Pragmatic prosody development from 3 to 8 years of age: A cross-sectional study in Catalan

Mariia Pronina1, Iris Hübscher2,3, Ingrid Vilà-Giménez1,4, Pilar Prieto5,1

1Departament de Traducció i Ciències del Llenguatge, Universitat Pompeu Fabra, Catalonia
2URPP Language and Space, University of Zurich, Switzerland
3Zurich University of Applied Sciences, Switzerland
4Departament de Didàctiques Específiques, Universitat de Girona, Catalonia
5Institució Catalana de Recerca i Estudis Avançats, Catalonia
mariia.pronina@upf.edu, iriscarmela.huebscher@uzh.ch, ingrid.vila@udg.edu, pilar.prieto@upf.edu

Abstract
Research on prosodic development has mostly focused on infants’ skills, and there is much less research on preschool and older children’s prosodic abilities and in particular on the advanced pragmatic uses of prosody (i.e., pragmatic prosody). The present cross-sectional study assesses children’s expressive pragmatic prosody profiles in three developmental stages. A total of 167 3-to-8-year-old Catalan-speaking children undertook the Audiovisual Pragmatic Test, which includes 35 everyday scenarios and elicits different speech act types. A total of 5697 answers were scored for prosodic appropriateness: 34%, 73% and 90% of the prosodically felicitous answers were produced at ages 3–4, 5–6 and 7–8, correspondingly. The results showed that, at all ages, children successfully produced basic expressive acts, unbiased assertions and requests. A significant difference was found between the performance of biased vs. unbiased, and basic vs. complex expressive acts at ages 3 and 5 (ps < .010, ps < .05), but not at 8 (ps > .05). Between ages 3 and 6 years, children develop pragmatic unbiased and basic expressive marking through prosody, while the biased and complex expressive meanings are refined later, between ages 6 and 8 years. Our finding suggest that prosodic abilities undergo developmental changes throughout childhood.

Index Terms: first language acquisition, development, pragmatic prosody

1. Introduction
Prosodic features are central in the expression of pragmatic meaning across languages. Speakers use different prosodic strategies to differentiate between speech acts, to mark phrase structure, to highlight information in an utterance, to signal their knowledge states (e.g., uncertainty or incredulity), to express their emotional states, and to convey politeness (for a recent review, see [1]; see also [2], [3]). Given the tight relationship between pragmatics and prosody, we will use the term “pragmatic prosody” to highlight the fact that this study focuses on the pragmatic uses of suprasegmental prosodic cues. Despite the close intersection between pragmatics and prosody, previous research on the development of the prosody-pragmatics interface is still limited. Specifically, past studies on prosodic development have primarily investigated the very first developmental stage (see [4], [5] for a review). For instance, these studies mainly focused on the first 2 years of life and explored infants’ sensitivity to prosodic characteristics in the process of language acquisition [6], [7], or very basic uses of prosody for signaling pragmatic intentions in infants’ first productions [8], [9]. However, to our knowledge, much less is known about more advanced uses of prosody at later stages of development, the preschool and school years, when children already have well-developed verbal skills. The existing studies on older children have explored a limited set of pragmatic functions. From all topics, the prosodic contrast between assertions and questions (e.g., [10], [11]) and the use of prosodic means to mark information structure (e.g., [12], [13], [14]) have been studied the most. Recently, studies have started to address other pragmatic aspects expressed via prosody. The work conducted by Hübscher and colleagues has investigated prosodic means used by children to signal and understand politeness [15], as well as epistemic states of uncertainty [16] and disbelief [17] (see [18], for a review). These studies have made a significant contribution to the understanding of the development of pragmatics; however, they tend to focus on specific pragmatic prosody skills rather than covering the broad picture of pragmatic prosody abilities in children.

