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Producing and understanding conditionals: When does it happen and why does it matter?

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Abstract

Comprehending complex conditional sentences plays an integral part in understanding many aspects of learning at school, particularly in subjects such as science and history, where hypotheses and alternative explanations are important. While simple conditionals are produced by pre-school children, the acquisition of complex conditionals occurs later. This cross-sectional and longitudinal design investigated the trajectory for production and comprehension of type II and type III conditionals in two cohorts of children, one starting in January of year 1 (age 5-6; n=225), the second in January of year 2 (age 6-7; n=292), with three measurement points over a 9 month period. Production was measured using a repetition task, comprehension by providing conditional sentences and asking the children to say whether four statements about each sentence were true. Single word reading and verbal and non-verbal ability were also measured. Production occurred much earlier than comprehension. By the start of year 3, 71% of children could repeat type II sentences and 52% could repeat type III sentences. In contrast, at the same point, fewer than 20% of children could understand either type II or type III conditionals. Logistic regressions showed that while production of type III conditionals predicted comprehension of both type II and type III conditionals 9 months later, comprehension of type II was also predicted by single word reading while type III comprehension was also predicted by ability. Acquisition of conditionals is likely to play an important role in academic success.

The results are discussed with respect to the importance of understanding conditionals for academic success.

Keywords grammar, conditional, production, comprehension, ability, reading

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1. Introduction

Grammar is essential for learning, comprehending and producing a language. The development can be described as a child's ability to move from using single words to combining word structures and sequences based on a set of rules of a given language to create grammatically correct sentences. The early stages of the developmental process are well established and across typically developing children (Barrett, 1989). By age 5, the majority of children are grammatically fluent in their native language without explicit instruction (Brown & Hanlon, 1970; Brown, 1973; Devescovi & Marchione, 2006; Mellanby & Theobald, 2014, chapter 3). The apparent ease with which infants develop language, including simple grammar, has been at the centre of the long-standing debate into language acquisition: the nativist view (Chomsky, 1965) takes the position that language development stems from innate cognitive modules that allow us to acquire grammar through experience; that it would be impossible to develop as much and as quickly as we do relative to the amount of direct instruction without an inbuilt language module. The connectionist view (Plunkett & Juola, 1999) shows from computer modelling of the acquisition of grammar, such as the early regularization of the past tense followed by later acquisition of the correct form, that grammar can be acquired simply by extracting rules from the statistical frequency of regularities in the input. This view looks at grammar acquisition as a domain-general process, which would not depend on a pre-defined grammar module. The neuroconstructivist view of grammar acquisition also does not rely on the existence of a pre-defined grammar module but considers that structurally defined modules within the brain develop as the result of interaction with the environmental language input (Sirois et al., 2008).

1.1 Complex grammar – the conditional

Once children have acquired the simple grammar of their language, they might begin to develop more grammatically complex sentences such as those involving counterfactual conditionals for example, *if you had skipped to the Discussion, you would not have read this example*. A form whereby the relation between properties or events is absent but implied. Simple conditionals such as 'If you remember your shoes we will go to the park' are acquired quite early. Yet acquisition of the more complex forms of the conditional continues to be difficult for some older children (Amidon, 1976), and indeed, some adults never reach full acquisition (Evans, Handley, Neilens & Over 2008). However, the developmental trajectory for acquiring complex grammar is not much researched.

Conditional structures are used to express a condition on which something else depends; they are hypothetical, use the connective 'if', and are a way of communicating through words about past, present and future consequences. Syntactic structure is complex, including a

conditional clause and a main (result) clause, and the verb typically changes its form in either one or both clauses, increasing complexity. It has been identified as one of the most difficult aspects of English grammar to master (especially for English as a second language learners; see Celce-Murcia & Larsen-Freeman, 1999, chapter 27), but also an essential one for complete comprehension and production of the language (Tuan, 2012). There are many variations of conditional sentence, the names for which differ by discipline. This paper will focus on what are considered to be the two most difficult types of conditional sentence, firstly, one often referred to in the pedagogical literature as 'type II', which uses the conditional clause *'if + 'past tense'* and the main clause *'would + infinitive'*, for example, *if you wanted to know more, you would continue to read.* Secondly, one often referred to in the pedagogical literature as 'type III', which uses the *'if + past perfect tense'* and the main clause *'would have + past participle'*, for example, *if you had stopped reading, you would have missed the most complex conditional of all.* Such a statement is counterfactual in that the first clause, the antecedent, is known or believed not to have been realized. Type III is the least frequently used of the conditional sentence types, therefore exposure to it is generally less (Hwang, 1979).

Being able to comprehend and produce conditional sentences is needed for communicating about actions and consequences. The conditional is used throughout schooling (increasingly so in secondary school), for example, 'Europe would have had a very different history if the Second World War had not taken place'. Lack of understanding of conditionals, particularly in history or science lessons, could lead to underachievement of otherwise bright children because of misunderstanding questions and information. A recent study of 101 children aged 7-8 found that those who were able to comprehend type III conditional sentences were significantly more likely to show comprehension of scientific hypothesis testing compared to those that had no acquisition (Svirko, Gabbott, Badger & Mellanby, in review). If a child transitions into adulthood without conditional comprehension, this could lead to general misunderstandings and reduced opportunities.

