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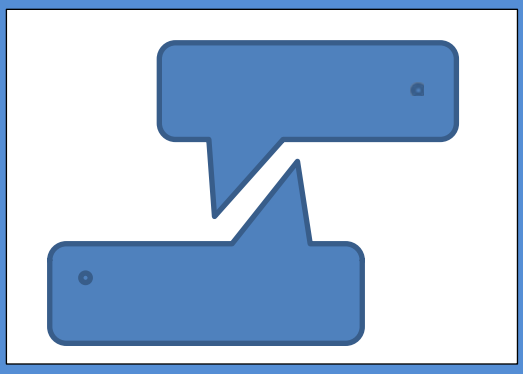

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Mehmet Akif Ersoy University
mehozcan20@gmail.com

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The developmental trajectory of English conditional grammar in 4- to 11-year-old children

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Julia R. Badger[1]
University of Oxford
Emily Pascoe[2]
University of Oxford
Louisa Jagmetti[3]
University of Oxford
Elinor Baldwin[4]
University of Oxford
Jane Mellanby[5]
University of Oxford

Abstract

Grammar is an essential aspect of language and communication, yet little is known about the developmental trajectory of the conditional – a complex grammar structure. We extended existing research to get a clearer idea of the developmental trajectory of Type I, Type II and Type III conditionals in typically developing children aged 4- to 11-years old. Data from 316 children were collected on measures of production and comprehension of the conditional, alongside measures of general ability, memory and word reading. Our data shows that as the complexity of the conditional sentence increases, so does the difficultly in correctly reproducing it. However, a more stable development was observed when measuring children's comprehension which, along with the observed links between acquisition and reasoning, suggests that comprehension may be reliant on a qualitative change in children's thinking. We also found links between acquisition and word reading which points to an important relationship between success in the early stages of reading and the internalisation of this grammar. Conditional grammar is important within key

[1] Bio: Dr. Julia R. Badger is a Research Associate in the Department of Experimental Psychology at the University of Oxford. Her research focuses on developing educational tools to identify academic potential. Corresponding author: Julia.badger@psy.ox.ac.uk

[2] Bio: Miss Emily Pascoe is a Graduate Student from the Department of Experimental Psychology at the University of Oxford. Her interests lie in the ways in which teachers can balance differences in prior exposure so that all children reach their potential.

[3] Bio: Miss Louisa Jagmetti is a Graduate Student from the Department of Experimental Psychology at the University of Oxford.

[4] Bio: Miss Elinor Baldwin is a Graduate Student from the Department of Experimental Psychology at the University of Oxford. Her primary interest is in identifying protective factors that can be used to foster resilience in at-risk children.

[5] Bio: Dr. Jane Mellanby is an Emeritus Fellow of St. Hilda's College, working within the Department of Experimental Psychology at the University of Oxford. Her primary interest is in seeking reasons for underachievement relative to potential among typically developing children, and the contribution of complex grammatical forms on academic performance.

school subjects such as English, maths and science; we were able to combine our data with published data to map out the ages at which typically developing children should be able to reproduce and comprehend conditionals. Identifying those children who are lagging behind in this language development should in turn allow targeted intervention and enable a reduction in the number of those entering secondary school without complete production or comprehension of conditionals.

Keywords conditional, grammar, development, trajectory, production, comprehension

1. Introduction

There is no doubt that grammar is an essential aspect of language that enables the user to form full, meaningful sentences and understand the linguistic information they receive. Its use within a language enables the transition from employing individual words, for example, '*Mary, Mummy the ball throw to now'* to using rules that combine words and word-sequences to produce grammatically correct sentences, for example, '*Mary, throw the ball to Mummy now*'. Full acquisition refers to the ability to both correctly produce and correctly comprehend. As a result of years of researching the acquisition of many forms of grammar, schools have performance-expectations in place which can help to identify those children who may not be as competent in one or more aspects of grammar learning. Knowing the typical development of grammar types can ensure targeted support where needed.

In typically developing individuals, the first stages of grammar production and comprehension are well researched (Barrett, 1989). Without explicit teaching, children are generally fluent in the simple grammar of their native language by the age of five (Brown, 1973; Brown & Hanlon, 1970; Devescovi & Marchione, 2006; Mellanby & Theobald, 2014). It is believed that this early ability to produce and comprehend simple grammar is acquired implicitly through exposure to grammatical speech patterns (Brown & Hanlon, 1970). In early childhood, most children also start acquiring sentences of greater grammatical complexity; this paper will focus on the acquisition of an under-researched complex grammatical form - the conditional. There are many variations of conditional structure, four of which are detailed below. Conditional sentences use the connective 'if' as a way of communicating hypothetical information about past, present or future consequences. Type 0 uses the conditional 'If + simple present' and the main clause 'simple present' (see Table 1 for sentences examples). Type I uses the conditional clause 'if + simple present' and the main clause 'will + simple future'. Type II uses the conditional clause 'if + past tense' and the main clause 'would + infinitive'. Type III uses the conditional clause 'if + past perfect (or plu-perfect) tense' and the main clause 'would have + past participle'.