From the point of view of global assessment of prosodic abilities, in general, the current tools do not target the developmental path followed by pragmatic prosody skills in typically developing children, as the majority of such tools are designed for use in clinical populations or focus on receptive prosodic skills (see [19], for a brief review). However, there is a novel test, the Audiovisual Pragmatic Test (APT) [19], [20] recently developed by our research group, that allows for the assessment of prosody in pragmatically relevant contexts (for more details, see Methods). The APT is a sound tool to measure pragmatic prosody skills, which has been validated and showed good to excellent psychometric characteristics [21]. The APT was previously used to explore pragmatic prosody skills in 3-to-4-year-old children (see [22]). The main aim of the present cross-sectional study is to expand on our previous investigation on 3-to-4-year-olds and assess the development of pragmatic skills in two additional age groups (ages 5–6 and 7–8). Thus, this study will comprehensively analyze and compare prosody and its pragmatic functions (i.e., pragmatic prosody) in three stages of development, specifically, in children aged 3–4, 5–6 and 7–8 years.
2. Methods

2.1. Participants

A total of 167 children (68 boys and 99 girls) aged between 3 and 8 participated in this cross-sectional study. They were recruited from 4 public schools in the province of Barcelona (Catalonia). One hundred and two children were between ages 3–4 years, 34 were 5–6 years, and 31 were 7–8 years. See Table 1 for full participants’ characteristics. Catalonia is a bilingual region where both Catalan and Spanish are spoken, with Catalan being the main language of instruction in all Catalan public schools. Caregivers gave informed consent prior to the participation of their children, and also filled out a family language questionnaire based on [23] to ensure that the participating children were predominantly exposed to Catalan (overall daily exposure to Catalan was 67%, SD = 23). Based on these reports, all participants were typically developing children, with no prior history of communication disorders.

2.2. Materials

2.2.1. The Audiovisual Pragmatic Test (APT)

To assess pragmatic prosody abilities, all children were administered the Audiovisual Pragmatic Test (henceforth, APT; see [20], for materials and detailed explanation). The APT items were developed in a way that allows for the evaluation of children’s prosody in relation to pragmatic context. The test is strongly based on previous research and assessment tools in the area of children’s pragmatics and prosody (e.g., standardized pragmatic assessment tools for children such as CASL-2 [24], and TOPL-2 [25]). Moreover, its elicitation procedure follows the Discourse Completion Task (DCT) methodology, which is widely used in both pragmatic and prosodic research and has been demonstrated to be a reliable and effective method to elicit pragmatically relevant productions [26]. The analyses showed that APT has good to excellent psychometric properties in terms of internal consistency, content validity, test-retest reliability and convergent validity, suggesting that it is a valid and reliable instrument for testing children’s pragmatic prosody [21].

The items in the APT consist of a set of 47 short social scenarios presenting everyday contexts, arranged in increasing level of difficulty. The items are verbally presented to children on a role-play basis with the support of colored pictures that reduce memory load and help children to immerse themselves in the situations. Children are asked to react to the social scenarios, and they answer by freely uttering speech. The use of contextual prompts and the DCT methodology allows for the elicitation of natural (semi-) spontaneous responses in ecologically valid and proven pragmatic contexts.

The APT contexts elicit responses that can be classified into six speech acts. First, there are two types of assertions: unbiased (e.g., neutral statement) and biased (e.g., expressing focus). Then, there are also two types of requests: unbiased

<table>
<thead>
<tr>
<th>Age group</th>
<th>Total N</th>
<th>Sex (male / female)</th>
<th>Age M (SD) indicated as years; months</th>
<th>Age range indicated as years; months</th>
<th>% Daily Catalan exposure M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 to 4 years</td>
<td>102</td>
<td>45 m / 57 f</td>
<td>3.7 (0.3)</td>
<td>3.3 – 4.3</td>
<td>57% (23%)</td>
</tr>
<tr>
<td>5 to 6 years</td>
<td>34</td>
<td>21 m / 13 f</td>
<td>6.4 (0.3)</td>
<td>5.9 – 6.8</td>
<td>77% (19%)</td>
</tr>
<tr>
<td>7 to 8 years</td>
<td>31</td>
<td>21 m / 10 f</td>
<td>8.4 (0.4)</td>
<td>7.9 – 8.8</td>
<td>78% (19%)</td>
</tr>
</tbody>
</table>

