



Universitat  
Pompeu Fabra  
Barcelona

Treball de fi de màster de Recerca

# The Relationship between Narrative Abilities and Multimodal Imitation Abilities in Preschool Children

Eva Castillo i Sánchez

**Màster:** Lingüística Teòrica i Aplicada

**Edició:** 2018-2019

**Directors:** Dra. Pilar Prieto

**Any de defensa:** 2019

**Col·lecció:** Treballs de fi de màster

**Departament de Traducció i Ciències del Llenguatge**

## **Acknowledgements**

First of all, I would like to express my great appreciation to Dra. Pilar Prieto, my supervisor, for her guidance and support throughout the development of this thesis. I would also like to thank Mariia Pronina for her constant assistance and for letting me be involved in her PhD research project. I would like to particularly thank her along with Jelena Grofulovic for helping me conduct the inter-rater reliability for the present project. I also owe my gratitude to Iris Hübscher who together with Pilar Prieto encouraged me to take this research path. I am especially grateful for her advice and useful critiques of this research work.

I would like to extend my thanks to Anna Massanas for her willingness to participate in the recording of the audio-visual stimuli for this research project. I am also thankful to the audio-visual technicians at Universitat Pompeu Fabra for helping me record the audio-visual stimuli.

I am grateful to the schools *Escola Brusi* and *Escola Bogatell*, where the experiment was conducted. My grateful thanks are also extended to the children that participated in the present work and their families.

Additionally, I wish to thank my beloved friends Ainhoa David and Jennifer Fray. Ainhoa, for helping me with the administration of the tests as a research assistant, and Jennifer, for proofreading the present thesis. Their assistance has been greatly appreciated.

Finally, I would like to offer my special thanks to my family for giving me the strength and support I need to achieve my goals.

## **Abstract**

Previous studies have shown that gestures precede and predict children's milestones in vocabulary, sentence structure, and narratives. Yet little is known about whether multimodal imitation abilities (understood as the ability to jointly imitate gestures, prosody, and lexical content) and narratives are correlated in typically developing preschool children. To examine the potential correlations between narratives and imitation (multimodal imitation and object-based imitation), 31 typically developing 3- to 4-year-old children performed a narrative task, a multimodal imitation task and an object-based imitation task. The correlations obtained revealed that (a) narratives correlate with multimodal imitation (as well as gestural, prosodic and lexical imitation separately); and (b) object-based imitation does not correlate with either multimodal imitation or with narratives. These results show that multimodal abilities (specifically, gesture and prosodic abilities) form a tightly linked communication system that is strongly related to language, and highlight the potential importance of multimodal imitation trainings in language development.

**Keywords:** multimodal imitation, narratives, object-based imitation, gesture imitation, prosody imitation, lexical imitation, preschool children

## Table of contents

### Acknowledgements

### Abstract

<b>1. Introduction</b> .....	1
<b>2. Methodology</b> .....	8
2.1 Participants.....	8
2.2 Materials .....	9
2.2.1. <i>Renfrew Bus Story Test</i> .....	9
2.2.3. <i>Multimodal Imitation Task</i> .....	9
2.2.3. <i>Object-Based Imitation Task</i> .....	13
2.3 Procedure .....	14
2.3.1. <i>Renfrew Bus Story Test</i> .....	15
2.3.2. <i>Multimodal Imitation Task</i> .....	15
2.3.3. <i>Object-Based Imitation Task</i> .....	16
2.4 Coding.....	17
2.4.1. <i>Renfrew Bus Story Test</i> .....	17
2.4.2. <i>Multimodal Imitation Task</i> .....	18
2.4.3. <i>Object-Based Imitation Task</i> .....	18
2.5. Inter-rater reliability .....	19
2.6 Statistical Analysis.....	19
<b>3. Results</b> .....	19
<b>4. Discussion and conclusions</b> .....	22
<b>5. References</b> .....	27

## **1. Introduction**

Previous studies have shown that narrative development is strongly associated with language development and that narrative performance in children predicts later literacy achievement (e.g. Dickinson & McCabe, 1991; Feagans, 1982; Hedberg & Westby, 1993; Michaels, 1981) and academic success (e.g. Bishop & Edmundson, 1987; Burns, Griffin, & Snow, 1999; Dickinson & McCabe, 2001; Paris & Paris, 2003). Additionally, narrative development has shown to be strongly related to the development of oral language (Morrow, 1985) and the development of concepts (Applebee, 1978; Vygotsky, 1962). It is at about ages 3 or 4 years (i.e. during the preschool years) that children start producing narratives (Applebee, 1980; Berman & Slobin, 1994; Stradler & Ward, 2005) and those narratives change dramatically until the early elementary school years. It is not surprising then that narrative skills have been defined by Demir, Levine & Goldin-Meadow (2012, p. 6) as “an oral language skill that is argued to provide the missing link between oral language and later reading comprehension”.

Gestures, which are considered an integral part of face-to-face interaction, have also been demonstrated to play a fundamental role in the process of narrative development. Infants between 9 and 12 months are already able to produce pointing gestures in isolation, even before they start to produce their first words, indicating that gesture precedes speech in language development (e.g. Bates, 1976; Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979). During the early verbal period (i.e. when children start producing their first words) infants already use gestures combined with words in order to have a richer communicative repertoire (Greenfield & Smith, 1976; Masur, 1983; Özçaliskan & Goldin-Meadow, 2005), and they continue using gestures even when they begin to utter two-word combinations in order to convey more complex meanings (Stites & Özçaliskan, 2017). Importantly, co-speech gestures have been shown to be a precursor to narrative development and are used in training

procedures designed to boost narrative performance in preschool and early elementary school children (Demir, Levine, & Goldin-Meadow, 2015; Stites & Özçaliskan, 2017; Vilà-Giménez, Igualada, & Prieto, 2019; Vilà-Giménez & Prieto, 2018). Demir et al. (2015) showed that children who develop the ability to create iconic gestures with character viewpoint at 5 years of age produce more structured and complex narratives at 6, 7, and 8 years of age. Additionally, in their research with children ages 4 to 6, Stites & Özçaliskan (2017) showed that children at this stage of development used gesture-speech combinations to introduce new characters in a story with a character viewpoint before introducing referents using noun phrases. However, not only representational gestures but also beat gestures have been demonstrated to have a positive effect on narratives scores. In a training study experiment with a pretest and posttest design, Vilà-Giménez & Prieto (2018) showed that encouraging 5- and 6-year-old children to produce beat gestures improved their narratives in fluency and structure during posttest. A significant improvement in 5- and 6-year-olds' narrative structure scores was also observed in Vilà-Giménez, Igualada & Prieto (2019) after a brief training in which children had to observe an adult telling stories while highlighting the focal elements of the discourse with beat gestures. Beat gestures, which start being produced between 5 and 7 years of age (e.g. Capone & McGregor, 2004; Colletta, Guidetti, Capirci, Cristilli, Demir, Kunene-Nicolas, & Levine, 2015), are strongly associated with prosodic prominence, as they are both used to highlight and organize elements in discourse (Prieto & Esteve-Gibert, 2018). In fact, previous research has demonstrated that gesture and prosody are closely related to each other in adult speech and in development, both at the temporal and at the semantic-pragmatic level (see Rusiewicz & Esteve-Gibert, 2018 for a review). The fact that children use this multimodal unit consisting of beat gesture and prosodic prominence as a focus-marking strategy indicates that prosody also plays an important role in narrative development.

An increasing number of studies have related the development of gesture to the development of narrative abilities. For example, in a study with 5- and 10-year-old children Colletta et al. (2015) showed that co-speech gesture production and narratives develop together in childhood. Moreover, gesture imitation abilities have been shown to be strongly linked to the development of communication and language. Nevertheless, little is known about whether early narrative abilities in children are positively correlated with multimodal imitation abilities (understood as the ability to jointly imitate gestures, prosody, and lexical content). Given the fact that the use of gestures is associated to precursor stages of narrative production in children and that children use prosody, together with gesture, as a focus-marking strategy in discourse, we hypothesize that narrative and multimodal imitation abilities should be strongly correlated.