Table 1
Example sentences for all four conditional Types

CONDITIONAL TYPE	
TYPE 0	If you rest, you feel better
TYPE I	If you rest, you will feel better
TYPE II	If you rested, you would feel better
TYPE III	If you had rested, you would have felt better

Although the conditional is thought to be one of the most important grammatical structures for full development and use of the English language (Tuan, 2012), it is also one of the most challenging aspects of English grammar to learn (see Celce-Murcia & Larsen-Freeman, 1999). In fact, even for young adult and adult native speakers who have not fully grasped the grammatical structure of conditionals, sentences can easily be misinterpreted (Amidon, 1976; Evans, Handley, Neilens, & Over, 2008) and errors in communication made.

1.1. Acquisition of the conditional

Children are able to correctly use the connective 'if' at around two and a half years of age (Bowerman, 1986; Bloom, Lahey, Hood, Lifter, & Fiess, 1980), and by age three some children can understand conditional concepts (Bloom et al 1980; Harris, German, & Mills, 1996) and have some understanding of the alternative consequences of an action indicated by their use of 'nearly' and 'almost' (Kahneman and Varey, 1990). However, whilst these simpler phrases and statements show an appreciation of the hypothetical, they are not equivalent to the acquisition of the conditional. There are few papers detailing the development of the conditional and even when put together, there are great gaps and question marks on the trajectory line. There is no published literature, to our knowledge, on the formal assessment of Type 0 conditionals. Below, we detail what is known so far for Types I, II and III.

1.1.1. Type I

Amidon (1976) tested 48 children aged 5, 7 and 9 on their comprehension of 16 simple Type I conditional sentences and found a dramatic reduction in the number of errors made between the ages of 5 and 7. To the best of our knowledge, this is the extent of the research literature formally testing and assessing the development of Type I conditionals.

1.1.2. Type II

Badger and Mellanby (2018a) tracked 517 children aged 5-7 years, across a 9-month period. They found a plateau effect for the production of Type II

sentences as measured by sentence repetition, whereby 70% of children had full acquisition by age 5. The 70% plateau continued through to their oldest age group of 7-year olds. Contrastingly, they found that fewer than 5% of the same participants showed complete *comprehension* of Type II conditionals when aged 5-6, but that this gradually increased to around 20% by age 7. They also found that comprehension of Type II conditionals, as measured by answers given to questions about the meaning of a conditional sentence, was predicted by Type II production and word reading ability.

1.1.3. Type III

Svirko (2011) longitudinally assessed the development of Type III conditional sentence reproduction in 128 children aged 6-9. She found that whilst 32% of children aged between 6- and 7-years-old could accurately reproduce Type III conditionals, this proportion increased to 68% for 8- and 9-year-olds. She also found an increase in the reproduction of Type III conditionals was associated with general ability, memory, vocabulary and parental education.

As well as testing Type II conditionals, Badger and Mellanby (2018a) tested Type III conditionals. Using the same method, they found that just over 10% of 5- to 6-year-olds were able to reproduce Type III sentences. As in Svirko's work, they found that 30-40% of children aged 6-7 were able to accurately reproduce Type III conditional sentences. This increased to about 50% by 7-8 years of age. Similar to the production-comprehension relationship seen with Type II conditionals, Badger and Mellanby found that only 10% could *comprehend* Type III conditional sentences at age 6, which increased to 20% by age 7. They found that comprehension of Type III conditionals was predicted by Type II production and general ability.

It seems that while many young children can produce simple conditional forms, comprehension of conditionals does not occur until later. However, as can be seen, much is unknown about the developmental trajectory across all types of conditional structures throughout different ages of childhood, with work tending to focus on Type II and Type III conditional development between the ages of 5- and 8-years-old.

It has been suggested that there is a critical period in which to implicitly acquire grammatical structures after which acquisition becomes increasingly difficult and must be taught explicitly. In fact, some late learners (post-critical period learning) will never achieve native proficiency (Newport, 1990). Individual differences in the grammatical performance of adults (Ross, 1979) supports this theory. Consequently, understanding the full developmental trajectory of when conditionals are acquired has wide implications for the teaching of complex grammar.

1.2. Why is complex grammar important?

Failure to achieve proficiency of certain complex grammatical structures, including the conditional, can have several consequences regarding aspects of education including English, mathematics and science. Indeed, an understanding of cause and effect and hypotheticals is required for many school subjects. Evidence shows that children who have a good mastery of grammar have a superior reading level as, for example, they are better equipped to use the context of the sentence to identify familiar words (Willows & Ryan, 1986; Muter & Snowling, 1998). In 2011, Svirko found a direct relationship between complex grammar development and attainment in literacy for children aged 6-9. Research has also found correlation between grammar and performance in arithmetic questions - both word and number problems (Cowan, Donlan, Newton, & Lloyd, 2005). Furthermore, children who have not acquired the conditional by age 8 have greater difficulty using scientific reasoning at age 10 (Svirko, Gabbott, Badger & Mellanby, 2019). Svirko (2011) postulates that as children move through the education system, they are likely to have increasing exposure to more complex types of grammar. If children do not have full command of this grammar, they are less likely to be able to access resources, restricting their attainment in a range of subject areas. This is problematic as lacking proficiency may impede otherwise successful students due to misunderstanding of questions and information (see Svirko et al., 2019 for an example of how conditional understanding predicts scientific understanding). Recently, Badger, Howarth, Svirko and Mellanby (unpublished) have shown that one factor associated with children underachieving at school relative to their potential, is their acquisition of complex grammar.

