Gesture and language in narratives and explanations: the effects of age and communicative activity on late multimodal discourse development*

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ABSTRACT

This article addresses the effect of communicative activity on the use of language and gesture by school-age children. The present study examined oral narratives and explanations produced by children aged six and ten years on the basis of several linguistic and gestural measures. Results showed that age affects both gestural and linguistic behaviour, supporting previous findings that multimodal discourse continues to develop during the school-age years. The task (narration vs. explanation) also had clear effects on the use of language and gesture: gestures and subordinate markers were more frequent in explanations than in narratives, whereas cohesion markers were more often used in narratives. Altogether, these results show partly distinctive developmental patterns between narrative monologic discourse behaviour and explanatory behaviour in the context of dialogue and question–answer exchanges.

INTRODUCTION

In the present study, we compare children's use of language and gesture in two communicative activities, a narrative task and an explanatory task, at two different stages of development. Previous research on language development (e.g. Berman & Slobin, 1994) has shown that narrative construction is one of the skills that develops during the school-age years, and a parallel developmental change in gesture use has been observed, albeit to a lesser extent, between the ages of six and ten years (Colletta, Pellenq & Guidetti, 2010). The questions of whether the same developmental changes observed in narratives occur in other communicative activities and whether six- and ten-year-olds are sensitive to differences between the communicative activities they undertake have received far less attention. Explanations, for example, have been widely studied, especially from a functional point of view in early child language (see, for example, Veneziano & Sinclair, 1995), but they haven't received the same treatment from a multimodal perspective. The aim of our research is to compare oral explanations and narratives produced by the same two groups of children in order to study the effect of age and the effect of the task in their use of language and gestures.

Although studies of language acquisition tend to focus on the early preschool years (Capirci, Caselli, Iverson, Pizzuto & Volterra, 2002; Guidetti, 2002; Rowe & Goldin-Meadow, 2009; among others), when most language skills emerge, language development is known to be a lengthy process in which the use of both language and gesture continues to develop during the school-age years. Numerous linguistic abilities develop beyond the preschool years, most of them related to discourse construction. Yet, when dealing with the notion of discourse and its role in later language acquisition, the specific constraints of different discourse genres and modalities should be taken into consideration, since part of later language development in children involves an improved command of different types of discourse (Tolchinsky, 2004; Verhoeven, Aparici, Cahana-Amitay, van Hell & Viguié-Simon, 2002). The consideration of these constraints will have theoretical implications for the study of both language acquisition and gesture development.

The most widely studied genre of extended discourse is narrative. Although children begin to talk about past events when they are as young as two years, the development of the skills involved in narrating extends over several years. Analyses of narratives have yielded a wealth of information on the developmental changes that occur in the narrative abilities of school-age children (Berman & Verhoeven, 2002), such as changes in the linguistic expression of temporality and causality (Bamberg, 1987; Berman & Slobin, 1994); changes in the use of referential expressions to track referents and express contrasts, such as old–new information in discourse (Hickman, 2003); an improvement in the mastery of complex syntactic structures

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(e.g. passive voice, some subordinate clauses; see Diessel, 2004; Scott & Windsor, 2000) or in the linkage between sentences (Jisa, 2004; Verhoeven *et al.*, 2002); and changes in the strategies used to interact with an interlocutor (Bamberg & Damrad-Frye, 1991).

Few studies of children's narratives have attended to gesture use, even though the development of gesture or gesture–speech combinations has been a subject of growing interest over the last few years. Thanks to the pioneering work of Capirci and colleagues (see, for example, Capirci *et al.*, 2002; Capirci & Volterra, 2008) and more recent work from Liszkowski and colleagues (e.g. Liszkowski, Carpenter & Tomasello, 2007), we now know a great deal about gesture–speech combinations at the transition from the prelinguistic to the linguistic period. Gestures in this context can be divided up into two major categories: deictic gestures (e.g. pointing) intended to establish a referent, and representational gestures, a less homogeneous category which includes different types of gestures that do not necessarily have the same status and function (for a discussion, see Guidetti, 2002). Broadly speaking, representational gestures must represent something (e.g. an object, a character or an idea). The fact that they are also referred to as 'iconic' gestures by some authors is a reminder that the terminology used to classify gestures is not always consistent in the literature. Other types of co-speech gestures have been shown to appear at later stages of development, indicating that the co-speech gesture system is reorganized in the course of development, but the number of studies devoted to multimodality in older children remains scant.