Imitation, understood as “the ability to learn and replicate others’ responses and knowledge” (Subiaul, Zimmermann, Renner & Schilder (2016, p. 2), has been shown to be an essential ability for the development of social communication behaviors such as language (see also Rogers & Pennington, 1991). In relation to social communication, numerous empirical and longitudinal studies investigating various aspects of visual and oral imitation have shown that imitative behaviors naturally occur in early language interaction throughout infancy and early childhood (Carpenter, Nagell, & Tomasello, 1998; Carpenter, Tomasello, & Striano, 2005; Lieven & Stoll, 2013). For example, Carpenter, Tomasello and colleagues observed that (1) there is a relationship between the age of emergence of imitation of arbitrary actions and the age of emergence of referential language in infancy; and that (2) role reversal imitation (that is, the ability of a child to learn how to switch roles with an adult in a joint task) is positively related to various measures of language in typically developing 18-month-old infants and in autistic children between the ages of 5 and 11 years. Additionally, in their study Lieven & Stoll (2013) observed that spontaneous imitation of actions was

predominantly used in 8-month-old infants, highlighting the importance of imitation in the preverbal stages of development. A positive association between imitation and language was also found in Bates et al. (1979), who analyzed the relationship between language imitation and language production and comprehension in children between the ages of 9 to 13 months. They showed that imitation can precede, follow and even coincide with production, indicating a significant correlation between language imitation and language development. In her study investigating the relationship between spontaneous imitation at 14 months and elicited imitation at 20 months, Snow (1989) concluded that vocal and gestural imitation at 14 months were significantly correlated with language skills (e.g. number of verbs produced or total productive vocabulary) at 20 months. On the contrary, object-mediated imitation was negatively correlated with language measures. Imitation of novel words also plays an important role in early development predicting infants' later lexical development, as it has been demonstrated by Masur & Eichorst (2002). Moreover, in a study with 10- to 16-month-old infants, Masur & Ritz (1984) showed that at this stage, hand and arm movements with no communicative significance, such as opening and closing of the fist or raising an arm, were less imitated than more communicative gestures such as waving or pointing. This finding supports the idea that the social function of gestures influences infants' imitation. Something similar happens with facial imitation, which is strongly linked to interpersonal social engagement (Rogers, Hepburn, Stackhouse, & Wehner, 2003). Regarding prosody, it has been suggested that early in development children are already able to imitate prosody. In a study with 10- to 13-week-old infants, Gratier & Devouche (2011) observed that by 3 months infants are already able to selectively use specific prosodic contours in situations of imitation occurring during social interactions. Additionally, Loeb & Allen (1993) reported that by 3 years of age typically developing children are already able to imitate preceding intonation contours, although in a less accurate way than 5-year-olds. Thus, while evidence suggests a



close relationship between different types of imitation, such as vocal or gesture imitation, and language in their initial stages, it is still unclear whether this relationship still holds in the preschool stage. In addition, although there is previous research analyzing gesture, vocal and even verbal imitation in infants, no study so far has directly investigated the relationship between gesture imitation in conjunction with prosody and lexical imitation (multimodal imitation), and language and narrative performances during the preschool stage.

Gesture imitation has also been compared to other types of non-communicative imitation such as object-based imitation. Previous research comparing gesture imitation and object-based imitation shows that typically developing children between 6 and 20 months old imitate actions on objects better and more frequently than gestures (Abravanel, Levan-Goldschmidt, & Stevenson, 1976; Christie & Slaughter, 2009; Kim, Óturai, Király & Knopf, 2015; Rodgon & Kurdek, 1977). Additionally, in previous studies with children with ASD it has been observed that while gesture imitation is related to expressive language, object-based imitation is related to play skills (Stone, Ousley, & Littleford, 1997). However, to our knowledge little is known about how object-based imitation abilities vs. gesture imitation abilities in conjunction with prosody and lexical imitation abilities (multimodal imitation) continue to develop at later stages of development and whether they are associated with children's narrative skills, a global measure of children's linguistic abilities.

The main purpose of the current study is to examine whether narrative abilities in children between 3 and 4 years of age are related to multimodal imitation abilities. Previous research has shown that gesture plays a fundamental role in preschool and early elementary school children's narrative development (Demir et al., 2015; Stites & Özçaliskan, 2017; Vilà-Giménez, Igualada, & Prieto, 2019; Vilà-Giménez & Prieto, 2018), and that children use beat gestures associated with prosodic prominence in order to highlight information in discourse

(Hübscher & Prieto, 2019; Prieto & Esteve-Gibert, 2018). In addition, it has been observed that gesture and vocal imitation are closely related to language in young, typically developing children (Snow, 1989) and in young children with language impairment (Stone et al., 1997; Wray, Saunders, McGuire, Cousins, & Frazier Norbury, 2017), but so far it is unclear whether this relationship still holds in later stages of development. Therefore, we predict that multimodal imitation abilities will significantly correlate with narrative abilities in preschool children. From our perspective, multimodal imitation abilities integrate not only the gestural component, but also the prosodic and the lexical components, which will also be analyzed.

The target population of this study is 3- to 4-year-old children. This specific age group is of particular interest in relation to narrative development and imitation abilities. In relation to narrative development, children start producing narratives between ages 3 and 4 (Applebee, 1980; Berman & Slobin, 1994; Stradler & Ward, 2005). During this transition period, children become more discursive, use more complex language and their narrative structure is better integrated (Bamberg, 1987; Berman & Slobin, 1994; Demir, Fisher, Goldin-Meadow, & Levine, 2014; O'Neill & Holmes, 2002). Therefore, the age range between 3 and 4 years of age is considered to be particularly relevant for the study of children's development of narrative abilities. In relation to imitation abilities, evidence shows that developmental changes in the fidelity of imitation are experienced during this period (Dickerson, Gerhardstein, Zack, & Barr, 2013; McGuigan, Makinson, & Whiten, 2011; McGuigan, Whiten, Flynn, & Horner, 2007; Moser, et al., 2015; Sherwood, Subiaul, & Zawidzki, 2008; Subiaul, Anderson, Brandt, & Elkins, 2012). Prior to age 3, though infants tend to copy adult's actions such as clapping, their performance is characterized by goal neglect and it is therefore more accurate to label this behavior mimicry rather than imitation (Jones, 2007). In contrast, older children show an understanding of the goal or intention of a specific action and their imitative behavior is thus focused on outcomes. In fact, research

shows a clear progression from mimicry to imitation. Dickerson et al. (2013) found that while children between 1.5 and 2 years of age merely mimicked gestures, 2.5- to 3.5-year-olds imitated them as they were able to copy models more closely, thus showing a greater degree of fidelity in their imitative behavior.

Apart from investigating the relationship between multimodal imitation and narratives at this stage of development, we also wanted to assess whether another type of non-communicative imitation, i.e. object-based imitation, is related to narrative performance. Previous evidence has shown that that infants imitate actions on objects better and more frequently than gestures (Abravanel et al., 1976; Christie & Slaughter, 2009; Kim et al., 2015; Rodgon & Kurdek, 1977). In addition, it has been observed that object-based imitation is related to play skills, whereas gesture imitation is related to expressive language (Stone et al., 1997) and vocal imitation to estimated vocabulary (Rodgon & Kurdek, 1977). Therefore, we predicted that object-based imitation abilities might not correlate with either multimodal imitation abilities or with narrative abilities. This will contrast with the positive correlations which are predicted to occur between narrative abilities and multimodal imitation abilities.