1.3. The current study

The research described above has highlighted the gradual development of conditionals from using the connective 'if' to being able to produce and comprehend Type III sentences. However, as outlined above, the developmental trajectory of this essential aspect of grammar is, at times, unclear and incomplete. Despite its importance, research on conditional grammar acquisition is limited.

The aim of this study was to extend the work most recently carried out by Badger and Mellanby (2018a) by using their conditional grammar test battery, to work with both younger and older children to gain a greater understanding of the developmental trajectory of conditional grammar in children aged 4-11 years of age. We decided to use the same test materials as Badger and Mellanby to keep the trajectory investigation comparable.

Acquisition of a grammatical form implies both production in normal speech and comprehension. However, demonstrating the natural production of grammar is a very labour-intensive endeavour. In this paper we have used the elicited repetition method as a measure of ability to produce a conditional sentence. This is thought to tap into the unconscious underlying acquisition of the specific structure (Lust, Flynn & Foley, 1996). As in Badger and Mellanby (2018a), we also collected measures of general ability, word reading and short-term memory. We adapted and extended their test battery to allow the testing of children aged 4-5 years. This enabled us to examine the developmental trajectory of children's acquisition, both production and comprehension, of Type I, Type II and Type III sentences in children aged 4- to 11-years-old. In turn, this provides a stronger framework on which to consider exposure to, and teaching of, these important yet often overlooked complex grammatical structures. Children who are falling behind their peers can be identified, allowing more specific targeting of educational support to ensure their best outcomes both within the classroom and beyond.

2. Methodology

2.1. Participants

A total of 316 children from four U.K. primary schools participated. Of which, 90 were in Reception (aged 4-5 years, M = 5;4 years), 55 were in Year 3 (aged 7-8 years, M = 8;3 years), 54 were in Year 4 (aged 8-9 years, M = 9;4 years), 64 were in Year 5 (aged 9-10 years, M = 10;3 years) and 53 were in Year 6 (aged 10-11 years, M = 11;3 years). There were 154 females (49%).

2.2. Data collection and processing

Participants were tested individually across two-three sessions. The ability tests were completed in one session and took 30-60 minutes; all other tests were completed together and took 10-15 minutes. Due to the wide age range of our participants, different tests were completed: details of which year group completed which test can be found within every test description.

2.2.1. Naglieri Nonverbal Ability Test (NNAT)

The NNAT (Naglieri, 1997) is a 30-minute non-verbal test that provides a measure of general ability without the need for spoken or written language. The test requires participants to choose one of five puzzle pieces that best completes the geometric pattern presented. There are two practice questions with feedback before the children continue with the rest of the test questions alone. Standardised age scores are calculated. This test was administered to the Reception children as one of the few ability tests suitable for children that young.

2.2.2. Verbal and Spatial Reasoning test for Children (VESPARCH)

The VESPARCH test (Mellanby, McElwee & Badger, 2016) is an online test which has been argued to constitute an approximation to a measure of fluid intelligence (Badger & Mellanby, 2018b). The tests are completed individually with headphones so that words and instructions can be read aloud whilst simultaneously highlighted on screen and replayed as often as needed. There is no time limit. There are two tests – one verbal and one spatial – with an equal mix of categorical and analogical questions. Five practice questions with extensive feedback are provided prior to each section. Standardised age scores are calculated. Although this test considers both verbal and spatial reasoning, it is only designed and standardised for children aged 7-12. Therefore, it was only administered to the children in years 3-6.

2.2.3. Early Word Recognition (EWR)

EWR (York Assessment of Reading for Comprehension, Hulme et al., 2009) is a reading test designed for children aged 4-7. The 30 words increase in difficulty, from *off* to *school*. If a participant sounds out a word phonetically, they are asked to try to repeat it as a whole word. The maximum possible score is 30. This test was administered to the Reception children but was not suitable for the children in our study aged 8+ who required a more challenging test (see below). The majority of children in years 3-6 would be at ceiling level on this test.

2.2.4. Single Word Reading Test (SWRT)

The SWRT (GL Assessment) is a test measuring word reading. Both word cards of the SWRT are matched for difficulty and contain six sets of ten words that increase in difficulty, from *see* to *pseudonym* (word card 1) and *yes* to *beguile* (word card 2); participants are given one of the two cards. There is no time limit. If a participant sounds out a word phonetically, they are asked to try and repeat it as a whole word. The maximum possible score is 60. This test was administered to the children in years 3-6 only as it was not designed for the younger children.

2.2.5. Forward Digit Span

A paper and pencil version of the Automated Working Memory Assessment (AWMA; Alloway, 2007) of digit span was used. It measures verbal short-term memory by identifying the maximum length of a random number sequence children can recall immediately after hearing it. Six blocks each containing six digit-sequences are presented, which increase by one digit per block. The maximum possible score is 36. This test was administered to the children in years Reception-4.

2.2.6. Complex Grammar tests

2.2.6.1. Production

Sentence repetition was used to assess the production of conditional sentences. The test used was designed by Svirko (2011) expanding on the elicited repetition method (Lust et al., 1996), and was later adapted by Badger and Mellanby (2018a). It has been suggested that sentence repetition taps into different types of processing – a discussion of this can be found in Badger and Mellanby (2018a) – with research pointing to the importance of the reconstruction of the verb in a sentence rather than every word, which makes it an ideal way of assessing the acquisition of complex grammar.