1.2 The relationship between production and comprehension

The development of language production and language comprehension with regards to simple grammar is well documented although until fairly recently, the two were studied separately. Even the more recent work combining and thus providing a framework of previous findings and theories is unable to explain fully the relationship between the two skills. Yet the relationship is an important one in language development: once fully understood it would aid "understanding of the

overall architecture of the cognitive system serving language" (Meyer, Huettig & Levelt, 2016, p. 3).

Overall, it is agreed that language production cannot simply be due to imitation of adult speech. Infants and children make sentence and grammatical mistakes that the adults surrounding them do not; infants may pick up vocabulary and accents from adults, but they must learn/understand a concept or the correct grammatical construction of a sentence before they can imitate it through production. Although it is important to note that comprehension of a sentence does not automatically result in a correct (re)production, for example, Mummy: "Jack, Mary's going outside now", Jack: "Yes, Mary go now". We could conclude from this that comprehension must precede production. However, it is clear that children are also able to reproduce words or short simple sentences without fully comprehending the meaning; they may later use the same words or short sentence contextually incorrectly. In fact, it does not always ring true that the words first understood by a child are the first produced by the child: a list of both of these could read very differently (Clark & Hecht, 1983). Furthermore, in real life interactions the speaker is likely to give cues such as gaze or gesture that make meaning accessible even if the actual language is not fully understood. There have been various suggestions and models trying to decipher the relationship between these two key language skills (see Meyer et al., 2016 for a review of recent work). Although under continued debate, the current consensus is that language production and comprehension of simple grammar are distinct skills but closely linked, activating one another in different situations, for example, error monitoring (a comprehension task) is most efficient when production is activated (Kittredge & Dell, 2016). One way of looking at the relationship is to follow the developmental trajectory of production and comprehension in a large group of children, as we report in the current study.

1.1.1. The development of conditional production and comprehension

There is limited research on the acquisition and development of the conditional and research conducted often involves small samples and limited type use. Bloom, Lahey, Hood, Lifter and Fiess (1980) followed the production of a wide variety of connectives in four children from age 2 to 3. Since the children were very young, the structure of the sentences they produced never went beyond simple forms, and the majority of the sentences were very short and grammatically incorrect (Bowerman, 1986). 'If' as a connective was found to emerge around age 2-and-a-half years. As part of a larger study, Amidon (1976) tested 48 children aged 5, 7 and 9 on their comprehension of sixteen simple conditional sentences (type I; eight 'if' and eight 'if-not', for example, 'if it rains you will get wet'), and found a dramatic reduction in the number of errors made between ages 5 and 7. Most recently, Svirko (2011) tested 128 children at two time points, on tests of type III

production: once when the children were aged 6-7 and again when the children were aged 8-9. She found that 32% of children aged 6-7 and 68% of children aged 8-9 were able to repeat at least one out of four such sentences correctly.

Experiments with young children using 'acting out' of conditional scenarios show that with this physical representation of conditional concepts, some children can understand these concepts at a remarkably young age (Harris, German and Mills, 1996) They showed that some children as young as 3 years of age were not only able to think about complex (counterfactual) scenarios when acted out using toys and props, but were also able to imagine alternative actions and outcomes. For example, when the 32 children were tested after hearing that "Sally chose to use a black pen instead of a blue pen or a pencil and her fingers got all inky" responded correctly to the question "What should Sally have done instead so that her fingers wouldn't get all inky? [prevention question]". In addition, a number of children also suggested alternative options that were not explicitly stated in the question such as "'Cos she should have done it with a crayon". Kahneman and Varey (1990) found that children as young as 2 years of age showed an appreciation of conditional/counterfactual scenarios through the use of the words 'nearly' or 'almost'. For example, children said "[that pitcher] almost fall" after the experimenter stopped a pitcher from falling off a ledge. This suggests that children as young as 2 can conceptualize something that has not actually happened, but that could have happened if the situation had played out differently. Therefore, it is possible that young children can think through conditional situations when provided with concrete cues before they can produce them. Although these studies are useful in starting to understand the development of the connective 'if', they use different conditional types, ages and methods which means that although together they show a continued growth in acquisition, they do not allow us to map a developmental trajectory for either production or comprehension of any conditional type. They also do not provide sufficient information about the *relationship* between conditional production and comprehension.

1.1.2. Measuring the acquisition of conditionals

1.1.2.1. *Production*

Conditional production was measured using the elicited repetition method first described by Lust, Flynn and Foley (1996) and elaborated for measuring conditionals and used extensively by Svirko (2011).

There are differing views as to what sentence repetition tests actually measure. On the one hand, Alloway and Gathercole (2005) have put emphasis on the involvement of a distinct memory system that is uniquely linked to language skills via the episodic buffer (Baddeley, 2000), plus some involvement of the phonological loop. They argue that this separate component of working memory would have a 'causal

influence in the development of language skills in children.' On the other hand, Klem et al., (2015) have shown by modelling the relation of sentence repetition to the development of other language skills, in particular vocabulary and grammar, that it is not a separate predictor of language development but is actually part of an 'underlying unitary language construct'. This view is supported by the findings that sentence repetition is impaired in children with developmental language problems such as SLI or dyslexia (Moll et al., 2015), and that sentence repetition involves conceptual processing and grammatical encoding (as discovered from studies using active, passive and embedded sentences with children speaking an inflectionally rich language (Kannada) (Nag et al., 2017). So what is going on when a child repeats a sentence? The reconstruction hypothesis of Lombardi and Potter (1992, Potter and Lombardi, 1990) proposed that the precise form of a sentence is not what is represented but actually the sentence is regenerated from a conceptual representation. Their research pointed to the importance of the verb in a sentence in dictating the structure of a remembered sentence, which makes it an excellent way of assessing the acquisition of complex grammar.

