suggesting that these initial constructions might precede the concept of counterfactuality. At age 3, children also start producing counterfactual wishes and conditionals about the past, although their productions are not adult-like, lacking the past perfect construction.

From corpus data alone, we cannot know whether children have acquired the ability to reason counterfactually at this age, but the way they use counterfactual constructions spontaneously are suggestive that they do. Why then, do 3-year-old children

often fail counterfactual comprehension tasks? While comprehension research often reports that 4-year-olds, but not 3-year-olds have developed the ability to reason counterfactually (Guajardo et al., 2009; Nyhout & Ganea, 2019; Riggs et al., 1998; Robinson & Beck, 2000), this type of research mostly considers past counterfactual conditionals. Is it possible, that children struggle with the past construction specifically, rather than counterfactual reasoning itself? Our results suggest they might, three-year-olds spontaneously use counterfactual constructions undoing past events, but not yet using a past perfect, e.g., "No he would have smelled really bad if he **died**". In fact, we found the same pattern in adults, a phenomenon that has been extensively described by Crutchley (2004, 2013). Even adults, sometimes use a single past marker for counterfactuals with past temporal orientation, instead of the double past marking, e.g., "If they **took** my wages into consideration, they would have let us buy next door even" (Crutchley, 2013, 15). In fact, the canonical 'past counterfactual construction' only accounted for one third of the variety of structures adult speakers used to talk counterfactually about the past (Crutchley, 2013, p. 456). This variability, in combination with the fact that past counterfactuals are a lot less common than present counterfactual constructions in spontaneous speech, does suggest the linguistic complexity of the past counterfactual construction could contribute to children's difficulty understanding these types of constructions. However, this idea requires future exploration.

Bootstrapping of the "Fake" Past Tense

When looking at the longitudinal data of six children we observed a noteworthy, yet unreliable pattern we will speculate about. For 4/6 children, present-for-past substitutions did not occur after the onset of the counterfactual conditional. For half of them, this was simply because they were never observed making any present-for-past errors. This finding is compatible with a scenario where children first start to use the counterfactual *wish*-construction without having discovered the relation between the "fake" past and the expression of counterfactual meaning. Then, once children successfully figure out this mapping, they cease using the present tense in wishes. Since they have now acquired the mapping between "fake" past and counterfactuality, they can start observing it in other environments, i.e., the counterfactual conditional, allowing them to attribute counterfactual meaning to the conditional construction as well. In other words, it is possible that the dedicated *wish*-construction in English bootstraps the acquisition of the "fake" past, which in turn facilitates learning the counterfactual conditional. However, there are children (i.e., Abe and Adam) that do not follow this pattern. Abe starts using the counterfactual conditional before the end of his present-for-past error period. Notably, Abe also participated in a longitudinal study investigating the development of hypothetical conditionals (Kuczaj & Daly, 1979), so this could have accelerated his acquisition of the counterfactual conditionals

compared to other children. For Adam, the recordings ended before we could determine whether his unexpected present-for-past error at age 5 was an unremarkable slip-up or a continuation of his error period. A fully analogous argument has been made for dedicated epistemic adverbs like *maybe* as potentially helping children learn the more complex variable-meaning modal verbs like *may* or *must* (i.e. auxiliaries with both epistemic and deontic (or other root modality) meanings). However, since we only had longitudinal data available for a small subset of children, we cannot draw any hard conclusions from this sample about the bootstrapping hypothesis.

Considerations and Future Directions

In this paper, we have investigated the acquisition of counterfactual constructions from a form-to-meaning mapping perspective and argued that the linguistic complexity of the counterfactual constructions contributes to their relatively late acquisition. The thought that complexity of linguistic structures plays a role in the emergence of such structure in children's speech is by no means original (Cournane, 2021; Reilly, 1982). For example, Reilly summarizes the relationship between cognitive and linguistic complexity as follows: "*Language and cognition are independent yet interactive systems where cognition is basically responsible for the sequence of acquisition, but it's the linguistic complexity of a structure that determines when that structure will appear in a child's grammar*." (Reilly, 1982, p.xi). We view the process of acquiring counterfactual constructions in a similar way. In order to communicate counterfactuality, children need to have reached certain developmental milestones, including the abilities of holding multiple possibilities in mind (Leahy & Carey, 2019) and considering a false possibility temporarily true (Beck, McColgan, et al., 2011; Byrne, 2007). However, the onset of a linguistic construction also depends on various factors, including its linguistic complexity. Specifically, we argue that constructions that are dedicated to expressing counterfactuality (propositional wishes in the case of English) should help children to detect these constructions in their input, and in the case of English, help discover the link between counterfactuality and the "fake" past tense.