Regarding school-age children's story-telling, McNeill (1992) observed children's use of representational gestures in narratives and showed that children can productively use content-loaded hand gestures in narrating from the age of four or five years. Other observations also suggest that gestures become increasingly intertwined with speech as children become older (Capirci & Volterra, 2008) and that their use for the purpose of achieving cohesion increases with age (Colletta, 2009; Reig Alamillo, Colletta & Kunene, 2010; Sekine & Furuyama, 2009). Colletta (2009) and Graziano (2009) analyzed narratives spontaneously produced by French and Italian schoolchildren. They found that older children used co-speech gesture in a similar way to adults and for several different purposes: the representation of the narrated events and characters' attitudes, abstract pointing to mark discourse cohesion, pragmatic framing of the utterance, discourse connotation, discourse demarcation between the processing of the event frame and the speaker's comments, and synchronization between speaker and listener.

Consistent with these descriptions are the findings of Colletta *et al.* (2010), who analyzed the narrative performance of two groups of French children and one group of adults. Their analysis of 122 narratives produced

by subjects who were asked to retell a story seen in a cartoon clip showed two parallel developmental changes: a move towards longer and linguistically more complex narratives, and a developmental shift towards greater use of gestures (including hand and head gestures, shoulder shrugs and posture change, facial expressions) by older children and adults.

In sum, there is evidence that the narratives of school-age children undergo major changes regarding both speech and gesture, but to complete the overall picture of later communicative development, further information is needed regarding the linguistic and gestural behaviour of school-age children in other types of communicative task.

Although the development of the ability to construct explanations is an equally interesting topic in terms of the later stages of development, it has received far less attention in the literature. Children are said to produce their first explanatory speech acts (e.g. justifying their demands or behaviour) at the end of their second year but, as pointed out by Colletta and Pellenq (2009), little is known about the immense gap between children's first verbalized explanations and the written or oral explanatory discourse that they are able to produce in their final years of schooling. Some studies have been conducted on children's explanations, mostly those produced by younger children (Barbieri, Colavita & Scheuer, 1990; Veneziano & Sinclair, 1995), specifically with a view to analyzing their content (presence of intentionality, theory of mind, physical causality, inferential processes, etc.), and the links that are established between events and the linguistic connectives (especially 'because') that are used to express these links (Bloom, Lahey, Hood, Lifter & Fiess, 1980).

Few researchers have undertaken the multimodal analysis of explanatory behaviour, with the exception of Goldin-Meadow and her collaborators, who studied young children's use of gesture in the resolution of mathematical tasks (Garber, Alibali & Goldin-Meadow, 1998; Goldin-Meadow, 1997). They showed how gestures are used by children in their explanations and how these gestures can be interpreted by other children.

For their part, Colletta (2004) and Colletta and Pellenq (2009) studied explanations produced by French children aged three to eleven years. The analysis was conducted on two distinct sets of data. The first set of data was taken from video recordings of children aged from six to eleven years engaged in conversation with an adult prompting the children to produce causal explanations and verbal reasoning on family and social topics (Colletta, 2004). The second set of data was taken from video recordings of nursery and preschool classroom interactions during teaching sessions (language sessions, experiments relating to the topics of air and water, art workshops and sessions involving logical reasoning) as an investigation on how teachers prompt their pupils to produce verbal explanations (Simon, 2009). All the explanations were formulated by children in response to a

'why' question asked either by an adult (interviewer or teacher) or by another child. The authors analyzed the formal aspects of the explanations and found an increase in all observed measures: duration, number of syllables, number of clauses, use of connectives and use of co-speech gestures. As for gestures, children mostly produced pointing and representational gestures that either referred to physical objects (giving the shape or size of an object, pointing to a character depicted in a picture from a storybook), or represented ideas and abstracts concepts (as in gestural metaphor, described by McNeill, 1992).

The results of Colletta and Pellenq (2009) provide evidence for the existence of developmental changes affecting the multimodal construction of explanations. However, the explanations elicited in this study were relatively heterogeneous, as far as the topic, the context of production and the role of the interlocutor (adult or peer) were concerned, and although Colletta (2004) carried out comparisons with the development of (other) types of monologic discourse, the narratives and explanations were not produced by the same children. The present study therefore sets out to complement these findings by analyzing explanations produced by school-age children in a more controlled setting and comparing this type of discourse with narratives produced by the same group of children.

The explanatory task in this study (see the 'Method' section) was designed to explore children's ability to provide explanations for events occurring in a story. The content of the explanations provided by the six- and ten-year-olds in this study will be examined elsewhere. In this article, we focus on the linguistic and gestural devices employed by the six- and ten-year-old children in an explanatory task and compare these results with their performance in a narrative task. Two main questions are addressed in this article. The first one concerns the age effect: Do children aged six and ten differ regarding the linguistic and gestural measures considered in this study? The second one concerns the task effect: Do children's narratives differ from the same children's explanations regarding the same linguistic and gestural measures?