In order to investigate the relationship between narrative abilities and multimodal and object-based imitation abilities, 3- to 4-year-olds' narrative abilities were assessed through the Renfrew Bus Story Test (Renfrew, 1997) adapted for Catalan speakers. Gesture, prosody and lexical imitation abilities were assessed through the Multimodal Imitation Task, which was specifically designed for this study and was based on examples coming from the Reciprocal Imitation Training (Ingersoll, 2008) for children with Autism Spectrum Disorder (ASD). In addition, an Object-Based Imitation Task was employed, which was an adaptation of one of the multistep object-based imitation tasks used in Subiaul et al. (2016).

## 2. Methodology

### 2.1 Participants

A total of 31 typically developing native Catalan-speaking children (16 male and 15 female,  $M$  age = 46.48 months,  $SD$  = 3.4 months; range 41–52 months) of middle-class background from the Barcelona area participated in the experiment. They were enrolled in one of two public schools of a middle-class neighborhood in central Barcelona (namely *Escola Antoni Brusi* and *Escola Bogatell*). The original sample was of 46 children. However, 6 of them were not passed on the tasks because they showed a lack of comprehension and fluency in Catalan in the vocabulary test used as screening measure. After the tasks were administered, additional 9 children were excluded due to their lack of collaboration ( $n=4$ ), and due to technical and experimental errors ( $n=5$ ).

As the language used to carry out the three tasks was Catalan, an expressive vocabulary test within the ELI (*L'avaluació del llenguatge infantil*) (Saborit Mallol, Julián Marzá, & Navarro Lizandra, 2005) was used as screening measure to ensure that the children participating in the experiment were proficient enough in Catalan. The ELI is a standard test that measures the vocabulary size of Catalan-speaking children from 0 to 6 years of age. In the ELI, a picture-naming task consisting of 30 pictures of common objects is used in order to evaluate the children's lexical knowledge. For each correct naming participants received 1 point, with the maximum score being 30. The total score for each child (from 0 to 30) was later normalized to a scale of 0-100. To be able to participate in the experiment a minimum of 20% of successful completion of the test was established. Six children ( $n=6$ ) had to be excluded from the final analysis because according to the test they showed difficulties in understanding and speaking Catalan. After the tasks were administered, additional 9 children had to be excluded from the sample of this experiment. Four of them ( $n=4$ ) were excluded

because they showed a lack of collaboration. In addition, 2 children ( $n=2$ ) were excluded due to a technical error, and 3 of them ( $n=3$ ) due to an experimental error (3 children), leaving a final sample of 31 children.

## *2.2 Materials*

The materials of the present study consisted of three tasks, namely the Renfrew Bus Story Test, the Multimodal Imitation Task, and the Object-Based Imitation Task. As mentioned before, the main purpose of conducting the three tasks was to assess the potential correlation between the three types of abilities in the preschool years.

### *2.2.1. Renfrew Bus Story Test*






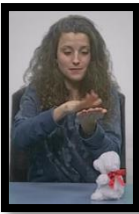

In order to assess narrative abilities, the Renfrew Bus Story Test (Renfrew, 1997) was adapted for Catalan speakers. The Renfrew Bus Story Test is considered one of the most widely used standardized tests for eliciting story retelling in preschool and young school-aged children (Westerveld & Vidler, 2015). In this story, there is a bus that decides to escape from his owner in order to explore the world around him. Unfortunately, the bus does not know how to use his brakes so he ends up inside a lake. When the driver finds the bus, he decides to help him. The basic materials used for the Renfrew Bus Story Test include the story of the bus in Catalan, ordered in a sequence of events, a series of color illustrations related to the story to be used as a support, and a soft toy. Since the children were aware of the fact that the experimenter knew the story, we asked them to tell it to a soft toy that was not present during the narration.







### *2.2.3. Multimodal Imitation Task*

In order to assess the children's ability to imitate multimodally, a special task was created based on the Reciprocal Imitation Training (RIT) technique, which has been used in several

studies to improve the social communication skills of children and teenagers with Autism Spectrum Disorder (ASD) (Ingersoll, 2008; Ingersoll, 2012; Ingersoll & Lalonde, 2010). The RIT is a naturalistic behavioral intervention designed to teach spontaneous imitation to young children with ASD by means of play interactions with a partner. The basic materials for the Multimodal Imitation Task used here consist of 12 items (see Table 1 below). They were created on the basis of examples coming from the RIT, as they combine different types of gestures with verbal labels, allowing us to test gesture imitation, prosody imitation and lexical imitation at the same time and to have a broader picture of children's gesture imitation abilities. As the RIT was designed for children with ASD and the present study was carried out with typically developing children, it was also taken into account that the examples included gestures with different levels of difficulty and verbal labels which were adjusted to the abilities of typically developing preschool children. Some pilot tests were conducted before the experiment to test the difficulty of the gestures and the verbal labels and to make sure that they were properly adapted to the children's abilities.

The 12 target items plus a familiarization item were designed to be used as prompts of the Multimodal Imitation Task, and they were grouped temporally so that they would form a sequence of conversational messages directed either at a teddy bear called *Esmolet* or at the camera. The 12 utterances consisted of exclamatives (expressing affective intonational meanings and greetings), questions (yes-no and wh-questions) or imperatives, mostly either directed at or referring to the bear, and each accompanied by the appropriate intonation and gestures. The 12 items can be seen in Table 1. Gestures were either conventional, iconic or metaphoric (see Cartmill, Demir, & Goldin-Meadow, 2012), and an action was also included as the first item, in order to initiate the story.

<b>Trial</b>	<b>Example</b>	<b>Gesture/ emotional expression and lexical content</b>	<b>Type</b>
Fam.		Waving hand <i>Hola Esmolet!</i> 'Hello Esmolet!'	Conventional
1		Palm face down, caressing the toy softly <i>Esmolet, ets tan suau!</i> 'Esmolet, you are so soft!'	Action
2		Quick downward movement with the right hand <i>Esmolet, anem al parc a baixar pel tobogan?</i> 'Esmolet, let's go to the park to go down the slide?'	Iconic
3		Spinning finger in circles <i>I després pujarem al carrusel!</i> 'Afterwards we will play with the merry-go-round'	Iconic
4		Hand rubbing stomach <i>Esmolet, per sopar menjarem una truita molt bona!</i> 'Esmolet, we'll be eating a tasty omelet for dinner!'	Metaphoric
5		Open up palms and then bring them together <i>Esmolet, abans d'anar a dormir llegirem un llibre!</i> 'Esmolet, before going to sleep we will read a book'	Iconic
6		Hands pressed together by face as if sleeping <i>Esmolet, ara anem a dormir!</i> 'Esmolet, let's go to sleep!'	Metaphoric

7		Finger to lip <i>Shhh, que l'Esmolet està dormint</i> 'Shhh, Esmolet is sleeping'	Conventional
8		Hands covering the eyes <i>Quina por que fa aquest llangardaix!</i> 'This lizard is so scary!'	Conventional
9		Wagging finger as if scolding <i>Això no es fa, llangardaix!</i> 'No-no, naughty lizard!'	Conventional
10		Shoulder shrug with open palms up clap <i>On us heu ficat?</i> 'Where are you?'	Conventional
11		Arms wrapped around self <i>Veig que sou molt amics!</i> 'I see that you are very good friends!'	Metaphoric
12		Clap hands <i>Bravo! Ho heu fet molt bé!</i> 'You have done it great!'	Conventional

**Table 1.** Familiarization example and 12 video-recorded prompts included in the Multimodal Imitation Task, temporally organized as a sequence of conversational messages.

A small teddy bear and a toy lizard were used for the Multimodal Imitation Task (see Fig.1).