The test used in this study contains four control sentences (no complex grammar) such as '*Simon picked some lovely flowers and gave them to his mum and dad'*, four type II conditional sentences such as *'If Peter ate too much at lunchtime, he would not be hungry tonight'* and four type III conditional sentences such as *'If Mary had broken her toy train, she would have tried to fix it'*. Each sentence is 16-17 syllables long. This test was administered to the children in years 3-6 (Type II sentences were not administered to children in years 5-6). Owing to the age of the children in Reception (ages 4-5), and consequently their shorter memory capacity, we adapted Badger and Mellanby's 2018a task for this age group by including Type I sentences such as *'If Tom goes to the shop, he will buy a hamster'* and by shortening the overall length of the sentences to 12-13 syllables. Only Control, Type I and Type II sentences were administered to the Reception children.

Each sentence was classified as either correct or incorrect which resulted in a maximum possible score of four for each sentence type. In-line with Badger and Mellanby (2018a), we divided the conditional sentence scores into categories of a score of 0 = 'no development', a score of 1-2 = 'incomplete development' and a score of 3-4 = 'complete development'.

The children in years 5 and 6 completed 6 sentences rather than 4 and so their categorisations were as follows: a score of 0-1 = 'no development', a score of 2-4 = 'incomplete development' and a score of 5-6 = 'complete development'.

2.2.6.2. Comprehension

Sentence-statement sets were used to assess the comprehension of conditional sentences (Badger & Mellanby, 2018a). A sentence is read out loud to each participant and they must then answer 'yes' or 'no' to four statements given about the initial sentence. The two control (sentences with no complex grammar), two Type II and two Type III sentence-statements sets were taken from Badger and Mellanby. We created two new Type I sentence-statement sets suitable for the Reception children, for example:

Type I sentence: *'If Simon eats slowly, he will be late for school'*

1. *Does the sentence mean that Simon is late for school?*
2. *Does the sentence mean that Simon is eating slowly?*
3. *Does the sentence mean that Simon is going to school?*
4. *Does the sentence mean that Simon eats before school?*

Each statement answer was classified as correct or incorrect which resulted in a maximum possible score of four for each sentence-statement set. A score of three or four out of four per sentence-statement set would equal a pass for that set, which resulted in a maximum possible score of two for each statement-sentence type. Reception children completed Control, Type I and Type II sets, children in years 3-4 completed Control, Type II and Type III sets, and children in years 5-6 completed Control and Type III sets. Again, following Badger and Mellanby, we divided the conditional sentence scores for each Type into categories with a score of 0 = 'no development', a score of 1 = 'incomplete development' and a score of 2 = 'complete development'.
The children in years 5 and 6 completed 4 sentence-statement sets rather than 2 and so their categorisations were as follows: a score of 0 = 'no development', a score of 1-2 = 'incomplete development' and a score of 3-4 = 'complete development'.

2.2. Data analysis

The data was analysed using SPSS version 25, both descriptively, and statistically using binary logistic regression models. Logistic regressions were used for univariate analyses and binary logistic regressions were performed for multivariate analyses with each predictor entered in a separate block. Improvement in model fit, as well as the predictors' odds ratios in the final model were considered. In the analysis the following independent variables were considered because previous work had suggested that they may all be associated with acquiring grammar: age, reasoning ability, sex, word reading, short-term memory, production and comprehension of other conditional forms (Badger & Mellanby, 2018b; Svirko 2011).

3. Findings

3.1. Exclusions

The control sentences acted as a means of testing every child's general language ability (MacDonald & Christiansen, 2002; Moll, Hulme, Nag & Snowling, 2013). Seventeen children (3 Reception, 7 Year 3, 1 Year 4 and 1 Year 6) only scored 0 or 1 passes in the control production sentences and were therefore removed from our production of conditionals analyses. Twenty-one children (10 Reception, 5 Year 3, 3 Year 4, 1 Year 5 and 2 Year

6) scored 0 passes in the control comprehension sentences and were therefore removed from our comprehension of conditionals analyses. These children were removed because their low scores on the control items meant that we could not be confident in their general language ability for that type of item when including complex grammar.

3.2. Badger and Mellanby (2018a)

As with Badger and Mellanby, we categorised the development of conditional sentences into 'no development', 'incomplete development' and 'complete development'. To show the full developmental trajectory we have included Badger and Mellanby's 2018 data (January Year 1 – September Year 3) into our own illustrations. However, all statistical analyses contain only the newly collected data. It is important to note that in Badger and Mellanby's trajectory, two groups of children were tested over 3 time points (group 1 = Y1 January, Y1 April and Y2 September; group 2 = Y2 January, Y2, April and Y3 September).

3.3. The Developmental Trajectory of Conditional Sentence Production

The percentage of participants within each of the developmental categories was considered across Type I, Type II and Type III sentence data.

3.3.1. Type I

Ninety-one percent of Reception children (YR) showed complete development in the reproduction of Type I sentences, with 7% showing incomplete and 2% showing no development at all.