The linguistic and gestural measures included in the analysis emerge from the previous literature dealing with narrative development in children, and several expectations regarding the first question emerge from this literature. We specifically expect to observe an increase in length and syntactic complexity in children's narratives, as well as changes in the use of connectives, subordinate markers, and age differences in the use of anaphoric expressions (in the sense that older children would use more explicit co-reference (NPs) and relative pronouns in narratives than younger children). In this study, we seek to confirm these developmental differences in the narrative task and, crucially, to observe whether the same (or other) signs of language development between the years of six and ten

are found in the explanatory discourses produced by the same group of children. The developmental changes expected in the explanatory task (Colletta, 2004; Colletta & Pellenq, 2009) would go in the direction of further use of linguistic connectives marking the relation between events and an age effect on the use of subordinate markers, a result that would support the idea that the development towards a complex syntax is equally found in different oral discourse genres. Regarding gesture development, we expect the age effect already observed in Colletta *et al.* (2010) on the gesture rate produced in narratives, and the same age effect is expected in explanations, with older children performing more co-speech gesture in every category than younger children. The comparison of these measures in two different oral discourse genres, which is not often found in the literature, has theoretical implications for fully understanding both linguistic acquisition and gesture development.

The second broad question stated before – regarding task effect – aims at providing information on whether different communicative activities affect children's use of language and gesture at later stages of acquisition. By analyzing explanations produced by school-age children in an interactive situation and comparing these with narratives produced by the same children, we would be able to explore the effect of the communicative activity on the use of language and gesture at these stages. The two tasks designed for this study differ in two essential characteristics: the main communicative goal of the discourse (narrative vs. explanatory), and the participation of the adult interlocutor in the interaction (see the 'Method' section), more active in the explanatory task. These characteristics are expected to be reflected in differences in the linguistic construction of the children's responses: narrative discourses are expected to show more discourse markers, and we expect to find differences in the reference tracking of the two tasks, given that the adult would introduce or reintroduce referents in his questions during the explanatory task. It is unclear, however, whether six- and ten-year-olds would be equally sensitive to these task differences and, therefore, whether the expected linguistic differences between narrative and explanatory discourses in the two tasks would be (equally) found in six- and ten-year-olds. Regarding the use of anaphoric expressions, we expected to see differences due to the particularities of each task: long monologic narrative discourses would require greater use of anaphoric expressions and, specifically, greater use of NPs, and it will be observed whether this difference is found equally in both age groups.

Concerning gesture behaviour, as the aim of the narrative task is to retell a story all in one go, we expect that overall gesture production will be higher in this task. However, as we stated above, gestures vary greatly in the way they accompany speech (Colletta, 2004; Kendon, 2004; see the 'Method' section for more details). We thus expect representational gestures to be the most frequent category in the narrative task to illustrate

and enhance the narration (e.g. the representation of events, places and characters). We also expect discourse gestures to be more frequent in this task than in the explanation task, as they show cohesion and demarcation properties that prove most useful in long strings of discourse built out of monologic sequences such as narratives. As for the gestures that accompany the explanatory responses, we expect performative and interactive gestures to be more frequent in this task than in the narrative task. Performative gestures replace verbalized speech acts and should be more frequent in explanations elicited in dialogue, allowing the child to agree or confirm his stance. Interactive gestures such as back-channel signals and phatic calls play a role in the ongoing process of social interaction by synchronizing behaviour among the participants, and should then be more present in the explanatory discourses elicited in this study, which are directly embedded in the interactive process.

METHOD

Participants

A total of 84 French-speaking children took part in the study. There was a group of 41 six-year-old children (mean = 5;8/range = 5;3–6;5) and a group of 43 ten-year-olds (mean = 10/range = 8;9–11). Both groups undertook a narrative task, followed by an explanatory task.

Gender was represented in the two age groups as follows: the six-year-old group contained 16 girls and 25 boys, and the ten-year-old group 21 girls and 22 boys. The children attended preschools and primary schools in predominantly upper-middle-class districts of Grenoble and Toulouse (France).

Procedure

Both the narrative and explanatory tasks were administered in the same session and were based on a 2 min 43 s clip of a Tom and Jerry cartoon shown to the participants on a laptop computer.

In the story, a mother bird leaves her egg in the nest. The egg accidentally falls out and rolls into Jerry's house. The egg hatches in Jerry's house and a baby woodpecker emerges. The baby bird then starts damaging Jerry's furniture. After a few failed attempts to calm the bird down, Jerry gets angry and decides to put the bird back in its nest.

For the narrative task, participants were asked to tell the story they had just seen to an adult sitting next to them, and to do so the best way they could. The narratives were videotaped for later analysis. An example of a narrative produced by a six-year-old is provided in (1):

(1)   En premier c'était la maman, elle tricotait, et puis après elle est partie, et puis l'oeuf il bougeait, et puis après il est tombé, il est arrivé dans la

maison de la petite souris, et puis la petite souris elle s'est réveillée, et elle s'est réveillée, et puis elle était assise dessus l'œuf, et puis après elle est partie, parce qu'elle avait peur un peu, et puis après il commençait à craquer l'œuf, et puis après il commençait à marcher, et puis petite souris elle va enlever l'œuf, qui est resté en haut sur la tête, et puis le petit il a dit maman, et puis après il cassait tout, et après il l'a ramené chez lui la petite souris dans son nid.