In the future, this hypothesis can be tested by doing comprehension studies investigating children's understanding of counterfactual wishes and conditionals, and by looking at other dedicated counterfactual constructions in other languages to compare their acquisition onset with that of multi-purpose constructions. If having a dedicated counterfactual construction (such as the *wish*-construction) indeed facilitates the discovery of the mapping of counterfactual meaning to the "fake" past, we expect this pattern to hold for other languages as well. As mentioned before, the amount of data we extracted was relatively small, considering that we looked through all eligible corpora available on CHILDES. Since the natural occurrence of counterfactual

constructions is fairly uncommon, future research directly targeting questions about "fake" past-tense usage might want to consider an elicitation task to elicit counterfactual speech, especially when working with languages that have relatively little (or no) corpus data available.

Conclusion

All in all, our findings are compatible with the view that counterfactual constructions are not only challenging because they require complex reasoning, but also because they involve complex form-to-meaning mapping. First, we showed that the counterfactual's "fake" past tense is a complex component of the English counterfactual construction, and that present-for-past tense errors occur in children's speech suggesting that children's initial representation of counterfactual wishes does not always include the obligatory "fake" past marking. However, these non-adult-like productions appear in appropriate counterfactual contexts, suggesting that the "fake" past is not a necessary prerequisite for expressing counterfactuality. Second, we found evidence that children generally acquire the more transparent counterfactual *wish*-construction before counterfactual conditionals. Studies solely focusing on the acquisition of counterfactual conditionals might thus underestimate children's ability to engage in counterfactual reasoning, confounding cognitive with linguistic complexity. However, these results are based on limited data and require larger consideration of the issue. Future research should investigate what role linguistic complexity plays in children's comprehension of counterfactual constructions, as well as how dedicated and undedicated counterfactual constructions are acquired in other languages.

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Data, code and materials availability statement

All data, code and materials related to this study are publicly available for researchers to examine and use. If any of the links provided here become unavailable, you can request access through contacting the first author of this paper (maxime.tulling@umontreal.ca).

All used corpus data is freely available on the CHILDES Talkbank (MacWhinney, 2000): https://childes.talkbank.org/, or can be accessed through the childes-db project via R, Python or MySQL (Sanchez et al., 2019): https://langcog.github.io/childes-db-website/. The coded data, complementary datafiles and all scripts related to corpus extraction, data processing, statistical analysis and visualization are available at: https://osf.io/h2jm3/.

Authorship and Contributorship Statement

MT conceived of the study, designed the study and wrote the first draft of the manuscript. AC contributed to the design of the study and revised the manuscript. All authors approved the final version of the manuscript and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Appendices

S1: Overview of Used Corpora

Table S1. ***Overview of all corpora used: corpus name, collection, children's age range (in months), the number of children documented, the number of utterances and wishes found separated by children and adults, and corpus citation. Shaded rows indicate corpora that did not include any*** **wish*****-utterances from children.***

Corpus	Collection	Min Age	Max Age	N	N Child Utterances (N wishes)	N Adult Utterances (N wishes)	Citation
Belfast	Eng-UK	24.1	54.2	11	25781 (1)	80899 (28)	(Henry, 1995)
Bliss	Eng-NA	40.0	64.0	4	1302 (1)	1011 (0)	(Bliss, 1988)
Bloom	Eng-NA	19.2	37.7	2	31970 (0)	36071 (NA)	(Bloom et al., 1974)
Bohannon	Eng-NA	36.0	36.0	3	4057 (0)	6737 (NA)	(Bohannon & Marquis, 1977)
Braunwald	Eng-NA	15.0	84.5	1	53311 (30)	33970 (21)	(Braunwald, 1971)
Brown	Eng-NA	27.1	62.4	2	96747 (32)	86172 (32)	(Brown, 1973)
Clark	Eng-NA	26.5	38.1	1	18185 (2)	24283 (9)	(Clark, 1979)
Compton-Pater	Eng-NA	8.0	38.7	3	25169 (1)	0 (0)	(Pater, 1997)
Cruttenden	Eng-UK	17.6	46.1	2	3061 (0)	0 (NA)	(Cruttenden, 1978)