3.3.2. Type II

The percentage of children who have complete development of the reproduction of Type II conditional sentences gradually increases with age from the Reception (YR) children tested in July (48%) through to the Year 4 (Y4) children tested in June (94%; see Figure 1). (Type II was not measured in year 5 or 6)

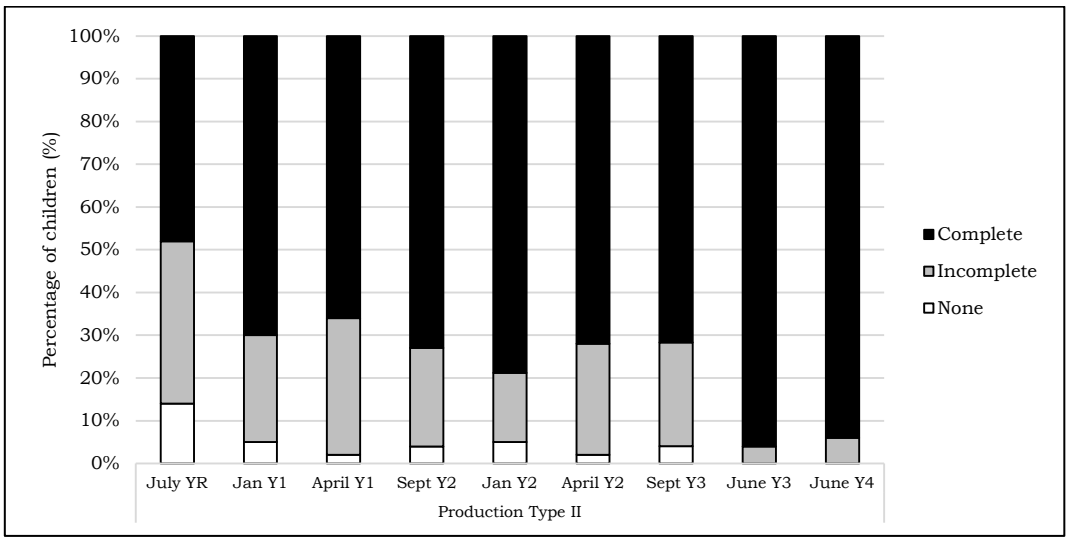

Figure 1. The percentage of children (Reception – YR – aged 4-5 years to Year 4 – Y4– aged 8-9 years) showing complete, incomplete or no development for Type II conditional sentence production, split by month and U.K. school year tested. Note: Jan Y1 – Sept Y3 data taken from Badger and Mellanby (2018a).

3.3.3. Type III

When considering Type III production, the Year 1 children tested in January (taken from Badger & Mellanby, 2018a) show only 13% with complete development which increases to 78% for children in Year 6 (Y6). Interestingly, the percentage of Year 6 children who have complete production of Type III conditionals (78%) is similar to the percentage of Year 2 (Y2) and beginning of Year 3 (Y3) children who have complete production of Type II conditionals (74% (average) and 71%, respectively), suggesting a 3-year delay in acquisition of Type III production compared with type II.

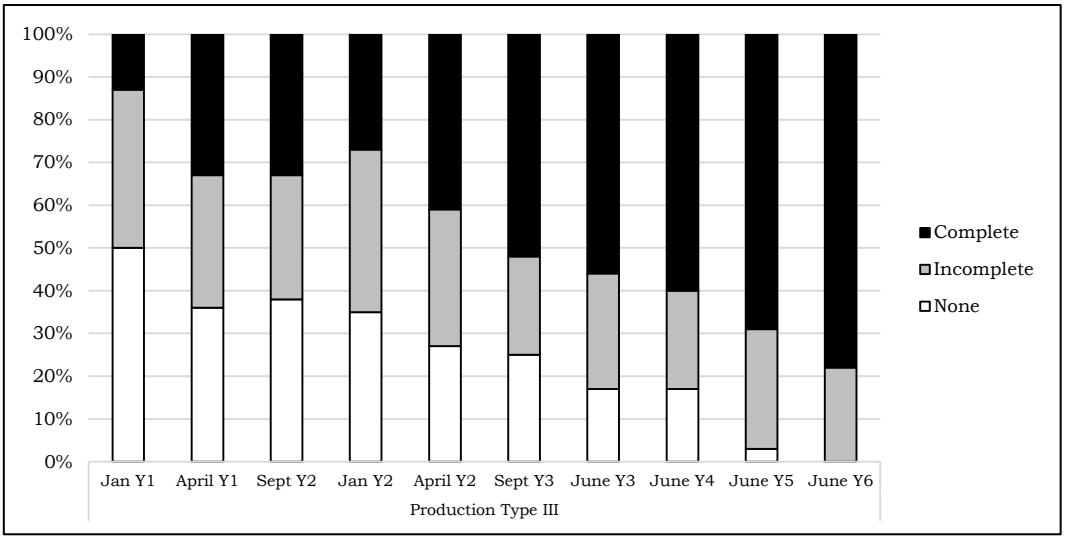

Figure 2. The percentage of children (Year 1 – Y1 – aged 5-6 years to Year 6 – Y6 – aged 10-11 years) showing complete, incomplete or no development for Type III conditional sentence production, split by month and U.K. school year tested. Note: Jan Y1 – Sept Y3 data taken from Badger and Mellanby (2018a).

3.4. The Developmental Trajectory of Conditional Sentence Comprehension

3.4.1. Type I

Ninety-four percent of Reception children (YR) showed no development in the comprehension of Type I sentences, with 6% showing incomplete comprehension and none of them showing complete development.