1.1.2.2. Comprehension

The well-validated Test for Reception of Grammar (TROG; Bishop, 2005) tests comprehension of increasingly complex grammatical constructs by asking a child to choose which of four pictures denotes a statement delivered by a researcher. This particular mode of testing cannot be used for conditionals since a construct such as 'If I had not forgotten my homework I would not have got into trouble at school' would be too complex to illustrate unambiguously in pictures. This means that the developmental trajectory of the conditional is not well researched in spite of it being an important component in language. Therefore, we have devised a new test for comprehension of complex conditionals which involves a statement read aloud to the child and/or presented in written form. The child is then asked four questions of the form 'does the sentence mean…?' and has to reply to each with yes or no. (We note that a somewhat similar test was devised by Berent (1985) to measure acquisition of comprehension of conditionals in adults learning English as a second language.)

1.2. Current study

The primary aim of the study was to explore the developmental trajectory of the most complicated conditionals – type II and type III – with children aged 5-8 years, by using a cross-sectional *and* longitudinal design (two cohorts of children: year 1 and year 2 tested at three points over one year). The secondary aim was to explore the relationship between production and comprehension of these types and investigate what may support or hinder development. Testing took place over 9 months with children being tested in January, April and September.

All children were tested on the production and comprehension of type II and type III conditional sentences. These two tasks are well matched in style and delivery. Measuring both of these language skills using well-matched tests enabled us to look at the relationship between the development of production and comprehension in complex grammar. The more we can understand about the developmental acquisition of the conditional, the better-targeted teachers can make the educational support for those who struggle.

2. Methodology

2.1. Participants

A total of 517 children, from six British primary schools, participated in the January testing session: 225 in the year 1 cohort (M = 5;11 years) and 292 in the year 2 cohort (M = 6;10 years); 264 were male. Of these, 490 children also participated in the May testing session, and finally, 462 also went on to participate in the September testing session: 199 from the year 1 cohort (M = 6;7 years, range = 6;1-7;1 years) and 263 of the year 2 cohort (M = 7;6 years; range = 7;0-8;1 years); 230 were male. The attrition was due to children moving schools or prolonged illness.

Across two consecutive days, an additional 53 year 1 and year 2 children (M = 6;8 years, range 6;3-7;3, of which 31 were male) completed all three production and comprehension sentence sets, used to measure acquisition of complex grammar at three time points in the main study. Repeated measures ANOVAs were conducted for each of the conditional test types (type II production, type III production, type II comprehension and type III comprehension) to ensure there were no differences between the test sets (i.e., to ensure difficulty on the production type II test was consistent across the three testing time points). The sets of sentences were well matched with only a couple of significant differences between the type II comprehension set scores F (2,104) = 6.53; p = .002. Post-hoc tests revealed that the difference was due to lower scores for set 2 (M = .34) than sets 1 (M =.55) and set 3 (M =.64).

2.2. Materials

2.2.1. Measure of Nonverbal Ability: Naglieri Nonverbal Ability Test – (NNAT)

The NNAT (Naglieri, 1997), is a 30-minute, nonverbal ability test. This test requires no spoken or written language; one must identify the missing pieces to complete the geometric patterns. Owing to time limits with each child and the number of assessments overall, children answered both practice questions and seven questions increasing in difficulty (Qs: 1, 11, 24, 29, 32, 35 and 36). Data from all 517 children showed that this selection resulted in a normal distribution (see Figure 1).

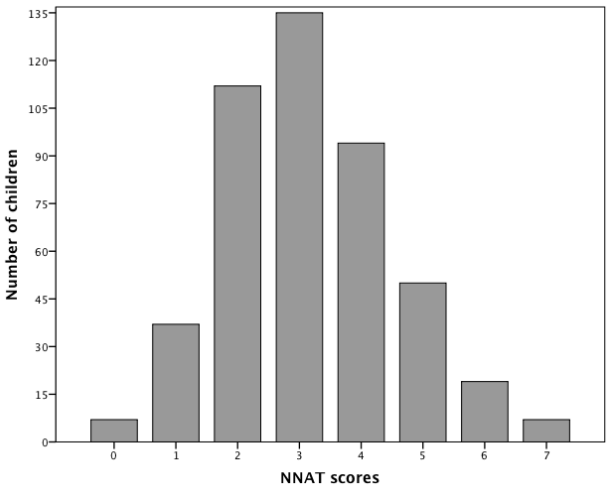

Figure 1. A normal distribution of NNAT scores for our seven chosen questions. Data presented is from the 517 children who took part at time 1.