Davis	Eng-NA	6.4	36.1	6	97128 (3)	0 (0)	(B. L. Davis & MacNeilage, 1995)
Davis-CDI	Eng-NA	8.9	35.7	4	3763 (3)	0 (0)	(Davis et al., 2018)
Demetras1	Eng-NA	24.9	47.9	1	6971 (1)	8293 (0)	(Demetras, 1989)
Demetras2	Eng-NA	26.5	33.8	1	9411 (3)	11119 (5)	(Demetras et al., 1986)
EllisWeis-mer	Clinical-MOR	30.0	66.0	13	71074 (11)	102876 (11)	(Weismer et al., 2013)
ENNI	Clinical-MOR	48.4	119.8	1	29269 (1)	650 (0)	(Schneider et al., 2006)
Evans	Eng-NA	71.3	71.3	1	4787 (0)	10 (NA)	(Evans, 1985)
Fletcher	Eng-UK	36.0	86.4	48	22073 (2)	26251 (0)	(Johnson, 1986)
Forrester	Eng-UK	12.0	60.0	1	7536 (2)	8919 (3)	(Forrester, 2002)
Garvey	Eng-NA	34.0	67.0	62	10338 (26)	9 (0)	(Garvey & Hogan, 1973)
Gathercole	Eng-NA	33.0	78.0	14	6724 (11)	2743 (1)	(Gathercole, 1986)
Gelman	Eng-NA	18.0	84.2	2	52281 (19)	126964 (32)	(Gelman et al., 1998, 2004, 2014; Jipson et al., 2016)
Gleason	Eng-NA	26.5	62.3	22	20247 (3)	38880 (6)	(Bellinger & Gleason, 1982)
Goad	Eng-NA	17.6	42.6	2	8853 (1)	0 (0)	(Parsons, 2006)
Gopnik	Eng-NA	24.0	64.7	1	3754 (1)	6347 (0)	(M. Gopnik, 1989)
Haggerty	Eng-NA	31.6	31.6	1	1739 (0)	0 (NA)	(Haggerty, 1930)
Hall	Eng-NA	54.0	57.0	36	124924 (71)	107305	(Hall & Tirre, 1979)
Hicks	Eng-NA	61.0	95.0	21	8992 (0)	5248 (NA)	(Hicks, 1991)
Higginson	Eng-NA	22.0	35.0	1	5953 (0)	9672 (NA)	(Higginson, 1985)
HSLLD	Eng-NA	42.6	141.9	11	130124 (25)	172908 (75)	(Dickinson & Tabors, 2001)
Inkelas	Eng-NA	6.3	45.9	1	1873 (0)	0 (NA)	(Inkelas & Rose, 2007)
Kuczaj	Eng-NA	28.8	60.4	1	32172 (25)	25622 (14)	(Kuczaj, 1977)
Lara	Eng-UK	21.4	40.0	1	57639 (4)	99728 (14)	(Rowland & Fletcher, 2006)
Mac-Whinney	Eng-NA	1.0	92.1	3	57675 (69)	63605 (17)	(MacWhinney, 1991)
Manchester	Eng-UK	20.7	36.3	13	249504 (5)	374198 (39)	(Theakston et al., 2001)
Morisset	Eng-NA	30.0	39.0	100	12964 (1)	19341 (0)	(Morisset et al., 1990)