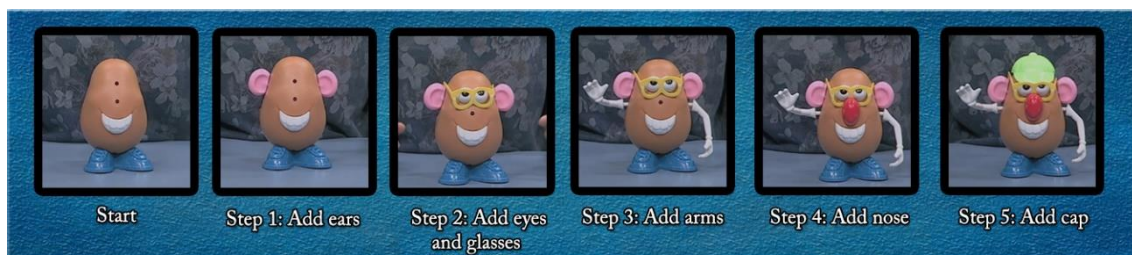


**Fig. 1.** *Teddy bear and toy lizard used for the Multimodal Imitation Task.*

A Catalan-speaking actress<sup>1</sup> was video recorded with a professional camera in one of the studios located at the Universitat Pompeu Fabra. During the video recording the actress reproduced the 12 items following the instructions of the author of the present thesis.

### *2.2.3. Object-Based Imitation Task*

The design of the Object-Based Imitation Task is based on the animal task used in Subiaul et al. (2016) directed to 2.5- to 4.5-year-olds. The task stimulus consisted of a 5-sequence action (Action 1 followed by Action 2, followed by Action 3, and so on) to be performed by children on a Mr. Potato Head®, using its body and its parts (ears, eyes with glasses, arms, nose and cap). The toy shoes and the toy mouth were already attached to the potato-shaped body.



**Fig. 2.** *Five-sequence action to be performed by children on the Mr. Potato Head®.*

It is important to note that there are some important differences between the original task (Subiaul et al., 2016) and the task created for this study, which are mainly motivated by the fact that in this study the younger children were 3.5 years of age, whereas the younger children in Subiaul et al. (2016) were 2.5 years of age. First, whereas in Subiaul et al. (2016) a rabbit and a monkey mounted on a wooden base were used, in the Object-Based Imitation Task a Mr. Potato Head® is used. Furthermore, whereas Subiaul et al.'s (2016) task consists

---

<sup>1</sup> I would like to thank Anna Massanas, the actress, for her help in recording the videos.

of a 3-sequence action, our Object-Based Imitation Task consists of a 5-sequence action in order to adapt the difficulty of the task to the age of the participants.

A video demonstration of the sequence was recorded. In the video, a Catalan-speaking actress (with only the hands shown) assembled the Mr. Potato Head® 3 times.

### *2.3 Procedure*

The children were assessed individually by the author of this thesis and one additional research assistant<sup>2</sup>. The three tasks were carried out in a quiet room at the participating schools and all the sessions were videotaped. In the room there was a table and two chairs, one for the participant and one for the experimenter. On the table there was a tablet, where the color illustrations for the Renfrew Bus Story Test, the video for the Multimodal Imitation Task, and the video for the Object-Based Imitation Task were shown. Hidden in a bag, the experimenter had the set of toys needed for the tests (see Materials section). Regarding the order of presentation, the narrative task (Renfrew Bus Story Test) was first administered together with other tests which are part of Mariia Pronina's PhD thesis project (Pronina, 2019). In the second block of 20 minutes the two imitation tasks were carried out (Multimodal Imitation Task and Object-Based Imitation Task).



---

<sup>2</sup> I would like to thank Ainhoa David, the research assistant, for helping the author of this thesis to assess the children.



*Fig.3. On the top of the panel, the author of this thesis and a child carrying out the Renfrew Bus Story Test. On the left side, the author of this thesis and a child carrying out the Multimodal Imitation Task. On the right side, the author of this thesis and a child carrying out the Object-Based Imitation Task.*

### *2.3.1. Renfrew Bus Story Test*

Children were first asked to listen to the experimenter's lively explanation of the Renfrew Bus Story while looking at a sequence of color illustrations corresponding to the situations happening in the story. After the children listened to the story, the experimenter asked them to retell it to the soft toy that was hidden while the experimenter was telling the story. If the children did not mention all of the actions occurring in the story, the experimenter asked them if they wanted to add anything else. The experimenter stopped the task when the children informed the experimenter that they had finished, or when the children did not say anything within 10-15 seconds after the experimenter had asked them whether they wanted to say anything else.

### *2.3.2. Multimodal Imitation Task*

The Multimodal Imitation Task involved first watching a brief video with instructions and an introduction to *Esmolet* the teddy bear, which was given to the child right before the first familiarization trial. The video playback was then paused while the experimenter repeated the instructions in person, and this was followed by a familiarization trial to make sure the child

understood that they were supposed to imitate what they saw modeled in each video clip. The imitation task proper then began. The child was asked to view a continuous sequence of 12 videos as described above, each video separated from the next by a 7-second pause. After the child watched two repetitions of each trial, the experimenter first imitated the gestures, intonation and lexical content as in the video and then encouraged the child to do the same, saying “*Ara tu!*” (‘Now it’s your turn!’). Then the child proceeded to imitate the behaviors performed by the experimenter, which had previously been depicted in the video clip, using *Esmolet* the bear him/herself and a toy lizard in accordance with the model when appropriate (see Table 1 in the Materials section). After piloting the materials with 4 children, it was decided to have the adult intervene in this manner because, as has been noted previously by several authors (e.g., Dickerson et al., 2013; Flynn & Whiten, 2008; Nielsen, Simcock & Jenkins, 2008), children perform poorer on gestural imitation tasks when actions are presented only in video format, a phenomenon that can be explained by the lack of social contingency inherent in a video.

### *2.3.3. Object-Based Imitation Task*

The Object-Based Imitation Task involved first explaining the instructions of the task and introducing the Mr. Potato Head ® and, after that, watching a video with 3 demonstrations of the sequence of actions performed on the Mr. Potato Head ® (see Figure 2). After the first demonstration, the video was paused and the experimenter repeated the instructions to make sure that the children understood that they were supposed to imitate what they saw modeled in the video and that they had to repeat it in the same order. The video was paused again before the third and last demonstration while the experimenter reminded the child that this would be the last demonstration before they had to imitate the model. Verbal cues such as “*Mira això!*” (‘Look at this!’), “*Oi que és divertit?*” (‘Isn’t that fun?’) and “*Una última vegada!*” (‘One last time!’) were used in the video before each demonstration and also before

each action of the sequence to capture the attention of the child. After the child watched the 3 demonstrations, the experimenter handed the Mr. Potato Head ® (main body and parts) to the children and encouraged them to imitate the model in the video by saying “*Ara et toca a tu!*” (‘Your turn!’).

## 2.4 Coding

The performance of the 31 children in the Renfrew Bus Story Test, the Multimodal Imitation Task and the Object-Based Imitation Task was coded online by the author of this thesis and one research assistant.

### 2.4.1. Renfrew Bus Story Test

Following previous studies on the assessment of narrative abilities (Demir et al., 2014; Vilà-Giménez et al., 2019), children's narrative abilities were assessed in terms of narrative structure scores. Narrative structure was coded using an adaptation of the coding system employed by Vilà-Giménez et al. (2019). A score ranging from 0 to 6 was given to each child (see Table 2 below).