2.2.2. Verbal and Spatial Reasoning for Children (VESPARCH)

Verbal reasoning was measured using the online VESPARCH test (Mellanby, McElwee & Badger, 2016). It approximates to a measure of fluid intelligence (Badger & Mellanby, 2017). The whole tests consists of two parts, one measuring verbal reasoning and one measuring spatial reasoning. Both parts have an equal number of analogical and categorical questions (split into two sections), with five practice questions and comprehensive feedback at the start of each section. Children complete the test individually with headphones; there is no time limit, all words and instructions are read aloud (and can be replayed as many times as is needed), and the words and concepts are highly familiar. Raw scores are automatically converted to standardized age scores (SAS).

2.2.3. Single Word Reading Test (SWRT)

The SWRT (GL Assessment) consists of 60 single words increasing in difficulty from *see* to *pseudonym* (word card 1) or *yes* to *beguile* (word card 2). There are two word lists matched for difficulty and familiarity. Individually, children read through as many of the words as they can. If a word is sounded out phonetically, the child is asked to try and blend the sounds into a whole word. The raw score is converted into a standardized age score.

2.2.4. Measures of Complex Grammar

2.2.4.1. *Conditional production*

In order to test production of conditionals we used a sentence repetition test. The eight-sentence conditional production test design (Svirko, 2011) has two components: four grammatically simple sentences (control sentences), for example, '*Simon picked some lovely flowers and he gave them to his mum and dad'* and four grammatically complex sentences (type III conditionals), for example, *'If Peter had*

bought some ice cream, he would have shared it with his friends'. Control sentences were included because an inability to repeat simple grammatical sentences may be an indication of other language or memory difficulties beyond complex grammar. All the grammatically simple and grammatically complex sentences have 16-17-syllables. We included an additional four type II conditional sentences, for example, *'If Jen practised the piano, she would be ready for the show'*, to Svirko's well-established format taking the total number of sentences from 8 to 12. We designed three different sets of 12 sentences to be administered at each testing time point. Scores are given for the control sentences, the type II conditional sentences and the type III conditional sentences. Each sentence is either correct or incorrect, allowing for a maximum score of 4 for each set of sentence types at each time point. Owing to the limited range of potential scores (0-4), and in line with Svirko's conditional sentence repetition testing, we divided the scores into 3 categories: 0 = no development (acquisition), 1 or 2 = incomplete development and 3 or 4 = complete development.

2.2.4.2. *Conditional comprehension*

We used our conditional comprehension test to assess children on two grammatically simple (control) sentence-statement sets, two type II sentence-statement sets and two type III sentence-statement sets (see example below).

Type 3 Sentence: Paul would have gone to France if he had found his passport.

1. *Does the sentence mean that Paul did not go to France?*
2. *Does the sentence mean that Paul found his passport?*
3. *Does the sentence mean that Paul is going to France today?*
4. *Does the sentence mean that Paul likes America?*

Each single comprehension set is much longer to administer than each single production sentence, which resulted in our including fewer overall since we were restricted by the time available to test each child. The experimenter read the sentence and statements out loud regardless of whether the child could also read them so that the child always heard the sentence spoken correctly. This made certain that the answers they gave were based on correctly heard structures. Answers to each of the four statements (per sentence) were recorded as correct or incorrect and a score of 4 out of 4 per sentence-statement set would result in a pass for that sentence. This allowed for a maximum score of 2 for each type (control, type II or type III) at each time point. The scores were categorized as 0 = no development (comprehension), 1 = incomplete development and 2 = complete development.

2.3. Procedure

There were three testing phases. The children completed the NNAT in the first testing session, and all additional tests during all three testing sessions (note: due to a testing packet error, no comprehension type III questions were administered during time 1). All testing was completed individually and lasted about 10-15 minutes a session. Thirty-five children were unable to repeat or understand any of the control simple structure sentences at time 1. Therefore, they were removed from our complex grammar analyses, as we could not be confident of the interpretation of their data. This resulted in a final sample of 427 children (175 of which were from the Year 1 cohort). Verbal reasoning data (VESPARCH) was acquired for 149 of the children (25 year 1 and 124 year 2; 68 = male). This data was collected a year after our project data, but was age standardized. All data has been analyzed quantifiably using SPSS; specific tests are details throughout the findings section.

3. Findings

3.1. Developmental trajectory

Children were categorized into three developmental categories: 1) no development, 2) incomplete development, and 3) complete development (see methods), for each of the four conditional tests (type II production; type II comprehension; type III production; type III comprehension).

3.1.1. Production

Figure 2a shows that the development of type II production appears to have already reached a plateau by year 1 (age 5-6) of around 70% of children showing complete acquisition.