(e.g., information-seeking question) and biased (e.g., incredulity question). In this way, biased assertions and requests contain a pragmatic bias such as epistemic stances, marked information structure or negation. Finally, there are two types of expressive acts: basic expressive acts revolving around basic social situations (e.g., thanking, greeting), and complex expressive acts that include more complex pragmatic contexts (e.g., expressing congratulations, praise or concern).

2.2.2. Coding

The answers were first evaluated for pragmatic appropriateness by the examiner (the first author or one of the three research assistants). The pragmatic component of the response was scored from 0 to 2, with 0 being pragmatically inappropriate (e.g., unrelated answers) and 2 being highly pragmatically appropriate (e.g., a polite request for permission). Pragmatically inappropriate responses were automatically scored as incorrect for prosody.

If the response was coded as pragmatically appropriate (i.e., 1 or 2 in the pragmatic coding), the examiner then evaluated the prosodic component of the response. This evaluation was based on the examiner’s judgement of how natural and appropriate the response sounded for the target pragmatic context. Since different prosodic and more general linguistic strategies (e.g., syntactic) can be used to encode a specific speech act (e.g., a request produced as an imperative or as a question), the target responses were not expected to display a unique prosodic target. Rather the prosodic component of the answers was assessed by evaluating if the prosody used by the child—intonation, duration, amplitude—was consistent with the target speech act (e.g., imperative or question intonation to express a request). In this way, prosodically felicitous answers were produced with the intonation that would be appropriate if the situation was really happening; prosodically infelicitous answers were produced with the intonation that did not correspond to the pragmatic meaning or was too inexpressive, and some answers could not be evaluated for prosody because the response was embedded in the main clause such as “I would say/answer that...” (i.e., indirect speech).

In order to calculate interrater reliability, two specially trained independent raters coded a subset of data (25%, specifically, 26 participants of 3–4 years of age, 9 participants of 5–6 years and 8 participants of 7–8 years). Across age groups, the overall agreement between the three coders (the original rater, which was the first author, and two additional raters) was 85% for pragmatic scores and 88% for prosodic scores and a high degree of inter-rater reliability was found for both pragmatic and prosodic scores [27]. Results by age also revealed a high or good degree of intrarater reliability. For the youngest 3- to 4-year-old group, the overall agreement between the three raters was 83% for pragmatic scores, with Fleiss kappa coefficient of .79, and 87% for prosodic scores, with Fleiss kappa coefficient of .81, suggesting high reliability. For the 5- to 6-year-old group, the overall agreement between the three
raters was 83% for pragmatic scores, with Fleiss kappa coefficient of .77, indicating high reliability, and 86% for prosodic scores, with Fleiss kappa coefficient of .70, suggesting good reliability. Finally, for the oldest 7- to 8-year-old group, the overall agreement between the three raters was 91% for pragmatic scores, with Fleiss kappa coefficient of .84, indicating high reliability, and 91% for prosodic scores, with Fleiss kappa coefficient of .68, suggesting good reliability.

2.2.3. Procedure

The children were individually assessed in their school in a quiet room by the examiner, either the first author (the collection of approximately a third of the preschool data and all the school data) or one of the research assistants (the collection of two thirds of the preschool data). All testing was conducted in Catalan. Illustrations accompanying test items were displayed by the experimenter at the computer screen in front of the child. Since the last 12 items represent more socially complex situations, the 3- to 4-year-olds were administered only the first 35 items of the APT, all types of speech acts are covered in the this shortened version. The older children were administered the full 47-item version. Two familiarization trials were presented before the start of the test. The test was stopped if necessary, for example, if the child expressed his/her will to discontinue. In general, a total of 42% of children aged 3–4, 94% of children aged 5–6 and 100% of children aged 7–8 managed to finish the test. The total duration of the testing was around 15–20 minutes.