3.4.2. Type II

Matching the pattern of development regarding Type I comprehension, none of the children in Reception had complete comprehension of Type II conditionals. This does gradually increase to 28% in the Year 4 (Y4) children (see Figure 3), but it is not until September of Year 3 (Y3) that there is any consistent increase.

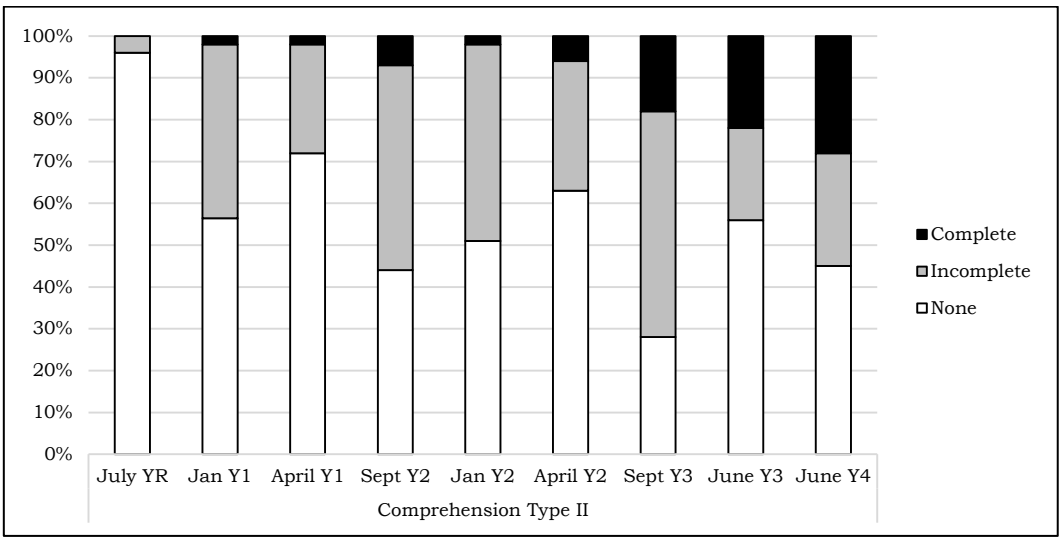

Figure 3. The percentage of children (Reception – YR – aged 4-5 years to Year 4 – Y4 – aged 8-9 years) showing complete, incomplete or no development for Type II conditional sentence comprehension, split by month and U.K. school year tested. Note: Jan Y1 – Sept Y3 data taken from Badger and Mellanby (2018a).

3.4.3. Type III

Complete comprehension of Type III increases steadily from year 1 until the end of year 4. Interestingly, the proportion is the same (30%) for Type III as for Type II at the end of year 3 (Figs 3 and 4). Between the end of year 4 and the end of year 5, comprehension of Type III increases dramatically to 75% (Fig 4).

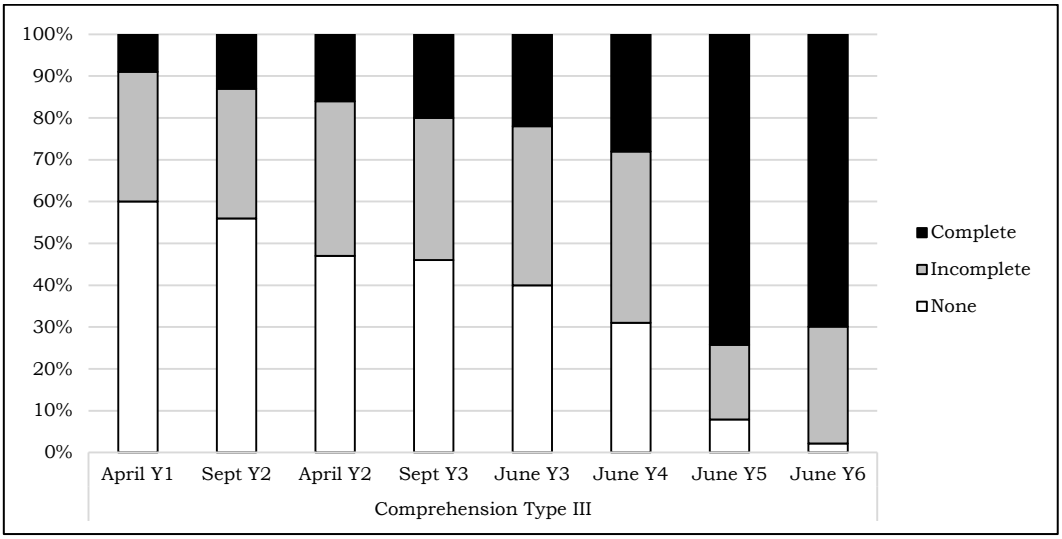

Figure 4. The percentage of children (Year 1 – Y1 – aged 5-6 years to Year 6 – Y6 – aged 10-11 years) showing complete, incomplete or no development for Type III conditional sentence comprehension, split by month and U.K. school year tested. Note: April Y1 – Sept Y3 data taken from Badger and Mellanby (2018a).

3.5. What influences development?

Since almost all (91%) of Reception children showed complete production of Type I conditionals and none of them could comprehend them, this data was unsuitable for investigating factors that differentiate between those who could and could not understand conditionals. Similarly, such analyses were not carried out for Type II production by the Year 3 and Year 4 cohorts.