MPI-EVA-Manchester	Eng-UK	24.0	37.1	2	253910 (14)	320710 (83)	(Lieven et al., 2009)
Nelson	Eng-NA	19.6	32.8	1	4552 (4)	1624 (1)	(Nelson, 1989)
New-England	Eng-NA	13.5	33.0	24	12041 (0)	43667 (NA)	(Ninio et al., 1994)
Newman Ratner	Eng-NA	11.0	288.0	1	23268 (0)	164190 (NA)	(Newman et al., 2016)
Paido-English	Eng-NA	27.0	69.0	1	10169 (0)	0 (NA)	(Edwards & Beckman, 2008)
Penney	Eng-NA	59.9	72.1	21	1491 (0)	944 (NA)	(Judd, 2018)
Peterson-McCabe	Eng-NA	48.0	113.0	1	10361 (1)	7216 (0)	(Peterson & McCabe, 1983)
Post	Eng-NA	22.7	32.2	1	16893 (0)	18755 (NA)	(Demetras et al., 1986)
Providence	Eng-NA	11.1	48.1	6	176132 (16)	283927 (109)	(Demuth et al., 2006)
Sachs	Eng-NA	15.0	57.1	1	17236 (0)	12222 (NA)	(Sachs & Nelson, 1983)
Smith	Eng-UK	26.1	45.4	1	5308 (0)	0 (NA)	(Smith, 1973)
Snow	Eng-NA	29.6	45.1	1	13520 (2)	21033 (16)	(MacWhinney & Snow, 1990)
Sprott	Eng-NA	33.0	61.0	27	4718 (2)	1606 (0)	(Sprott, 1992)
Suppes	Eng-NA	23.5	39.7	1	33950 (1)	35172 (4)	(Suppes, 1974)
Thomas	Eng-UK	24.4	59.7	2	218984 (58)	372363 (153)	(Lieven et al., 2009)
Tom-merdahl	Eng-UK	29.0	45.0	1	12027 (2)	13879 (2)	(Tommerdahl & Kilpatrick, 2014)
Valian	Eng-NA	21.7	32.8	1	15945 (1)	27715 (2)	(Valian, 1991)
VanHouten	Eng-NA	28.0	43.4	26	4455 (1)	8736 (0)	(Van Houten, 1986)
VanKleeck	Eng-NA	37.0	48.0	20	6677 (0)	8756 (NA)	(van Kleeck et al., 1985)
Warren	Eng-NA	30.0	70.0	11	3563 (0)	5847 (NA)	(Warren-Leubecker, 1982)
Weist	Eng-NA	25.0	60.2	7	47577 (8)	65165 (12)	(Weist & Zevenbergen, 2008)
Wells	Eng-UK	17.7	60.8	31	57537 (14)	40756 (11)	(Wells, 1981)
Total	NA	1.0	288.0	585	2247665 (478)	2934114 (771)	

S2: Intercoder Reliability Values

Table S2. ***Results from calculating overall accuracy (%), Gwet's AC1 coefficient and Conger's kappa statistic for each coded variable.***

Variable	Test	Value	CI (95%)
Main Subject	Percent Agreement	0.94	(0.893,0.987)
	AC1	0.94	(0.884,0.987)
	Conger's Kappa	0.80	(0.64,0.951)
Embedded Subject	Percent Agreement	0.96	(0.921,0.999)
	AC1	0.96	(0.913,0.999)
	Conger's Kappa	0.94	(0.881,0.998)
Subjunctivity	Percent Agreement	0.96	(0.921,0.999)
	AC1	0.95	(0.903,0.999)
	Conger's Kappa	0.89	(0.784,0.997)
Temporal Orientation	Percent Agreement	0.88	(0.815,0.945)
	AC1	0.87	(0.792,0.941)
	Conger's Kappa	0.60	(0.403,0.797)
Bare Error	Percent Agreement	0.93	(0.879,0.981)
	AC1	0.92	(0.871,0.982)
	Conger's Kappa	0.28	(-0.034,0.6)
Tense Error	Percent Agreement	0.89	(0.828,0.952)
	AC1	0.88	(0.807,0.95)
	Conger's Kappa	0.61	(0.439,0.79)
Evidence Counterfactuality (before discussion)	Percent Agreement	0.61	(0.513,0.707)
	AC1	0.52	(0.401,0.64)
	Conger's Kappa	0.49	(0.358,0.612)
Evidence Counterfactuality (after discussion)	Percent Agreement	0.87	(0.803,0.937)
	AC1	0.84	(0.757,0.922)
	Conger's Kappa	0.83	(0.743,0.918)