Score	Explanation	Example
0	No structure or descriptive sequence.	-
1	Descriptive sequence with the characteristics of the main character but no sequence of actions.	<i>Un autobús</i> (‘A bus’)
2	Only one action is described (typically, the final action); descriptive sequences may be added.	<i>L'autobús va caure al llac</i> (‘The bus fell into the lake’)
3	Only one action/event is mentioned but more actions are described after the experimenter asks children if they want to add something else (no temporal or causal order).	- <i>L'autobús va caure al llac</i> (‘The bus fell into the lake’) - <i>I què més?</i> (Anything else?) - <i>El conductor va telefonar una grua</i> (‘The driver called for a tow’)
4	A sequence of actions described in a temporal but not causal order.	<i>L'autobús va caure al llac i el conductor va telefonar una grua</i> (‘The bus fell into the lake and the driver called for a tow’)
5	Actions are temporally and causally organized.	<i>L'autobús va caure al llac perquè no sabia frenar i el conductor va telefonar la grua</i> (‘The bus fell into the lake because he didn’t know how to stop, and the driver called for a tow’)

<b>6</b>	The narrative is complete, including temporal and causal structures, and details about the story.	
----------	---	--

**Table 2.** *Scoring system used for coding narrative structure*

#### 2.4.2. *Multimodal Imitation Task*

As noted, in this task the child was encouraged to globally imitate the actress' behavior (gesture, prosody and lexical content). Since it was conceivable that the child would fail to reproduce one or more of these elements, these three dimensions were evaluated separately. Thus, for each of the 12 videos, a separate score from 0-2 was given for gesture, prosody and lexical imitation yielding a possible maximum of 6 points. A score of 0 points was given if the child either failed to imitate the component altogether or did something completely at variance from the model. A score of 1 was given if the child reproduced the modeled gesture, prosody or lexical content only partially. For gesture or prosody, this meant that the gesture or prosodic pattern produced by the child was similar but not identical to the model. In the case of lexical content, this meant that the child produced only part of the target utterance. Finally, a score of 2 points was given when the child accurately reproduced the gesture, prosodic pattern or lexical content exactly as displayed in the video. The scores obtained for each component were added to produce an overall imitation score per child (multimodal imitation score).

#### 2.4.3. *Object-Based Imitation Task*

Following Subiaul et al. (2016), in order to be awarded a point, children had to reproduce exactly each step and importantly in the same order as it was produced by the actress in the video. They were awarded 1 point if they imitated two actions in the correct order. For example, if children imitated Action 1 followed by Action 2, they were awarded 1 point; if they imitated Action 2 followed by Action 3, they were awarded 1 point; if they imitated

Action 3 followed by Action 4, they were awarded 1 point, and if they imitated Action 4 followed by Action 5, they were awarded 1 point. Therefore, the maximum score was 4.

### *2.5. Inter-rater reliability*

Inter-rater reliability was conducted by two independent coders<sup>3</sup> in order to test the reliability of the narrative structure and the gesture imitation coding. After training with examples and discussing the difficulties found, the coders concluded that while there was a high agreement when coding prosody, lexical content and object-based imitation, many more doubts arose when coding for narrative structure and gesture imitation. Therefore, it was decided to conduct inter-rater reliability with these two scores. After some joint training, the two coders rated 20% of the data. The results of the kappa test showed an overall agreement of 80.95% and a free-marginal kappa of 0.78 for the narrative structure coding, indicating a considerable agreement between the coders. The overall agreement for the gesture imitation coding was 84.13% and the free-marginal kappa of 0.76, indicating also a high agreement between coders.

### *2.6 Statistical Analysis*

The relationship between multimodal imitation abilities, object-based imitation abilities and narrative abilities was analyzed using the Pearson bivariate correlation tool in SPSS Statistics 25.0 (IBM Corp., 2017).

## **3. Results**

As it can be seen in Table 3, the results of the Pearson bivariate correlation analysis showed that multimodal imitation scores and object-based imitation scores were not correlated, with a correlation coefficient (R) of .114 and a significance of  $p=0.542$ . The Pearson bivariate

---

<sup>3</sup> I would like to thank Jelena Grofulovic and Mariia Pronina for helping me to test the reliability of the coding.

correlation analysis also found that the three components of the multimodal imitation score (gesture imitation, prosody imitation and lexical imitation) were correlated between each other (see Table 4). Gesture imitation scores and prosody imitation scores were positively correlated and highly significant statistically, with a correlation coefficient (R) of .590 and a significance of  $p < .01$ . This shows that children who imitated more accurately the target gestures also imitated more accurately the prosodic patterns, and vice versa. A moderate and positive correlation was also found between gesture imitation and lexical imitation that was statistically significant, with a correlation coefficient (R) of .497 and a significance of  $p = .004$ . In regards to the relationship between prosody imitation and lexical imitation scores, the statistical analysis showed that they were highly and positively correlated, with a correlation coefficient (R) of .785 and a significance of  $p < .01$ .

	Pearson coefficient (R) and significance (p)	Gesture Imitation	Prosody Imitation	Lexical Imitation	Object-Based Imitation
<b>Multimodal Imitation</b>	R	.780**	.919**	.895**	.114
	p	.000	.000	.000	.542

\*  $p < .05$  \*\*  $p < .01$

**Table 3.** Pearson coefficient (R) and significance (p) obtained between multimodal imitation scores and gesture imitation scores, prosody imitation scores, lexical imitation scores, and object-based imitation scores.

	Pearson coefficient (R) and significance (p)	Gesture Imitation	Prosody Imitation	Lexical Imitation
<b>Gesture Imitation</b>	R	1	.590**	.497**
	p		.000	.004
<b>Prosody Imitation</b>	R	.590**	1	.785**



	<i>p</i>	.000		.000
<b>Lexical Imitation</b>	R	.497**	.785**	1
	<i>p</i>	.004	.000	
* <i>p</i> < .05 ** <i>p</i> < .01				

**Table 4.** Pearson coefficient (R) and significance (p) obtained between gesture imitation scores, prosody imitation scores, and lexical imitation scores.

Correlations between multimodal imitation, object-based imitation and narrative structure scores were also examined (see Table 5). The Pearson bivariate correlation analysis shows that there is a positive relationship between multimodal imitation scores and narrative structure scores. This is shown by a correlation coefficient (R) of .458 and a significance of  $p=.010$ . Therefore, children with better multimodal imitation abilities also produced a better narrative structure and vice versa. Moreover, all 3 components of multimodal imitation (gesture, prosody and lexical content imitation) were also found to significantly correlate with children’s narrative scores. In regards to the relationship between gesture imitation scores and narrative structure scores, the results of the statistical analysis showed that they are also moderately and positively correlated, with a correlation coefficient (R) of .420 and a significance of  $p=.019$ . This indicates that children who imitated more gesture also produced better narrative structures. A positive correlation was also found between prosody imitation scores and narrative structure scores, with a correlation coefficient (R) of .380 and a significance of  $p=.035$ , and lexical imitation scores and narrative structure scores, with a correlation coefficient (R) of .381 and a significance of  $p=.034$ .

Finally, as for object-based imitation scores, no correlation was found with narrative structure scores, with a correlation coefficient (R) of .218 and a significance of  $p=.240$  (see Table 5).

	Pearson coefficient (R) and significance (p)	Gesture Imitation	Prosody Imitation	Lexical Imitation	Multimodal Imitation	Object-Based Imitation
<b>Narrative Structure</b>	R	.420*	.380*	.381*	.458**	.218
	p	.019	.035	.034	.010	.240

**Table 5.** Pearson coefficient (R) and significance (p) obtained between narrative structure scores and gesture imitation scores, prosody imitation scores, lexical imitation scores, multimodal imitation scores, and object-based imitation scores.

#### 4. Discussion and conclusions

The main goal of the present study was to examine the relationship between narrative abilities and multimodal imitation abilities in typically developing children between 3 to 4 years of age. The results of the Renfrew Bus Story Test and the Multimodal Imitation Task with 31 preschool children showed that a positive relationship exists between children's ability to produce good narratives (i.e. better organized and more complete narratives) and their multimodal imitation abilities. By contrast, object-based imitation was negatively correlated with narrative measures.