Because different tests were completed by different age groups, the following analyses will be split into 1) Reception, 2) Year 3 and Year 4, 3) Year 5 and Year 6.

For each conditional outcome, a univariate analysis was carried out with complete acquisition (production or comprehension) versus incomplete acquisition as the dependent variable. Those which made a significant contribution were entered in a hierarchical binary logistic regression, to find whether each sequential addition to the regression model significantly improved the accuracy of predicting the outcome. The final model showed whether any variables made independent contribution when other variables were controlled for.

3.5.1. Reproduction

The univariate analyses for the Reception children showed that the only variable related to the outcome (complete versus incomplete production of Type II conditionals) was sex: (p = .016): there were more females showing complete development and fewer showing incomplete development compared with males.

The univariate analyses for the Year 3 and Year 4 children showed that the following variables related to the outcome (complete versus incomplete production of Type III conditionals): age, spatial VESPARCH, digit span, SWRT, Type II and Type III comprehension. In the subsequent hierarchical regression (entered in the above order) age, spatial VESPARCH and SWRT significantly improved the model fit: p = .047; p = .009 and p = .005, respectively. However, in the final model only SWRT made a significant independent contribution to the outcome, see Table 2.

Table 2

Regression identifying that reading (SWRT) may relate to conditional reproduction

	Beta	*S.E.*	*Wald*	*df*	*Sig.*	*Exp(B)*
Age in months	.023	.031	0.544	1	.461	1.023
Spatial VESPARCH	.021	.017	1.437	1	.231	1.021
SWRT	.075	.029	6.780	1	.009*	1.078
**denotes statistical significance*						

The univariate analyses for the Year 5 and Year 6 children showed that the none of the variables related to the outcome (complete versus incomplete production of Type III conditionals).

3.5.2. Comprehension

With Type II conditionals comprehension, the univariate analyses for the Year 3 and Year 4 children showed that the following variables related to the outcome (complete versus incomplete comprehension): spatial VESPARCH, digit span, SWRT, and both Type III production and Type III comprehension. In the subsequent hierarchical regression only spatial VESPARCH significantly improved the model fit: p = .002 but this contribution was not significantly independent of the other variables.

With Type III conditional comprehension, the univariate analyses for the Year 3 and Year 4 children showed that again the following variables related to the outcome (complete versus incomplete comprehension): spatial VESPARCH, digit span, SWRT, and in this case both Type II production and Type II comprehension (either one entered.) In the hierarchical binary logistic regression, only spatial VESPARCH significantly improved the model fit: p = .042 but again, this was not significantly independent of the other variables.

The univariate analyses for the Year 5 and Year 6 children showed that none of the variables significantly related to the outcome (complete versus incomplete comprehension of Type III conditionals).

4. Discussion and conclusion

We investigated the developmental trajectory of Type II and Type III conditional grammar, whilst also taking a first look at the early development of Type I conditional grammar. Specifically, we extended work carried out by Badger and Mellanby (2018a) with 5- to 7-year-olds, meaning that we could track development of the conditional from age 4 (Reception) to age 11 (Year 6).

4.1. Production and comprehension

Reaffirming the findings of Badger and Mellanby (2018a), we found that in early school years, production, as revealed by elicited repetition, of all the three Types of conditional precedes comprehension.

As expected, as the complexity of the conditional increases (Type I – Type II – Type III), so does the difficultly in correctly reproducing it. For example, 91% of Reception children had complete Type I production but only 48% had complete Type II production; 70% of Year 1 children had complete Type II production but only 13% had complete Type III production. Svirko (2011) points out that the differences in the trajectory for the different types of production are probably caused by differing levels of exposure as well as by increasing complexity itself. Children are likely to have had more exposure to simpler structures such as Type I conditionals when they were younger but less exposure to Type II conditionals and even less exposure to Type III conditionals.

Interestingly, the developmental pattern of our comprehension results are comparable for the different conditional Types and by the end of Year 4, Type II and Type III are understood to a similar extent (~30%). These findings suggest that comprehension may not be related to exposure in the way that production may be.

We can see that the first point at which comprehension catches up with reproduction is of Type III sentences around Year 5 to Year 6 (age 10-11; Y5: production = 69%, comprehension = 75%; Y6: production = 78%, comprehension = 65%). Two possible causes of this relative improvement in comprehension are school grammar teaching and greater cognitive maturity. Towards the end of primary school, children in the UK are taught more explicitly about complex grammatical structures in preparation for their formal SPaG (spelling, punctuation and grammar) tests which they take near the end of Year 6. It could be that this teaching has prepared them for the increased complexity surrounding the meaning: they have been taught to look beyond the obvious and to pay more attention to the importance of grammatical structure. Secondly, perhaps understanding the concept of a hypothetical situation is too abstract a concept for most children below the age of 9 and this transition reflects a Piagetian stage-like shift in cognitive maturity which allows children to begin to think more abstractly (Inhelder & Piaget, 1958; Piaget, 1964). Comprehension of the hypothetical meaning of conditionals requires an ability to conceptualise potential antecedents and outcomes and this may only be possible with a qualitative change in the nature of children's thinking (see Svirko, 2011).