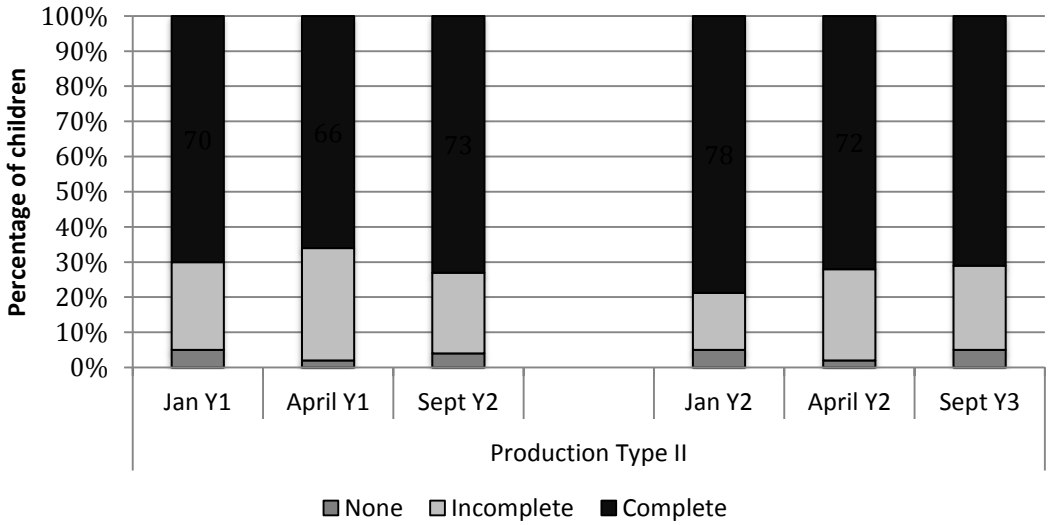

Figure 2a. Acquisition of type II production

The percentage of children categorized as either having none, incomplete or complete acquisition of type II conditional productions, presented developmentally from *January in Year 1 through to*

September in Year 3. The gap denotes the division between the two cohorts tested.

In comparison, Figure 2b shows a gradual acquisition of type III production, with just over 10% showing complete acquisition in the Y1 cohort January testing, increasing to just over 50% in the Y2 cohort September testing (at the start of their year 3, age 7-8).

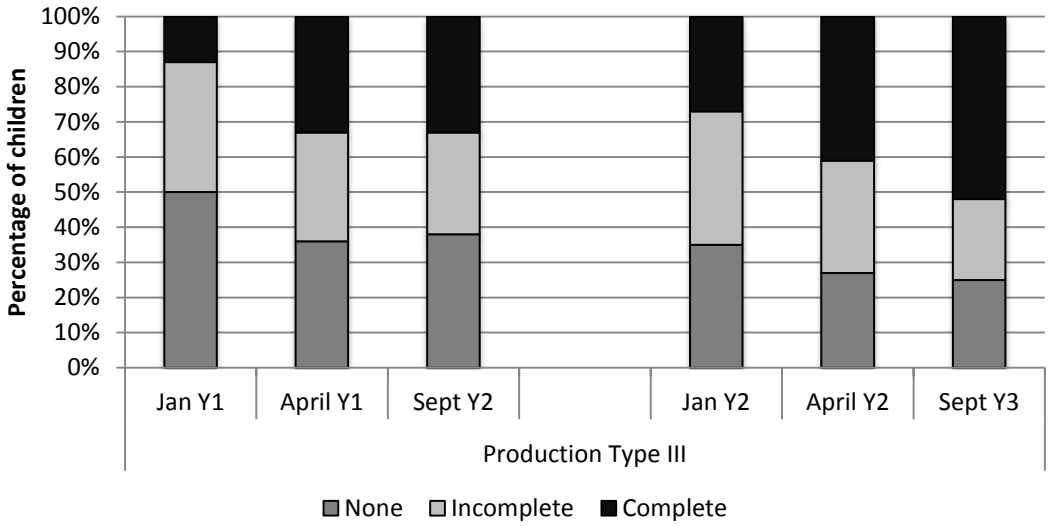

Figure 2b. Acquisition of type III production

The percentage of children categorized as either having none, incomplete or complete acquisition of type III conditional productions, presented developmentally from January Year 1 through to September Year 3. The gap denotes the division between the two cohorts tested.

3.1.2. Comprehension

Figures 3a and 3b show that very few children were scored as having complete comprehension, even by the start of year 3.

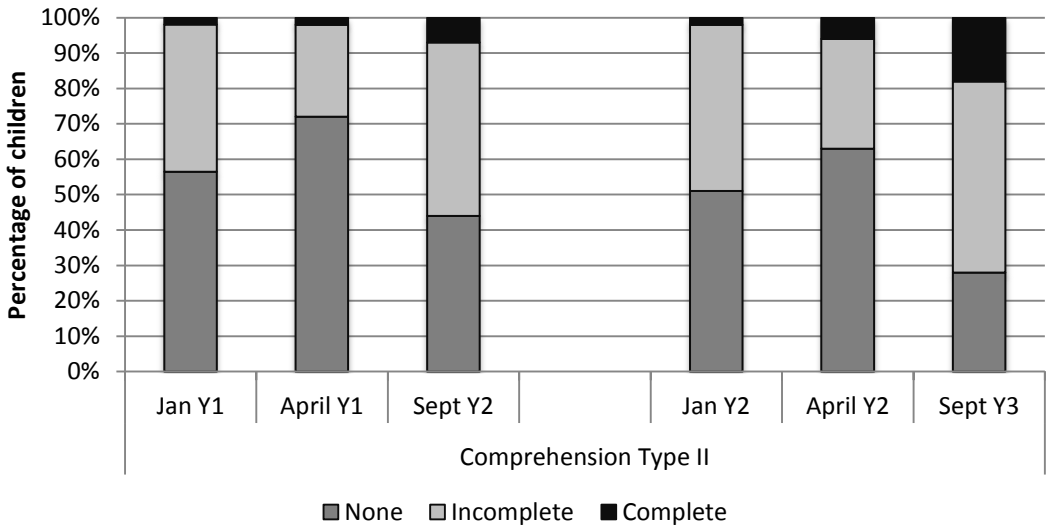

Figure 3a. Acquisition of type II comprehension

The percentage of children categorized as either having none, incomplete or complete acquisition of type II conditional comprehensions, presented developmentally from January Year 1 through to September Year 3. The gap denotes the division between the two cohorts tested.