'First there was the mummy, she was knitting, and then she left, and then the egg, it moved, and then it fell down, it ended up in the little mouse's house, and then the little mouse, he woke up, he woke up, and then he was sitting on top of the egg, and then he left, because he was a bit scared, and then it started to crack, the egg, and then it started to walk, and then the little mouse, he went and took off the egg that was still on its head, and then the little one said mummy, and then it broke everything, and then he brought it back to its house, the little mouse, to its nest.'

As soon as the child had finished telling the story, the explanatory data was collected as follows: the experimenter told the child that he was going to ask him or her some questions, and asked the following:

- Why does the mummy woodpecker leave the nest?
- Why does the egg end up in Jerry's house?
- Why is the baby bird pleased to see Jerry?
- Why does Jerry take the baby back to its nest at the end of the story?

These questions were chosen with the aim of collecting four different types of explanation: the formulation of a hypothesis in the first question, a procedural explanation in the second one, reference to the character's beliefs in the third question and a causal explanation in the last one.

In the explanatory task, the adult asked the children four questions and reacted to each of the children's answers in his speech turn. A typical interaction with a six-year-old child in the explanatory task is provided in (2):[1]

(2) ADULT: Bon, je vais te poser quelques questions, d'accord? Est-ce que tu peux me dire pourquoi la maman oiseau abandonne le nid?
'Well, I'm going to ask you some questions now, OK? Can you tell me why the mummy bird left the nest?'

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[1] These examples have been normalized for the sake of simplicity, but the conventions used in the original transcription of the corpus include the marking of elided syllables, hesitations, wrong pronunciations, and prosody information such as stressed words, pauses between two segments of speech and vocalic lengthening. See Colletta *et al.* (2009) for details.

CHILD: Ben … parce qu'elle est partie sans prendre l'œuf et il est tombé, l'œuf
'Uh … because she left without taking the egg with her and it fell down, the egg'

ADULT: D'accord; et est-ce que tu peux me dire pourquoi l'œuf est arrivé jusqu'à la maison de la souris?
'OK, and can you tell me why the egg ended up in the mouse's house?'

CHILD: Et, ben, parce que, parce que … il a … il s'est cassé, l'œuf; d'abord elle a marché, après il s'est cassé.
'Uh, because, because … it … it broke, the egg; first she walked, then it broke.'

ADULT: D'accord; est-ce que tu peux dire pourquoi le petit oiseau est très, très content de voir la souris?
'OK, can you tell me why the little bird is really, really pleased to see the mouse?'

CHILD: Parce que elle croyait que c'était la maman.
'Because she thought he was her mummy.'

ADULT: D'accord; et tu peux me dire pourquoi la souris le ramène dans son nid?
'OK, and can you tell me why the mouse takes it back to its nest?'

CHILD: Parce que c'était pas lui, elle voulait le mettre avec sa maman, mais sa maman elle est partie
'Because it wasn't him, he wanted to put it with its mummy, but its mummy has gone'

ADULT: D'accord, très bien, je te remercie
'OK, that's fine. Thank you'

The explanatory task was performed straight after the narrative task. This means that when the children were asked the four questions listed above, they had already made a cognitive effort to remember the events seen in the clip and organize them in a temporal sequence in order to tell the story out loud. Some of the answers provided by children involve alluding to events that had already been mentioned in the narrative. The questions and the subjects' answers were also videotaped. The sessions were recorded at the children's schools, and only the experimenter and the participant were present in the room while the two tasks were being performed.

Transcription and annotation
The data was entirely transcribed and annotated using *ELAN* software (www.mpi.nl/tools/), as well as an annotation scheme specially designed for

this study (Colletta, Kunene, Venouil, Kaufmann & Simon, 2009).[2] The annotations provided information on syntax, lexicon, discourse and co-speech gestures.

Speech coding

Several linguistic measures were included in the annotation scheme.

The speech annotation conventions were adapted from the VALIBEL conventions (www.uclouvain.be). The speech was first segmented into clauses, and the number of clauses was counted. The decision to take the number of clauses as a measure of the length of the linguistic productions – instead of, say, sentences, which might be a suitable descriptive unit for written texts, or 'utterances', which have too imprecise a definition for us to be able to undertake corpus annotation and quantitative analysis – was made in accordance with Berman and Slobin (1994). A clause was defined as a predicate matched by one, two or three arguments, corresponding to a series of words including a verb and its satellites, such as the subject and any complement(s). The clause count allowed us to estimate the length of the narrative and the explanations provided by each participant.