4.2. When does the ability to reproduce Type I, Type II and Type III conditionals emerge?

It is not clear from our work at what age typically developing children would start to be able to reproduce Type I or Type II conditionals since at age 4-5 years (Reception class) 91% show complete acquisition of Type I production and almost 50% show complete acquisition of Type II production. Further work with younger children is needed to establish when the ability to reproduce these forms emerges. Knowing that the connective 'if' emerges around 2.5 years of age (Bowerman, 1986; Bloom et al., 1980) we therefore recommend that children aged 2.5- to 4-years are tested on their reproduction of Type I and Type II conditional sentences, as in this study, to establish when these structures begin to be internalised. However, our results show that we can be fairly confident that Type III successful reproduction emerges around the age of 5 years.

Importantly, our work provides a guide to the ages at which typically developing children should be able to reproduce these three Types of conditional grammar. Thus, we can say that most children will be able to reproduce Type I conditionals by age 4-5, Type II by age 7-8 and Type III by

age 10-11. Identifying the minority of individuals who do not fit this pattern should allow the diagnosis of those who may be in need of additional support in their acquisition of complex grammar.

We have already hypothesised reasons that the ability to reproduce conditionals precedes their comprehension but that by year 5, comprehension has 'caught up'. However, despite this catch up in comprehension there were still 28% of children in Year 6 who showed either no or incomplete comprehension of Type III conditionals and 22% who showed either no or incomplete production of Type III conditionals. Following through into secondary school, preferably with a longitudinal study, should allow us to see what proportion of children still have difficulty with conditionals by the end of compulsory schooling. We know that some adults will never be able to correctly produce or comprehend conditionals (Evans et al., 2008; Newport, 1990; Ross, 1979) but at what age acquisition plateaus remains unknown. Being able to understand hypothetical situations becomes increasingly important in secondary school, especially in subjects such as science, maths, history and English. Inability to understand will lead to misunderstanding of information and discussion which will result in the individual being unable to show their full potential.

4.3. What factors are related to acquisition?

Previous research has shown the acquisition of conditionals to be linked to factors such as general ability, short term and working memory, reading and vocabulary, parental education (Svirko, 2011) and that comprehension was also predicted by production (Badger & Mellanby, 2018). The present work reaffirms this and for a wider age range, although our results show that the majority are not independent in their contribution.

This research also showed that at age 4-5 years, (Reception) girls scored higher than boys on their ability to produce type II conditionals, but this was not found in the older years. This supports the well-known language disadvantage of males in the early years.

Since by age 7-8, most of the children could reproduce Type II conditionals we could not look at what factors were affecting this acquisition. For Type III reproduction, while the ability was related to each of the measures taken, only age, spatial reasoning and SWRT made significant improvements to model fit. The finding that the contribution from SWRT was independent of the other variables points to a particularly important relationship between success in early reading and the internalisation of this grammar. In future work this should be expanded to include measures of reading comprehension rather than just single word reading. Furthermore, this role for SWRT in conditional acquisition (both production and comprehension)

supports the importance of a reciprocal relationship between reading and language development.

When considering comprehension at age 7-8, for both Type II and Type III, non-verbal reasoning (spatial VESPARCH) contributed significantly to the model, although the contribution was not independent of the other measures. That reasoning relates to the production and comprehension of conditionals supports the idea that children need to have reached a specific cognitive developmental stage, (perhaps a Piagetian stage-like shift in cognitive maturity) to be able to understand complex hypotheticals.

4.4. Limitations of the study

Firstly, it is important to note that the data was collected cross-sectionally not longitudinally. Although cross-sectional data can give an indication of the general developmental pattern of children of particular age groups, it does not track individual acquisitional changes over time. Conducting longitudinal studies would allow us to better understand the nuances in complex grammar development and the relationship between the development of reproduction and comprehension. Secondly because of the limited test-time capacity of the children, only a small number of conditional questions were used: conditional comprehension was analysed using data from only two questions each for the Reception, Year 3 and Year 4 children (although test-time capacity allowed for four questions for the Year 5 and Year 6). It is recommended that future studies focus on the comprehension of more items to reduce the likelihood of chance errors. Finally, we were limited to having to split analyses by age groupings due to the test measures used. This reduced power which may also have contributed to the lack of significance identified between the measures used and conditional development. Next time, and where possible, measures suitable to a wide age range should be implemented to get the full influence on development. It would also be beneficial to include additional demographic information such as whether English is an additional language, and which language is spoken at home.

4.5. Implications

Mapping the developmental trajectory of the conditional has important implications both for theory and for educational settings. We have shown when the majority of typically developing children are able to reproduce Type I, Type II and Type III conditional sentences, and we have a better idea of the age at which comprehension of these Types begins to emerge. Identifying those children who are lagging behind in this language development should in turn allow targeted intervention. The findings show that there will be a proportion of children who will enter secondary school without full understanding of the hypothetical meaning of these sentences. This is concerning. Conditional grammar is important within key subjects such as

English, mathematics and science (Svirko, 2011; Svirko et al., 2019) and so it is essential that children are able to both produce and comprehend these sentences to be able to work at, and show, their full potential at school and in examinations. In the early primary school years, at the stage where language is mainly being acquired implicitly from interactive exposure, introduction of conditionals into stories, drama and conversation in the classroom could help to offset the language disadvantage of some children. When the current curriculum starts teaching grammar explicitly in mid-primary school, we would propose that complex conditionals should be introduced into the curriculum.

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