2.2.4. Data analysis

The first 35 items out of a total of 47 were used for analysis in order to include the items that were administered in all age groups and make the results across age groups comparable. All missing answers, that is, the answers to the items that were not administered to the children because the test was stopped, were excluded from the analysis because they are not informative about the child’s pragmatic prosody skills (see also [22]). A total of 5697 answers were obtained during the administration of the APT. From these, a total of 3709 answers were pragmatically appropriate (a score of 1 or 2 for the pragmatic component of the answer) and therefore were eligible for prosodic scoring. Children’s prosodic scores obtained for different speech act categories (biased vs. unbiased speech acts, basic vs. complex expressive speech acts) were compared with linear mixed-effect models using the lme4 package [28]. The prosodic performance of the different age groups was compared by means of t-tests.

3. Results

3.1. Children of ages 3–4

The youngest age group started to successfully express different types of speech acts. Preschool children begin to produce basic expressive acts (32%), unbiased assertions (33%) and unbiased requests (24%) (Fig. 1, upper panel, the order of presentation of speech acts follows the order of higher to lower levels of achievement) but they tended to have more difficulties in expressing pragmatic biases (16% for biased requests and 15% for biased assertions) and complex expressive acts (12%). The analysis showed that biased speech acts are significantly more challenging than unbiased ($\beta = -0.559$, $t = -3.389$, $p = .007$), as well as complex expressive acts are significantly more difficult than basic ones ($\beta = -0.358$, $t = -2.820$, $p = .010$).

3.2. Children of ages 5–6

Five- to 6-year-olds performed significantly better on expressive prosodic use than 3- to 4-year-olds ($t(3136.8) = -3.169$, $p < .001$). The number of prosodically felicitous responses increased for all types of speech acts: 77% for unbiased assertions, 84% for basic expressive acts, 77% for unbiased requests, 55% for biased assertions, 67% for complex expressive acts, and 59% for biased requests (the results are presented following the order in the graph in Fig. 1, see middle panel). Complex expressive and biased speech acts continue to be the most challenging areas and these differences maintain significance ($\beta = -0.371$, $t = -2.239$, $p = .049$ and $\beta = -0.563$, $t = -3.535$, $p = .002$, correspondingly).

3.3. Children of ages 7–8

At 7–8 years of age, the percentage of prosodically felicitous answers increased significantly compared to the 5- to 6-year-old group ($t(2867.5) = -11.516$, $p < .001$). In all pragmatic areas, prosodic performance was approaching ceiling level: 74% for unbiased assertions, 84% for basic expressive acts, 91% for unbiased requests, 73% for biased assertions, 84% for complex expressive acts, and 88% for biased requests (Fig. 1, lower panel). The most challenging area with still some room for development was the expression of biased meanings such as focus and epistemic states. However, the differences on the performance on biased versus unbiased and basic versus complex expressive speech acts were not significant anymore ($\beta = -0.247$, $t = -1.787$, $p > .05$ and $\beta = -0.091$, $t = -1.119$, $p > .05$).

3.4. Cross-age comparison

First, the overall results showed that the total number of appropriate answers increased significantly from 3 to 8 years of age. While at the age of 3–4 years, the percentage of pragmatically and prosodically felicitous responses was 43% and 34%, correspondingly, it reached 78% and 73% in the group of the 5- to 6-year-olds, and 92% and 90% in the oldest group of 7- to 8-year-olds (Fig. 1). Second, considering results by speech act type, the group aged 5–6 significantly improved the prosodic performance on all speech acts compared to the group aged 3–4 (all $p < .001$). Next, the group aged 7–8 also significantly improved compared to the 5- to 6-year-olds in almost all speech acts (all $p < .001$), with the exception of basic expressive acts and unbiased assertion, for which a high level of performance was already reached at the previous developmental stage.