In order to test whether explanations, as well as narratives, become more syntactically complex between six and ten years of age, the occurrence of subordination markers was annotated. Three groups were established in the coding scheme, and the exhaustive list of elements found in the corpus for each of these categories is included here: relative pronouns (*que*, *qui* 'which'), conjunctions (*parce que* 'because', *que* 'that', *comment* 'how', *comme* 'since', *tellement* 'such/so', *alors que* 'although', *pourquoi* 'why', *quand* 'when', *car* 'because', *dès que* 'since', *pendant que* 'whereas', *vu que* 'given that', *puisque* 'because', *si* 'if', *où* 'where', *dès que* 'since'), and prepositions introducing non-finite and participial clauses (*à* 'to', *avant de* 'before', *après* 'after', *de* 'of', *pour* 'for', *en* 'in', *en train de* 'in the process of', *sans* 'without').

Measuring subordination markers provides information about the level of language complexity attained by a subject in a given language task, but does not necessarily reflect discourse abilities (Tolchinsky, 2004). To gauge these discourse abilities more accurately, therefore, the number of connectives and anaphors was measured. Connectives and anaphoric expressions ensure discourse cohesion at the micro-level of discourse (Halliday & Hasan, 1976). The elements coded as connectives in our corpus include the words that contribute to discourse structure marking logical or argumentative relations

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[2] Available for download: www.lat-mpi.eu/tools/elan/thirdparty/view?searchterm=Colletta.

between utterances (*car* 'because', *comme* 'since', *donc* 'so', *du coup* 'therefore', *mais* 'but', *ou* 'or', *parce que* 'because', *pour* 'for', *pourtant* 'though', *puisque* 'because', *si* 'if', *vu que* 'given that'), temporal relations (*alors* 'then', *après* 'later', *déjà* 'already', *d'abord* 'first', *ensuite* 'next', *finalement* 'finally', *maintenant* 'now'), reformulation (*enfin* 'in other words', *en fait* 'in fact'), conversational markers (*ben* 'well', *bon* 'well', *voilà* 'there'), and other connectives marking more than one of these relations (*et* 'and', *puis* 'then').

Note that elements commonly included under the group of discourse markers also belong to several different morphosyntactic categories, such as conjunctions, verbs, adverbs, etc., and the limits of the class discourse markers or connectives is part of an ongoing discussion which is out of the limits of this article (see Fischer, 2006, for a discussion). In our analysis, elements such as *parce que*, or *puisque* have been included both under subordinate conjunctions and under logical connectives. In the first group, they are taken as an indication of syntactic complexity, together with other subordination markers; in the second category, they are taken into account because they contribute to the discourse cohesion by explicitly marking logical or argumentative relations between clauses.

The category of anaphors includes linguistic expressions that serve to maintain the identity of previously introduced referents throughout the text. Anaphoric expressions differ in their referential content: personal pronouns are one of the anaphoric expressions with less referential content and their adequate use is conditioned to the speaker's good judgement on the availability of the referent. Definite NPs, on the other hand, specify most of the information needed to identify their referent but their use, in circumstances where the referent is clearly identifiable, is perceived as redundant (Gundel, Hedberg & Zacharski, 1993). The referential expressions included under the category anaphors in the analysis are: personal pronouns (*et l'oeuf bouge partout et **il** tombe dans une toile d'araignée* 'and *the egg* moves around and **it** falls into a spider's web'), relative pronouns (*et il arrive malencontreusement dans la maison de Jerry **qui** est en train de dormir* 'and unfortunately it ends up in the house that belongs to *Jerry*, **who**'s asleep), and definite noun phrases (NPs in Table 3), including definite NPs with or without lexical repetition (e.g. *ensuite l'oeuf s'est cassé, l'oisillon a cassé **l'œuf*** 'then *the egg* cracked, the fledgling cracked **the egg**'; *mais le petit oiseau reste avec la coquille sur les yeux … et après **le pivert** il fait maman* 'but *the little bird* still has the shell over its eyes … and then **the woodpecker** says mummy) and proper names (*Jerry l'a aidé un peu et dès que l'oisillon a vu **Jerry*** '*Jerry* helped it a bit and as soon as the fledgling saw **Jerry**'). These three types of anaphoric expressions were included in the analysis because of their high frequency, and because their adequate use, due to the different discursive and cognitive status of their referent, has

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been pointed out as one of the landmarks of late language development (Hickmann & Hendricks, 1999).

Gesture coding

Gesture units. The first step was to identify the gesture units (hand gestures, head gestures, shoulder shrugs, posture change, facial expressions) performed by each participant during the narrative production. Our method was based on Kendon's proposals (2004: 10–15). In order to decide whether a body movement should be counted as a gesture unit, the coder took the following three criteria into account: movement, location and configuration of the gesture stroke – the gesture stroke is the meaningful part of the gesture phrase, as explained in Kendon, assessing each one on a 2-point scale as follows:

– *Movement*: if the movement could be easily perceived and was of sufficient amplitude and speed, it was attributed 2 points; if it could not be easily perceived and was of insufficient amplitude and speed, it was attributed 0 points; if it was between the two, it was attributed 1 point.
– *Location*: if the gesture was performed in front of the speaker and in full view of the listener, it was attributed 2 points; if it was performed to one side and was almost, if not impossible, for the interlocutor to see, it was attributed 0 points; if it was between the two, it was attributed 1 point.
– *Configuration*: if the configuration (in the case of a hand gesture) corresponded to a precise hand shape, it was scored 2 points; if it had an imprecise form, it was given 0 points; if it was between the two, it was attributed 1 point.