There appears to be a gradual development of type II and type III conditional comprehension. Nevertheless, neither type shows more than 20% of children with complete comprehension (see Figures 3a and 3b).

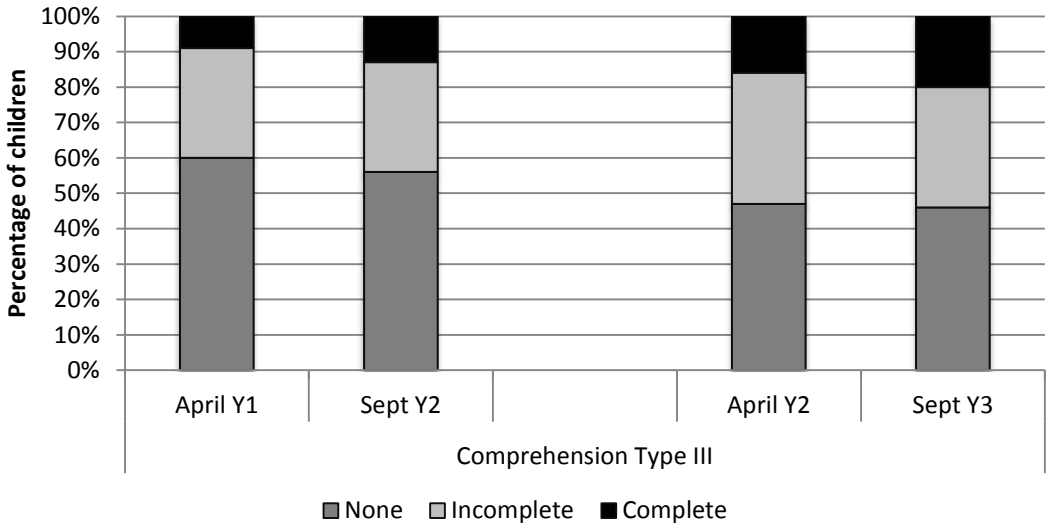

Figure 3b. Acquisition of type III comprehension

The percentage of children categorized as either having none, incomplete or complete acquisition of type III conditional comprehensions, presented developmentally from April Year 1 through

to September Year 3. The gap denotes the division between the two cohorts tested.

3.2. Stability of conditional development

Although our data show a gradual increase in the acquisition of the conditional, it must be noted that this development is not yet stable for all children.

3.2.1. Conditional production

Seventy-one percent of children in the year 1 cohort and 76% of those in the year 2 cohort who were categorized as having complete acquisition of type II production at time 1 remained in this category at time 3. For the type III production the percentages were 65% of the year 1 cohort and 83% of the year 2 cohort. The majority of the children whose competence with the conditional seemed to have gone backwards were now classified as having the conditional 'in development'.

3.2.2. Conditional comprehension

Only three children in the year 1 cohort were categorized as having complete acquisition of type II conditional comprehension at time 1; at time 3, two of these were in development and one showed no development. Of the four children in the year 2 cohort who had acquired type II comprehension at time 1, all four stayed within that categorization at time 3. (We are unable to provide comparative data for type III comprehension as this data was not collected at time 1).

3.2.3. Instability and 'ability'

There was no relationship between either the NNAT or the VESPARCH scores and unstable acquisition of type II conditional production. Scores remained equivalent between those children who were categorized as having complete type II production at time 1 and remained within this categorization or had reversed their categorization at time 3.

Those children who remained in the type III categorization from time 1 to time 3 were more likely to have higher NNAT and VESPARCH scores relative to the children who reversed their categorization. NNAT: average score of 4 (SD = 1.51) versus an average score of 3 (SD = 1.12). VESPARCH: average score of 108 (SD = 11.81) versus the four children who reversed: 85, 97, 106 and 106.

With regards to type II comprehension, NNAT data: only 7 children were categorized as having complete type II comprehension at time 1. Four remained within this categorization at time 3. VESPARCH data: Only 2 children were categorized as having complete type II comprehension at time 1. One remained within this categorization. We are unable to look at type III comprehension as this data was not collected at time 1.