4. Discussion and Conclusions

The results of the present study have broadened our knowledge about the acquisition of pragmatic prosody in the preschool and school years (ages 3–8). Overall, our findings suggest that pragmatic prosody abilities undergo considerable developmental changes throughout childhood, and that gradually approach performance of adults, whose prosodic production of different speech acts was previously described for Catalan using the same DCT methodology [29]. The results revealed different patterns of change for basic and more advanced uses of prosody. The basic uses significantly changed between ages 3 and 6 years and then advanced slowly or reached a plateau from ages 6 to 8 years. During the period between preschool (ages 3–4) and early school (ages 5–6) years, children mostly developed pragmatic unbiased and basic
expressive marking through prosody. Having mastered these prosodic productions at ages 5–6, children showed high and stable performance in ages 7–8 and the difference between 5–6 and 7–8-year-olds is not significant anymore.

In contrast, more advanced uses of prosody continuously improved from ages 3 to 8 years and in ages 3–6 there was a significant difference in the child’s ability to express unbiased and biased meanings. Children got better in the expression of pragmatic biases via prosody little by little. For example, while 3- to 4-year-olds almost did not utter incredulity questions and rarely produced sentences with corrective focus (usually as a simple “No!”), 5- to 6-year-olds began to do so. For instance, they started producing sentences with information structure marked prosodically (e.g., “No, I didn’t say X; I said Y”). By contrast, 7- to 8-year-old children reliably produced all kinds of speech acts and they were significantly better in producing biased speech acts than 5- to 6-year-olds. For example, they could accurately utter assertions and requests containing epistemic meanings (e.g., an incredulity question “Who?!! Pau won the competition?”). The expression of biased meanings is the area that still slightly lags behind but the difference with unbiased meanings is not significant anymore. In this way, in later years, between 6 and 8 years of age, when the primary uses of prosody are already mastered, more advanced pragmatic prosody dimensions, such as marking of knowledge states and information structure or adjusting prosody for complex social situations, are refined.

It should be noted that the rates of the provided appropriate responses in the youngest group are quite low and the children of 3–4 years do not necessarily respond to all items of the test as some of them represent more complex pragmatic meanings. Since the APT is appropriate tool for elicitation of pragmatically based prosodic productions, in our view, the poor performance of preschool children is informative about their pragmatic prosody skills that still have a lot of room for development (for more detailed discussion of this topic, see [22]).

The present study has demonstrated the utility of the APT for cross-age comparisons when building pragmatic prosody profiles of children of different ages. We believe that this tool also has the potential to be useful for cross-linguistic investigations and to finely assess the development in the realization of target pitch contours in children as compared to adults. All in all, future research can further explore the route of acquisition of pragmatic prosody in different languages and to discover cross-linguistic differences and similarities.

5. Acknowledgements

The authors thank the participating schools Escola Antoni Brusi, Escola Bogatell, Escola Pública Cristòfor Mestre, Col·legi Públic Estalella i Graells, as well as the children who took part in this study and their caregivers. We acknowledge our research assistants E. Castillo, A. Massanas and A. David and independent raters E. Castillo and J. Florit-Pons. This work was supported by funding from the Spanish MCIU, AEI, FEDER (PGC2018-097007-B-I00) and the Generalitat de Catalunya (2017 SGR_971, 2020 FI_B2 00192).

Figure 1. Percentage of prosodically felicitous responses by children of 3-4, 5-6 and 7-8 years of age, broken down by speech act category and degree of appropriateness of the answer.
6. References


[21] M. Pronina, P. Prieto, L. Bischetti, and V. Bambini, “Expressive pragmatics and prosody in preschoolers are more related to language skills than to social cognition.”