For a gesture to be counted as a unit it had to score 3 or more points.

Gesture function. Studies of co-speech movements mostly focus on hand gestures and on gestures that have representational and deictic properties. However, going back to the sixties and seventies, early work on gesture and body language (Ekman & Friesen, 1969; Kendon, 1990; Cosnier, 1993) showed that the whole range of gestures – hand gestures, head gestures, facial expressions and posture changes (linked to gaze patterns) – contributed to the social interaction process in all its dimensions: expression of thought and communicative goals, mutual understanding, synchronization between participants. More recent work on multimodal language development showed that one has to consider all functions of gestures when analyzing a child's language behaviour, as age-related changes affect the pragmatic and cohesive use of facial expressions and gestures as well as their pointing and representational use (McNeill, 1992; Colletta, 2004; Graziano, 2009; Colletta *et al.*, 2010). As a consequence, all co-speech body movements that were identified as gestures were then described and classified according to

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their function in this study. Six[3] different types of gesture were selected based on Ekman and Friesen's (1964), Bavelas, Chovil, Lawrie and Wade's (1992), McNeill's (1992), Cosnier's (1993), Kendon's (2004) and Colletta's (2004) classifications:

REPRESENTATIONAL, where the hand or head gesture, possibly in conjunction with facial expressions and other body movements, either represented a concrete object or a property of that object, a place, a trajectory, an action, a character or an attitude, e.g. the two hands forming an oval to represent an egg or a rapid downward movement of the hand or index finger to represent the fall of an egg – these gestures correspond to the 'iconic gestures' in McNeill's (1992) classification; or else symbolized an abstract idea, through metaphor, e.g. the right hand in a bowl shape, palm facing upward, to symbolize the story to be told, a negation head movement to represent the inability or ignorance of a character – these gestures correspond to the 'metaphoric gestures' in McNeill's (1992) classification.

DISCURSIVE, where a gesture helped to structure speech and discourse by accentuating or highlighting certain linguistic units, e.g. rhythmic movements (beats) of the head or hands accompanying the accentuation of certain words or syllables – these gestures were named 'batonic gestures' in Ekman and Friesen's (1964) classification; or marked discourse cohesion by linking clauses or discourse units, e.g. rapid head or hand gesture towards the right that accompanies a connective such as 'then' or 'after' and that marks transition to a new event in the story recall; anaphoric gesture, e.g. pointing towards a spot in frontal space which previously represented the verbalized referent in order to reactivate the same referent – these gestures correspond to the 'cohesive gestures' in McNeill's (1992) classification.

FRAMING, where the gesture expressed the narrator's emotional or mental state, e.g. face showing amusement to express the comical side of a situation, shoulder shrug or facial expression that expresses the obviousness of what is being asserted, or using 'finger inverted commas' to express distance in relation to terms used – these gestures were named 'gestualité métacommunicative' in Cosnier's (1993) classification and are part of the 'pragmatic gestures' type in Kendon's (2004) classification.

PERFORMATIVE, where the gesture expressed a speech act (yes answer, no answer, reply, etc.) either in replacement of speech, e.g. nodding one's

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[3] Deictic gestures (hand or head pointing to an element in the communication setting) were also originally included in the coding scheme, but no occurrences were found, due to the characteristics of the task, which did not require any references to the context. See other examples of each category in the coding manual:. www.latmpi.eu/tools/elan/ thirdparty/view?searchterm=Colletta.

head in agreement, face showing incomprehension in reacting to the interlocutor's question or request; or which reinforced the illocutionary value of the speech act, e.g. head nodding accompanying an affirmative response, head shaking accompanying a negative response – these gestures are part of the 'pragmatic gestures' in Kendon's (2004) classification.

INTERACTIVE, where a gesture either indicated that the speaker required or wished to verify his partner's attention or had reached the end of the speech turn or narrative, e.g. the speaker touches his partner to call on his attention, he sits back and turns his head towards interlocutor to invite him to talk; or indicated to the speaker that his interlocutor was paying attention to his speech, e.g. nodding his head while listening to the speaker. These gestures often occur with changes in gaze patterns and were respectively called 'phatic signals' and 'feedback signals' in Cosnier's (1993) gesture classification and they are part of the 'interactive gestures' type in Bavelas, Chovil, Lawrie and Wade's (1992) classification.