3.3. What predicts conditional comprehension?

Children who had acquired type II comprehension at time 3 had significantly higher scores on word reading (SWRT: out of 60) compared to those children who had incomplete acquisition at time 3: t (425) = -6.02; p < .001 (M = 33.58, SD = 7.76 vs. M = 24.92, SD = 10.42, respectively). They also had better production of type III sentences: p < .001 (M = 2.93, SD = 1.31 vs. M = 1.62, SD = 1.46, respectively). Children who had acquired type III comprehension at time 3 had significantly higher scores on nonverbal ability (NNAT; scores out of 7) compared to those children who had incomplete acquisition at time 3: t (425) = -3.80; p = .002 (M = 3.76, SD = 1.72 vs. M = 3.09, SD = 1.28, respectively). They also had better production of type III sentences (scores out of 4): p < .001 (M = 2.62, SD = 1.42 vs. M = 1.62, SD = 1.47, respectively). Using the VESPARCH data we acquired for 149 children, we found that those we had categorized as having complete type II comprehension at time 3 (N = 23) had a significantly higher verbal VESPARCH score compared to those we had categorized as having incomplete comprehension (N = 126): t (147) = -5.24; p < .001 (M = 110, SD = 8.53 and M = 99, SD = 12.57, respectively). Similarly, those we had categorized as having complete type III comprehension at time 3 (N = 26) had a significantly higher verbal VESPARCH score compared to those we had categorized as having incomplete comprehension (N = 123): t (147) = -2.90; p = .004 (M = 107, SD = 11.25 and M = 99, SD = 12.57, respectively). The verbal VESPARCH scores were also moderately correlated with the NNAT scores overall: r = .36, N = 149; p < .001.

Two stepwise binary logistic regressions were conducted: the dependent variables were complete versus incomplete acquisition of type II or type III comprehension at time 3 (children fell within the incomplete category if they were originally categorized as either in development or no development). Age in months was entered into the regressions first, followed by NNAT (at time 1), SWRT (at time 2 due to fewer children being able to complete this at time 1), production of type II and production of type III conditionals (at time 1; see Table 1). For the type II comprehension regression there were 57 children with complete comprehension and 370 with incomplete comprehension. For the type III comprehension regression there were 72 children with complete comprehension and 355 with incomplete comprehension.

Table 1
Logistic regression identifying variables that may relate to conditional comprehension.

Type II comprehension						
	Beta	S.E.	Wald	df	Sig.	Exp(B)
Age in months	.035	.029	1.43	1	.231	1.04
NNAT (T1)	.050	.110	0.21	1	.648	1.05
SWRT (T2)	.059	.021	8.10	1	.004*	1.06
Type II production (T1)	.156	.178	0.77	1	.381	1.17
Type III production (T1)	.304	.122	6.17	1	.013*	1.36

Type III comprehension						
	Beta	S.E.	Wald	df	Sig.	Exp(B)
Age in months	-.016	.024	0.45	1	.504	0.98
NNAT (T1)	.252	.102	6.13	1	.013*	1.29
SWRT (T2)	.013	.016	0.65	1	.422	1.01
Type II production (T1)	.078	.137	0.32	1	.569	1.08
Type III production (T1)	.271	.108	6.27	1	.012*	1.31

** denotes statistical significance.*

4. Conclusions and Discussion

The results highlighted three main findings. Firstly, we observed that conditional production occurs before conditional comprehension. However, where type II comprehension and type III production and comprehension showed a continued gradual development, almost all children could already produce type II conditionals by January of year 1 (age 5-6). Secondly, the results showed some instability of acquisition, with a small number of children showing a reversal of acquisition across time points. Thirdly, we found that type III conditional production predicted both type II and III comprehension, while additional factors predicting comprehension differed between the two types.

4.1 Developmental trajectory

The finding that children's ability to repeat conditional sentences occurs substantially before conditional comprehension goes against the generally accepted observation in young children that comprehension of language in general precedes its production. Unsurprisingly, the production of the linguistically more complex type III conditional occurs later than the production of the type II conditional. Since Bloom et al., (1980) showed that children as young as 2 and a half can use the connective 'if', it follows that somewhere between then and age 5, 70% of children move from simply using the

connective 'if', to being able to reproduce type II conditional sentences. Further research needs to be conducted to show this intermediate trajectory. In contrast to the development of conditional production, the comprehension of these structures, as measured by our test, is only achieved by a very small proportion of the children even by the start of year 3 (age 7).

One reason for the production showing earlier success than comprehension could be the difficulty of the two tasks – simply repeating a complex sentence would appear to be easier than answering four questions about it. Still, the children did not have a problem with demonstrating understanding of control sentences of matched length but which were grammatically less complex. It would therefore appear that it is the complexity of the conditionals rather than the nature of the test that is making them difficult.

4.2 Stability of development

An interesting finding is that while the majority of children who can produce the conditional sentences correctly at time 1 (start of year 1), can still do so at subsequent test times, there is a small number of children in whom this development appears to have reversed at later testing. If we consider that success in the repetition test represents an unconscious automatic acquisition of the structure of the conditional, then the lack of complete stability over time suggest that such processing is not always consistently demonstrable. It can be noted though, that fewer children in the year 2 cohort showed this instability compared with the year 1 children, suggesting that this is part of the developmental trajectory of acquisition. We would expect to see a further increase in stability of acquisition of the conditional if we were to test older children. The early instability also mirrors the more general finding in some areas of research with children showing that development proceeds unevenly and also sometimes appears to reverse or dip (such as, Johnson, Dziurawiec, Ellis & Morton 1991, re face recognition).