The present results on the positive correlation between narrative abilities and multimodal imitation abilities in preschoolers expand and complement previous studies assessing the effect of different types of imitation on language during early infancy, which showed a relationship between vocal, verbal and gesture imitation abilities and language skills in earlier stages of development (Carpenter et al., 1998; Carpenter et al., 2005; Masur & Eichorst, 2002). First, Carpenter, Tomasello and colleagues, reported a relationship between imitation and the early development of visual and oral aspects of language (Carpenter et al., 1998; Carpenter et al., 2005). Second, other studies have shown that

imitation abilities in the second year of life are related with vocabulary learning abilities. For example, in Masur & Eichorst (2002), infants' early spontaneous imitation of novel words was shown to be predictive of a larger vocabulary later in development. Similarly, infants with better vocal and verbal imitation abilities at 2 years of age have been shown to have larger lexicons at later stages of development (Bates, Bretherton, & Snyder, 1988; Masur, 1995; Masur & Eichorst, 2002; Snow, 1989). For example, it has been observed that imitation of more words outside the children's repertoire at the beginning of the second year is a predictor of non-noun lexicons by the end of that second year (Masur, 1995). Our study shows that this positive correlation still holds at later stages of development with more complex language skills.

All in all, previous evidence suggests a close relationship between different types of imitation, such as gesture, vocal or verbal imitation, and language in their initial stages. Additionally, this relationship has also been found in children with language impairments. For example, vocal imitation has been found to correlate with lexical abilities in both typically developing children and in children with ASD (Rodgon & Kurdek, 1977; Stone et al., 1997). Similarly, gesture imitation has been proven to correlate with language abilities in children with language impairment (Wray et al., 2017). However, the effects of gesture, prosody and lexical imitation on language have been assessed separately in previous research, so it was still unclear whether this relationship also existed between more general multimodal imitation ability, understood as the ability to jointly imitate gestures, prosody, and lexical content, and language in the preschool stage. Importantly, the present study, which is the first one to assess gesture, prosody and lexical imitation in conjunction, shows that the several dimensions of multimodal imitation (i.e., prosodic, gestural, and lexical) are strongly correlated not only among themselves but also with narrative abilities. This finding expands on previous evidence that highlights the predictor role of vocal/prosodic and gestural

imitation abilities in language acquisition with younger children showing for the first time that gesture imitation, prosody imitation and lexical imitation are related to language development not only separately, but also in conjunction.

The strong correlation between gesture and prosodic imitation abilities found in this study reflects directly on the nature of prosody and gesture in adult speech and also in development. Gesture has been demonstrated to have a close relationship with prosody in adult speech. At the temporal level, there is a significant body of literature showing that there is a tight coordination between gesture prominence and prosodic prominence in speech (e.g., Ambrazaitis & House, 2017; Esteve-Gibert, Borràs-Comes, Astor, Swerts & Prieto, 2017; Guellaï, Langus, & Nespors, 2014; Krahmer & Swerts, 2007; Krivokapic, Tiede, Tyrone, & Goldenberg, 2016). At the semantic and pragmatic levels, prosodic and gestural patterns are used together to express several communicative functions such as epistemic positioning, information status, politeness and speaker identity (see Brown & Prieto in press for a review). With respect to development, the review paper by Esteve-Gibert & Guellaï (2018) concluded that adults but also infants and children use prosodic targets as temporal anchoring points to align manual pointing gestures very early. Our study demonstrates that this strong relationship between gesture and prosody is also present in imitation at the preschool stage, and strengthens the validity of the argument presented in previous research according to which prosody and gesture can be considered as sister-systems due to their close relationship in development at the temporal, semantic and pragmatic level (see Hübscher & Prieto, 2019).

Another important result of the present study was the fact that object-based imitation abilities did not correlate with narrative abilities. This result is not surprising given previous results. For example, Ingersoll & Lalonde (2010) observed during their Reciprocal Imitation Training that verbal imitation in children with ASD improved more during gesture imitation

sessions than during object-based imitation sessions, suggesting that the addition of gesture imitation training to object-based imitation training is more effective than object-based imitation training alone in order to enhance language use in children with ASD. Additionally, previous studies with children with ASD also found that imitation of body movements (e.g. clapping hands, opening and closing the fist) was associated with expressive language but not with imitation of actions with objects (Stone et al., 1997). A potential explanation of these results is the fact that gesture imitation focuses on the social function of imitation due to its communicative component, whereas in object-based imitation this communicative component is not essential. Another possibility is that gesture imitation and language need a higher level of representation than object-based imitation. Psychology typically uses representations in order to explain mental states and behaviors. Representations are considered mediating entities which mediate between a stimuli and a response, a situation and a behavior or an input and an output. This definition of representation was developed by the cognitivists in order to fill in the gap between stimuli and responses suggested by the behaviorists (Greco, 1995). In gesture imitation tasks the availability of external cues is much more reduced and, therefore, visual memory and the integration of the sensory and motor systems play a much more important role (DeMyer et al., 1972). By contrast, it has been argued that it is easier for children to remember the action in object-based imitation because of the visual hints provided by the object (DeMyer et al., 1972; Rodgon & Kurdek, 1977). Additionally, the potential actions that children can do with their hands are limited by the object they are holding (Smith & Bryson, 1994). The present results also contradict previous research analyzing object-based and gesture imitation in 18-month-old typically developing children which showed a significant correlation between the two types of imitation (Kim et al. 2015). However, it has to be taken into account that in Kim et al. (2015) object-based and gesture imitation were assessed through the same task and that gesture imitation items were

shown between the object-based imitation items. In our study, object-based imitation and multimodal imitation were assessed separately. All in all, it seems likely that object-based imitation and multimodal language imitation are two distinct capacities in preschool children.

Our results strengthen the view that multimodal imitation abilities are key for language learning, also at later stages of development, e.g. during the preschool years. In this sense, it is not surprising that training multimodal abilities (and their integrated dimensions) are used to trigger greater gains in the rate of language use. One of the best examples is Ingersoll's Reciprocal Imitation Training, a naturalistic behavioral intervention designed for teaching spontaneous imitation to young children with ASD by means of play interactions with a play partner (Ingersoll, 2008). Verbal imitation is used in this approach in combination with object-based and gesture imitation. More recent treatments have used role-play, a form of imitation integrated into a context, to improve pragmatic skills in children with language learning disabilities (Abdoola, Flack, & Karrim, 2017). Some interventions have focused specifically on verbal and vocal imitation. The Melodic- Based Communication Therapy has been shown to be effective for improving expressive vocabulary, verbal imitative abilities and even pragmatics in children with ASD (Sandiford, Mainess, & Daher, 2013). Another widely used treatment, the Melodic Intonation Therapy, is based on the use of musical elements of speech. This technique has been applied for language rehabilitation in aphasic patients (Norton, Zipse, Marchina, & Schlaug, 2009) and children with ASD (Miller & Toca, 1979) and helps them to improve verbal expression. All things considered, the success of these treatments show the importance of imitation for enhancing language learning in children with language impairment.

Finally, the results of the present investigation expand on previous research analyzing gesture, prosody and lexical imitation as separate elements and suggest that there is a close

relationship between multimodal imitation (i.e. the combination of gesture, prosody and lexical imitation) and language. In addition, our findings complement previous research with infants and children with ASD and indicates that multimodal imitation and language are closely related also in typically developing preschool children. Future studies should go in the direction of developing multimodal imitation training paradigms combining gesture, prosody and lexical imitation for typically developing preschool children, as we believe that they can be a useful tool to facilitate and improve their language acquisition process. More attention should be paid to the role that prosody imitation (in isolation and in combination with gesture imitation) plays in preschoolers' language development. We also believe that future research should examine the relationship between multimodal imitation and other aspects of language such as vocabulary, as this study focuses only on narratives. To conclude, the significant association between gesture imitation, prosody imitation, lexical imitation and narrative abilities found at this stage of development highlights the importance of working on multimodal imitation skills and general multimodal capacities to boost children's language learning.