S3: Supplement to Figure 3

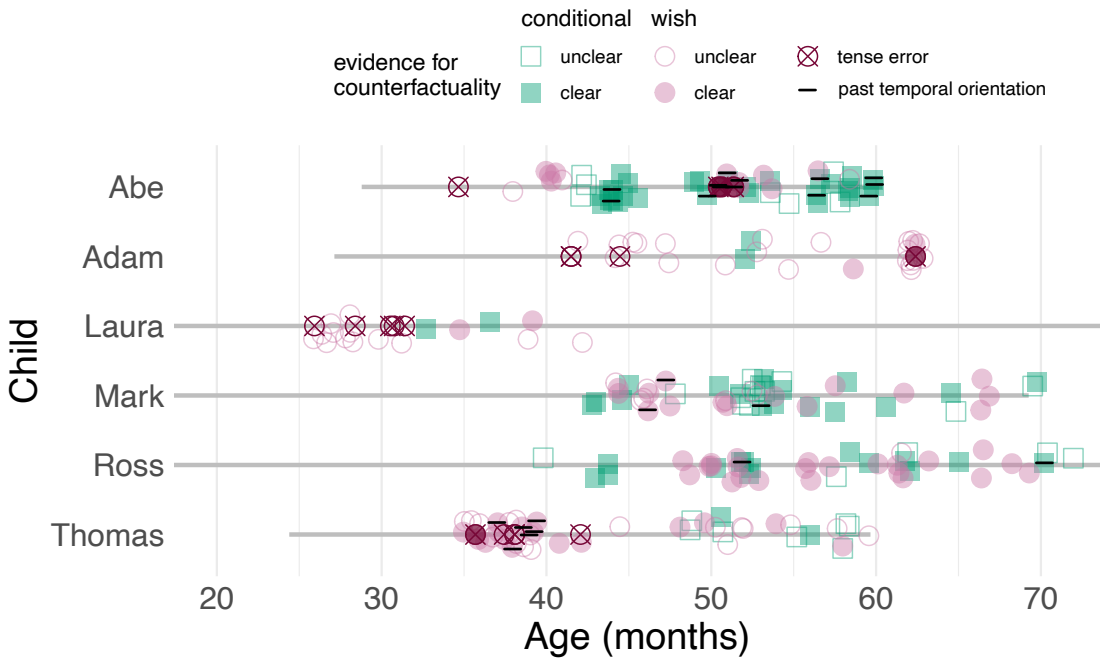

Figure S3. ***Counterfactual conditionals (green squares) and wishes (pink circles) for each child (y-axis) with age indicated in months on the x-axis. Filled shapes indicate that the evidence for counterfactuality is clear, empty shapes indicates the evidence is unclear. Struck-through (with cross) wishes indicate they contained a tense error in the form of a present-for-past substitution. Struck-through (with black dash) counterfactuals were uttered with past temporal orientation, all others are present temporal orientation. Grey line indicates recording span.***

S4: Overview of Children's Productivity with the Past Tense

Table S4. ***Overview of Children's Past Tense Productivity. For each child we recorded their age range (in months), total amount of utterances, total amount of produced present-for-past errors, age range while making errors, the proportion of correct past tense marking in the context of the temporal adverb yesterday (YD), total amount of past tense overregularization (OR) and age range of during which overregularized.***

Child	Abe	Adam	Laura	Mark	Ross	Thomas
Corpus	Kuczaj	Brown	Braunwald	Mac-Whinney	Mac-Whinney	Thomas
Min Age	28.8	27.1	15.0	5.5	16.4	24.4
Max Age	60.4	62.4	84.5	69.3	92.1	59.7
N Utterances	31958	46651	39750	20754	36379	218439
N Errors	4.0	4.0	5.0	*NA*	*NA*	5.0
Error Min Age	34.7	41.5	25.9	*NA*	*NA*	35.7
Error Max Age	51.4	62.4	31.4	*NA*	*NA*	42.1
N Past with YD	13/14	3/3	2/6	*NA*	*NA*	*NA*
YD Min Age	34.7	55.0	28.0	*NA*	*NA*	*NA*
N OR	218.0	22.0	8.0	*NA*	*NA*	22.0
OR Min Age	34.7	42.3	26.2	*NA*	*NA*	35.9
OR Max Age	51.2	62.4	31.0	*NA*	*NA*	42.1

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