4.3 Predicting conditional comprehension

Production of type III conditionals at time 1 was a significant predictor for both type II and type III comprehension. The predictive value of type III production for its comprehension 6 months later supports the expected interaction between production and comprehension as discussed in the introduction (Meyer et al., 2016). Additionally, word reading was predictive of type II comprehension (even after taking non-verbal ability into account), and non-verbal ability was predictive of type III conditional comprehension. Since it is well known that grammar and literacy are closely linked (Nation & Snowling, 2000), it is not unexpected that word reading and comprehension of conditionals are connected. That it is only a predictor of type II comprehension might be because this is the more commonly used conditional type of the two, and therefore more likely to have been experienced by children this age if they are good at reading. We

postulate that it is experience through reading more advanced books that has allowed those children who are better readers to have been exposed to this structure more often than those who are poorer readers and whose books are simpler in grammatical structure. In contrast, the type III conditionals are more conceptually complex than type II and therefore it is perhaps not unexpected to find a role for general ability (NNAT and VESPARCH). The lack of prediction of comprehension from type II production is probably a statistical artefact caused by the finding that almost all children had fully acquired type II production at the start of the study.

While few children could understand either type of conditional even at the start of year 3 (aged 7), there was a trend in the present work for type III conditionals to be understood earlier than type II. This might seem surprising, in view of the greater linguistic and conceptual complexity of type III conditionals, yet this is in line with the recent finding that comprehension of type II conditionals lags behind comprehension of type III in 13 year-old and 15 year-old school-children (K. Collis; A. Malhotra unpublished). So we have the situation that production occurs earlier for type II than type III while for comprehension the reverse is the case. It could be argued that this supports the view that production and comprehension are separate processes, but the finding that type III production in year 1 actually predicts type III comprehension 9 months later (having controlled for ability) supports an interaction between comprehension and production. This partial interdependence further supports the pattern discussed in the introduction.

The finding that production of both type II and type III conditionals precedes their comprehension appears to parallel what was found by Berent (1985) over 30 years ago in adults learning English as an additional language. However, pertinent to the general impression that with young children comprehension precedes production, he found that for simple conditionals (he called them 'real' as opposed to our type II 'unreal', and our type III 'past unreal') comprehension did precede production. This dissociation suggests that the relation between production and comprehension is different at different levels of complexity of language. Berent also found that for both production (using a substitution paradigm) and comprehension the scores were higher for those with a more advanced level of English acquisition. This suggests that comprehending complex conditionals may require integration with higher levels of general language proficiency. This would be achieved either by general development in children, or in adults learning a new language by further language teaching.

4.3.1 Socioeconomic factors

A central part of educational policy is to work towards removing the gap between the educational achievements of children from lower and

higher socioeconomic status (SES) groups. It is widely accepted that early language is acquired implicitly from exposure; studies into the complexity of the language used by mothers with their children has shown that language is actually simpler in homes of groups with lower SES (Hart & Risley, 1992; Hoff, 2006; for a summary see Mellanby and Theobald, 2014, chapter 3). Indeed, Svirko (2011) found that type III conditional production scores in year 2 were significantly related to SES of the children, as approximated by the IMD 2007 (Indices of Multiple Deprivation) on the dimensions of Income, Employment and Parental Education. By year 4, this relationship had markedly diminished, suggesting the influence of wider experience from reading, schooling and in the general community.

4.4 Educational Implications

The finding that so few children understood complex conditionals in year 1 and that this lack of understanding continued for most children at least until the start of year 3 needs to be taken into account with respect to the way in which teachers give information in the classroom. Since early acquisition of the conditional has been shown to be related to both reading and arithmetic (Svirko, 2011), as well as scientific reasoning (Svirko et al.), it also points to the possible value of attempting to increase the acquisition of conditionals in children. In the early years, where language acquisition is mainly implicit, extensive exposure to conditionals in the classroom might be an effective way of doing this. In support of this view, it has been shown that exposure to the passive in the classroom does indeed raise its acquisition in four year-old children who have not yet acquired it (Vasilyeva, Huttenlocher & Waterfall, 2006). Explicit teaching might be introduced in the middle primary years – rather than waiting as in the present primary school curriculum until year 6. Children who have mastered complex conditionals by the time they enter secondary school would be more likely to understand, and therefore enjoy, subjects such as history and science where hypothesis-making is important.

4.5 *Conclusion*

We report three main findings. First, we identified the developmental trajectories of type II and type III conditional production and comprehension in children aged 5-8. We showed that type II production occurs earlier than type III production. For both types of complex conditional, production, as measured by the repetition test, occurs before comprehension. Secondly, there was a certain degree of instability in conditional acquisition, although the acquisition was more stable with the older children suggesting that this instability is itself a feature of the developmental trajectory. Thirdly while type III production of both type II and type III conditionals is predictive of comprehension months later, additionally, single word reading is related to comprehension of type II conditionals, while non-verbal ability is related to the comprehension of type III.

The results support the view that production and comprehension of language, specifically complex conditionals, are to some extent independent. The predictive value of type III production for conditional comprehension though, suggests that the internalization of conditional structure tested by the production test supports the acquisition of comprehension. We propose that the relationship between production and comprehension is different for simple and complex language, as demonstrated by the acquisition of complex conditionals reported here compared with observations of the early stages of language acquisition, including simple 'if' sentences. We suggest that early intervention to accelerate the acquisition of complex conditionals could enhance later understanding, although the type and format of exposure needs to be appropriate to the age and language level of the child. Acquisition of such comprehension would be expected to aid understanding, and therefore interest, in important subjects such as history and science.

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