## **5. References**

- Abdoola, F., Flack, P., & Karrim, S. (2017). Facilitating pragmatic skills through role-play in learners with language learning disability. *The South African Journal of Communication Disorders*, 64(1), 12 pages.
- Abravanel, E., Levan-Goldschmidt, E., & Stevenson, M. B. (1976). Action imitation: The early phase of infancy. *Child Development*, 47(4), 1032-44.

- Ambrazaitis, G., & House, D. (2017). Multimodal prominences: Exploring the patterning and usage of focal pitch accents, head beats and eyebrow beats in Swedish television news readings. *Speech Communication, 95*, 100-113.
- Applebee, A. (1978). *The child's concept of story*. Chicago: University of Chicago Press.
- Applebee, A. (1980). Children's narrative: New directions. *The Reading Teacher, 34*, 137-142.
- Bamberg, M. (1987). *The acquisition of narratives*. Berlin: Mouton de Gruyter.
- Bates, E. (1976). *Language and context: The acquisition of pragmatics* (Vol. 13). New York: Academic Press.
- Bates, E., Benigni, L., Bretherton, I., Camaioni, L., & Volterra, V. (1979). *The emergence of symbols: Cognition and communication in infancy*. New York: Academic Press.
- Bates, E., Bretherton, I., & Snyder, L. (1988). *From first words to grammar: Individual differences and dissociable mechanisms*. New York: Cambridge University Press.
- Berman, R. A., & Slobin, D. I. (1994). *Relating events in narrative: A crosslinguistic developmental study* (Vol. 1). Mahwah, NJ: Lawrence Erlbaum.
- Bishop, D., & Edmundson, A. (1987). Language impaired 4-year-olds: Distinguishing transient from persistent impairment. *Journal of Speech and Hearing Disorders, 52*, 156-173.
- Burns, S., Griffin, P., & Snow, C. (1999). *Starting Out Right: A Guide to Promoting Children's Reading Success*. Washington, D.C: National Academy Press.



- Capone, N. C., & McGregor, K. K. (2004). Gesture development: A review for clinical and research practices. *Journal of Speech, Language, and Hearing Research, 47*(1), 173-186.
- Carpenter, M., Nagell, K., & Tomasello, M. (1998). Social cognition, joint attention and communicative competence from 9 to 15 months of age. *Monographs of the Society for Research in Child Development, 63*(4), 1-143.
- Carpenter, M., Tomasello, M., & Striano, T. (2005). Role reversal imitation and language in typically developing infants and children with autism. *Infancy, 8*, 253-278.
- Cartmill, E. A., Demir, Ö. E., & Goldin-Meadow, S. (2012). Studying gesture. In E. Hoff, *The research guide to methods in child language* (pp. 209-225). Malden, MA: Wiley-Blackwell.
- Christie, T., & Slaughter, V. (2009). Exploring links between sensorimotor and visuospatial body representations in infancy. *Developmental Neuropsychology, 34*(4), 44-460.
- Colletta, J.-M., Guidetti, M., Capirci, O., Cristilli, C., Demir, Ö. E., Kunene-Nicolas, R. N., & Levine, S. (2015). Effects of age and language on co-speech gesture production: An investigation of French, American, and Italian children's narratives. *Journal of Child Language, 42*(1), 122-145.
- Demir, Ö. E., Fisher, J. A., Goldin-Meadow, S., & Levine, S. C. (2014). Narrative processing in typically developing children and children with early unilateral brain injury: Seeing gesture matters. *Developmental Psychology, 50*(3), 815-828.
- Demir, Ö., Levine, S., & Goldin-Meadow, S. (2012). *Getting on track early for school success: TheSTEP assessment system to support effective instruction (PreK-3rd). Creating an assessment of literacy skills for three and four year olds.*

- Demir, Ö., Levine, S., & Goldin-Meadow, S. (2015). A tale of two hands: children's early gesture use in narrative production predicts later narrative structure in speech. *Journal of Child Language*, *42*, 662-681.
- DeMyer, M. K., Alpern, G. D., Barton, S., DeMyer, W. E., Churchill, D. W., Hingtgen, J. N., . . . Kimberlin, C. (1972). Imitation in autistic, early schizophrenic, and non-psychotic subnormal children. *Journal of Autism & Childhood Schizophrenia*, *2*(3), 264-287.
- Dickerson, K., Gerhardstein, P., Zack, E., & Barr, R. (2013). Age-related changes in learning across early. *Developmental Psychobiology*, *55*, 719-732.
- Dickinson, D., & McCabe, A. (1991). The acquisition and development of language: A social interactionist account of language and literacy development. In J. Kavanagh, *Communicating by language, Vol. 13. The language continuum: From infancy to literacy* (pp. 1-40). Parkton, MD, US: York Press.
- Dickinson, D., & McCabe, A. (2001). Bringing it all together: The multiple origins, skills, and environmental supports of early literacy. *Learning Disabilities Research and Practice*, *16*, 186-202.
- Esteve-Gibert, N., & Guellai, B. (2018). Prosody in the Auditory and Visual Domains: A Developmental Perspective. *Frontiers in Psychology*, *9*, 338.
- Esteve-Gibert, N., Borràs-Comes, J., Asor, E., Swerts, M., & Prieto, P. (2017). The timing of head movements: The role of prosodic heads and edges. *The Journal of the Acoustical Society of America*, *141*, 4727-4739.
- Feagans, L. (1982). The development and importance of narratives for school adaptation. In L. Feagans, & D. Farran, *The language of children reared in poverty* (pp. 95-116). New York: Academic Press.

- Flynn, E. G., & Whiten, A. (2008). Cultural transmission of tool-use in young children: a diffusion chain study. *Social Development, 17*, 699-718.
- Gratier, M., & Devouche, E. (2011). Imitation and repetition of prosodic contour in vocal Interaction at 3 Months. *Developmental Psychology, 47*(1), 67-76.
- Greco, A. (1995). The concept of representation in psychology. *Cognitive Systems, 4*(2), 247-256.
- Greenfield, P., & Smith, J. (1976). *The Structure of Communication in Early Language Development*. New York: Academic.
- Guellai, B., Langus, A., & Nespor, M. (2014). Prosody in the hands of the speaker. *Frontiers in Psychology, 5*, 700.
- Hedberg, N., & Westby, C. (1993). *Analyzing storytelling skills: Theory to practice*. Tucson, AZ: Communication Skill Builders.
- Hübscher, I., & Prieto, P. (2019). Gestural and prosodic development act as sister systems and jointly pave the way. *Frontiers in Psychology, 10*, 1259.
- IBM Corp. (2017). IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.
- Ingersoll, B. (2008). The social role of imitation in autism. *Infants & Young Children, 21*(2), 107-119.
- Ingersoll, B. (2012). Brief report: Effect of a focused imitation intervention on social functioning in children with autism. *Journal of Autism and Developmental Disorders, 42*(8), 1768-1773.

- Ingersoll, B., & Lalonde, K. (2010). The impact of object and gesture imitation training on language use in children with autism spectrum disorder. *Journal of Speech, Language, and Hearing Research, 53*, 1040-151.
- Jones, S. S. (2007). Imitation in Infancy: The Development of Mimicry. *Psychological Science, 18*, 593-599.
- Kim, Z., Óturai, G., Király, I., & Knopf, M. (2015). The role of objects and effects in action imitation: Comparing the imitation of object-related actions vs. gestures in 18-month-old infants. *Infant Behavior and Development, 41*, 43-51.
- Krahmer, E., & Swerts, M. (2007). The effects of visual beats on prosodic prominence: Acoustic analyses, auditory perception and visual perception. *Journal of Memory and Language, 57*, 396-414.
- Krivokapic, J., Tiede, M. K., Tyrone, M., & Goldenberg, D. (2016). Speech and manual gesture coordination in a pointing task. *Proceedings of the 8th International Conference on Speech Prosody*, (pp. 1240-1244). Boston.
- Lieven, E., & Stoll, S. (2013). Early communicative development in two cultures: a comparison of the communicative environments of children from two cultures. *Human Development, 56*(3), 178-206.
- Loeb, D. F., & Allen, G. (1993). Preschoolers' imitation of intonation contours. *Journal of Speech and Hearing Research, 36*(1), 4-13.
- Masur, E. F. (1983). Gestural development, dual-directional signaling, and the transition to words. *Journal of Psycholinguistic Research, 12*, 93-109.
- Masur, E. F. (1995). Infants' early verbal imitation and their later lexical development. *Merrill-Palmer Quarterly, 41*(3), 286-306.