WORD SEARCHING, where a hand gesture or a facial expression indicated that the speaker was searching for a word or expression. For example, frowning and staring upwards whilst searching for words or tapping fingers, with or without a reflective expression.

After the coding, word-searching gestures were finally excluded from the quantitative analysis because the numbers were too low and their analysis did not yield any interesting information about gesture use. Performative and interactive gestures were finally grouped in the 'other gestures category' on the basis that, in both cases, their function is related to the interaction with the interlocutor and we would therefore expect them to be used much more often in dialogue than in monologue.

Rates per clause

The results of the linguistic and gestural measures described above for the two tasks were not directly comparable, insofar as the narratives were considerably longer than the explanations, and were typically produced in a single speech turn, whereas the explanatory data were elicited in at least four speech turns.

Accordingly, in order to ensure comparability across tasks, we took the total number of each type of linguistic or gestural component (e.g. the number of subordination markers or the number of framing gestures, etc.) and divided it by the number of clauses. These rates allowed us to account for individual and age group differences, as well as to compare the proportions of linguistic and gestural components in the two tasks.

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TABLE 1. *Means (SD) of linguistic measures for six- and ten-year-olds' narratives and explanations*

		Clauses	Connective rate	Anaphor rate	Subordinate marker rate
Narratives	six-year-olds	26·02 (14·23)	1·08 (.36)	1·03 (0·19)	0·09 (0·08)
	ten-year-olds	44·32 (21·81)	0·94 (0·28)	1·19 (0·11)	0·15 (0·07)
Explanations	six-year-olds	11·71 (7·22)	0·85 (0·20)	0·85 (0·21)	0·68 (0·25)
	ten-year-olds	13·40 (5·97)	0·90 (0·23)	0·91 (0·23)	0·66 (0·15)

Reliability

In order to establish reliability in gesture coding, two separate coders identified the gesture units and attributed a function to each stroke. A third coder validated their annotations and settled any disagreements. On the basis of the 2/3 agreement method (which takes into account every time that two of the three coders agreed on identification of gesture units and on function attributed to each stroke, as in Colletta *et al.*, 2009), inter-rater agreement on the identification of gesture units was 87% for narratives and 90% for explanations, and agreement on the function attributed to each stroke was 99% for narratives and 95% for explanations.

RESULTS

Tables 1 to 4 set out the linguistic and gestural measures corresponding to the narrative and explanatory tasks for both age groups. All the data were processed with two-way ANOVAS: age group (2) × task (2). Age was regarded as a between-subjects factor and task as a within-subjects factor. This section is organized to present data according to the two types of effects expected: age and task. The results for the linguistic measures are presented in the first subsection, followed by the analysis of the gestural measures.

Effects of age and task on linguistic measures

Table 1 shows the means and standard deviations (SD) for the number of clauses and the rates of connectives, anaphors and subordinate markers in the narratives and explanations produced by both groups of children.

The results for the number of clauses indicated that, as expected, the verbal responses are overall longer in the narrative than in the explanatory task ($F(1, 82) = 163·38$, $p < 0·001$, $\eta_p^2 = 0·66$). More informative is the significant effect of age on the number of clauses ($F(1, 82) = 16·45$, $p = 0·0001$, $\eta_p^2 = 0·16$), indicating that older children produced longer discourses overall than younger children, and the interaction between the two

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factors was also significant $(F(1, 82) = 22 \cdot 02, \quad p = 0 \cdot 0001, \quad \eta_{\mathrm{p}}^2 = 0 \cdot 21)$, indicating that the observed effect of age depended on the task. In other words, the age effect was stronger for the narratives than for the explanations and the ten-year-olds' narratives were significantly longer than those of the six-year-olds. The difference between narrative and explanatory discourse length was greater for the ten-year-olds than for the six-year-olds.

In the analysis of the subordinate marking rate, only the task effect was significant $(F(1, 82) = 469 \cdot 24, p = 0 \cdot 001, \eta_{\mathrm{p}}^2 = 0 \cdot 85)$, indicating that, overall, more subordinate markers were produced per clause in the explanatory task than in the narrative task. In this first analysis, no age effect was observed, against our expectation (but see below).