- Masur, E. F., & Eichorst, D. (2002). Infants' spontaneous imitation of novel versus familiar words: Relations to observation and maternal report measures of their lexicons. *Merrill-Palmer Quarterly*, 48, 405-426.
- Masur, E. F., & Ritz, E. G. (1984). Patterns of gestural, vocal, and verbal imitation performance in infancy. *Merrill-Palmer Quarterly*, 30(4), 369-392.
- McGuigan, N., Makinson, J., & Whiten, A. (2011). From over-imitation to super-copying: Adults imitate causally irrelevant aspects of tool use with higher fidelity than young children. *British Journal of Psychology*, 102, 1-18.
- McGuigan, N., Whiten, A., Flynn, E., & Horner, V. (2007). Imitation of causally opaque versus causally transparent tool use by 3- and 5-year-old children. *Cognitive Development*, 22(3), 353-364.
- Michaels, S. (1981). "Sharing Time": Children's Narrative Styles and Differential Access to Literacy. *Language in Society*, 10(3), 423-442. doi:DOI: 10.1017/S0047404500008861
- Miller, S. B., & Toca, J. M. (1979). Adapted melodic intonation therapy: A case study of an experimental language program for an autistic child. *The Journal of Clinical Psychiatry*, 40(4), 201-203.
- Morrow, L. (1985). Retelling stories: A strategy for improving young children's comprehension, concept of story structure and oral language complexity. *The Elementary School Journal*, 85(5), 647-661.
- Moser, A., Zimmermann, L., Dickerson, K., Grenell, A., Barr, R., & Gerhardstein, P. (2015). They can interact, but can they learn? Toddlers' transfer learning from touchscreens and television. *Journal of Experimental Child Psychology*, 137, 137-155.

- Nielsen, M., Simcock, G., & Jenkins, L. (2008). The effect of social engagement on 24-month-olds' imitation from live and televised models. *Developmental Science, 11*(5), 722-731.
- Norton, A., Zipse, L., Marchina, & Schlaug, G. (2009). Melodic intonation therapy: shared insights on how it is done and why it might help. *Annals of the New York Academy of Sciences, 1169*, 431-436.
- O'Neill, D. K., & Holmes, A. C. (2002). Young preschoolers' ability to reference story characters: The contribution of gestures and character speech. *First Language, 22*, 73-103.
- Özçaliskan, S., & Goldin-Meadow, S. (2005). Gesture is at the cutting edge of early language development. *Cognition, 96*, 101-113.
- Paris, A., & Paris, S. (2003). Assessing narrative comprehension in young children. *Reading Research Quarterly, 38*, 36-76.
- Prieto, P., & Esteve-Gibert, N. (2018). *The Development of Prosody in First Language Acquisition*. Amsterdam/Philadelphia: John Benjamins Publishing Company.
- Pronina, M. (2019). Sociopragmatic development in the preschool years: the link with prosodic and gestural abilities and Theory of Mind (PhD research proposal). Universitat Pompeu Fabra.
- Renfrew, C. (1997). *Bus story test—A test of narrative speech* (4 ed.). Bicester, England: Winslow Press.
- Rodgon, M., & Kurdek, L. (1977). Vocal and gestural imitation in 8-, 14-, and 20-month-old children. *Journal of Genetic Psychology, 131*, 115-123.

- Rogers, S. J., & Pennington, B. F. (1991). A theoretical approach to the deficits in infantile autism. *Development and Psychopathology*, 3(2), 137-162.
- Rogers, S. J., Hepburn, S. L., Stackhouse, T., & Wehner, E. (2003). Imitation performance in toddlers with autism and those with other developmental disorders. *Journal of Child Psychology and Psychiatry*, 44(4), 763-781.
- Rusiewicz, H. L., & Esteve-Gibert, N. (2018). "Set in time: temporal coordination of prosody and gesture in the development of spoken language production. In P. Prieto, & N. Esteve-Gibert, *The Development of Prosody in First Language Acquisition*. Amsterdam: John Benjamins.
- Saborit Mallol, C., Julián Marzá, J. P., & Navarro Lizandra, J. L. (2005). *ELI : L'avaluació del llenguatge infantil*. Castelló de la Plana: Publicacions de la Universitat Jaume I.
- Sandiford, G. A., Mainess, K. J., & Daher, N. S. (2013). A pilot study on the efficacy of Melodic-Based Communication Therapy for eliciting speech in nonverbal children with autism. *Journal of Autism and Developmental Disorders*, 43(6), 1298-1307.
- Sherwood, C. C., Subiaul, F., & Zawidzki, T. W. (2008). A natural history of the human mind: Tracing evolutionary changes in brain and cognition. *Journal of Anatomy*, 212, 426-454.
- Smith, I. M., & Bryson, S. E. (1994). Imitation and action in autism: A critical review. *Psychological Bulletin*, 116(2), 259-273.
- Snow, C. (1989). Imitativeness: A trait or skill? In G. E. Speidel, & K. E. Nelson, *The many faces of imitation in language learning* (pp. 73-90). New York: Springer-Verlag.
- Stites, L., & Özçaliskan, S. (2017). Who Did What to Whom? Children Track Story Referents First in Gesture. *Journal of Psycholinguistic Research*, 46, 1019-132.

- Stone, W. L., Ousley, O. Y., & Littleford, C. D. (1997). Motor imitation in young children with autism: What's the object? *Journal of Abnormal Child Psychology*, 25(6), 475-485.
- Stradler, M. A., & Ward, G. C. (2005). Supporting the narrative development of young children. *Early Childhood Education Journal*, 33(2), 73-80.
- Subiaul, F., Anderson, S., Brandt, J., & Elkins, J. (2012). Multiple imitation mechanisms in children. *Developmental Psychology*, 48, 1165-1179.
- Subiaul, F., Zimmermann, L., Renner, E., Schilder, B., & Barr, R. (2016). Defining Elemental Imitation Mechanisms: A Comparison of Cognitive and Motor-Spatial Imitation Learning Across Object-and Computer-Based Tasks. *Journal of Cognition and Development*, 17, 221-243.
- Vilà-Giménez, I., & Prieto, P. (2018). Encouraging children to produce rhythmic beat gestures leads to better narrative discourse performances. *Proc. 9th International Conference on Speech Prosody 2018*, 704-708.
- Vilà-Giménez, I., Igualada, A., & Prieto, P. (2019). Observing storytellers who use rhythmic beat gestures improves children's narrative discourse performance. *Developmental Psychology*, 55(2), 250-262.
- Vygotsky, L. (1962). *Thought and language*. Cambridge, MA: MIT Press.
- Westerveld, M. F., & Vidler, K. (2015). The use of the Renfrew Bus Story with 5-8-year-old Australian children. *International Journal of Speech-Language Pathology* ISSN:, 17(3), 304-313.



Wray, C., Saunders, N., McGuire, R., Cousins, G., & Frazier Norbury, C. (2017). Gesture production in language impairment: It's quality, not quantity, that matters. *Journal of Speech, Language, and Hearing Research*, 60, 969-982.