The subordination markers annotated in the explanations included ones such as *parce que* 'because' and *pour* 'for'/'in order to', which were used to initiate the child's speech turn, in such a way that the 'main clause' was contained in the adult's speech turn and was not explicitly uttered by the children, as exemplified in (3):

(3) ADULT: Pourquoi le bébé oiseau est content de voir Jerry ?
'Why is the baby bird pleased to see Jerry?'
    CHILD: Parce qu'il croit que c'est sa maman
'Because it thinks [Jerry] is its mummy'

The use of subordination markers in this context depends more on the dialogic format of the exchange than on the explanatory goal of the discourse. In order to check to what extent the task effect on the use of subordination markers per clause was dependent on these subordination markers initiating speech turn, we also calculated the subordination rate excluding these occurrences of subordinating markers. This changed the subordinate marking rate in the explanatory task (for six-year-olds, mean = 0·26 $(SD = 0·15)$ and for ten-year-olds, mean = 0·35 $(SD = 0·11)$), but the narrative task data remained the same. The results of this analysis still showed a significant task effect $(F(1, 82) = 129 \cdot 68, p < 0 \cdot 001, \eta_{\mathrm{p}}^2 = 0 \cdot 61)$, and the age effect is now significant as well $(F(1, 82) = 17 \cdot 92, p < 0 \cdot 001, \eta_{\mathrm{p}}^2 = 0 \cdot 17)$. This analysis revealed two pieces of information. First, the task effect on the use of subordination markers was not exclusively due to the question–answer format of the explanatory task, since it persisted when only the subordination markers inside the speech turn were taken into account. Second, the difference between six- and ten-year-olds became evident when the subordination markers initiating turn were excluded, suggesting that the syntactic complexification repeatedly shown in long narratives as children get older is also found in shorter, explanatory discourses.

Turning to discourse cohesion, the analysis of the connective rate showed a significant effect of task $(F(1, 82) = 18 \cdot 26, p = 0 \cdot 00005, \eta_{\mathrm{p}}^2 = 0 \cdot 18)$, indicating that the use of connectives was higher in the narrative task than

TABLE 2. *Mean number per clause (SD) for each type of connectives in six- and ten-year-olds' narratives and explanations*

		Temporal	Logical	*et* 'and'	Other
Narratives	six-year-olds	0·68 (0·55)	0·03 (0·08)	0·71 (0·59)	0·11 (0·15)
	ten-year-olds	0·64 (0·59)	0·19 (0·25)	0·90 (0·88)	0·22 (0·20)
Explanations	six-year-olds	0·08 (0·19)	0·29 (0·20)	0·15 (0·25)	0·06 (0·11)
	ten-year-olds	0·08 (0·11)	0·67 (0·59)	0·27 (0·34)	0·26 (0·34)

in the explanatory one, and a significant interaction between age and task $(F(1, 82) = 9·69, p = 0·002, \eta_p^2 = 0·10)$, indicating that the effect of task depended on age: the narratives produced by the younger children had a higher rate of connectives.

The expected higher rate of connectives in narratives than in explanations is confirmed in our data, but instead of finding an increase in the use of connectives with age, the higher rate is found in young children's narrative discourses. A closer look at the types of connectives used in the two tasks sheds further light on these results. Table 2 sets out the use of temporal connectives, logical connectives, *et* 'and' and 'other connectives', which includes conversational and reformulation markers (see the 'Method' section), in the two tasks.

Not surprisingly, the use of logical connectives was greater in the explanations than in the narratives $(F(1, 82) = 71·97, p < 0·001, \eta_p^2 = 0·46)$ and the analysis also showed that older children produced more logical connectives than younger children $(F(1, 82) = 18·43, p = 0·00004, \eta_p^2 = 0·18)$, and this effect was amplified in the ten-year-olds' narratives $(F(1, 82) = 6·82, p = 0·01, \eta_p^2 = 0·07)$, while temporal and *et* 'and' connectives were more frequent in the narratives than in the explanations $(F(1, 82) = 80·81, p < 0·001, \eta_p^2 = 0·4,$ and $F(1, 82) = 43·89, p < 0·001, \eta_p^2 = 0·34,$ respectively). There also was an age effect of the 'other connectives' production: older children produce this type of connectives more often than younger children $(F(1, 82) = 19·64, p = 0·00002, \eta_p^2 = 0·19)$. The fact that the decrease in the use of these connectives with age did not significantly affect the explanatory discourses as it did the narratives sheds light on the difference in the connective rate across tasks for the younger children, and the absence of this difference for the older ones.

The second measure accounting for discourse cohesion was the presence of anaphoric elements. The analysis of the anaphor rate indicated that both age and task effects were significant, as was the interaction between the two factors. The age effect $(F(1, 82) = 10·7, p = 0·001, \eta_p^2 = 0·11)$ showed that, overall, there were more anaphors per clause in the discourses produced by the older children, while the task effect $(F(1, 82) = 85·56, p < 0·001,$

TABLE 3. *Mean number per clause (SD) for each type of anaphor in six- and ten-year-olds' narratives and explanations*

		Personal pronouns	Relative pronouns	NPs
Narratives	six-year-olds	0·68 (0·17)	0·03 (0·03)	0·30 (0·15)
	ten-year-olds	0·74 (0·16)	0·04 (0·04)	0·39 (0·14)
Explanations	six-year-olds	0·67 (0·15)	0·02 (0·04)	0·16 (0·15)
	ten-year-olds	0·75 (0·22)	0·03 (0·05)	0·12 (0·12)

$\eta_\mathrm{p}^2 = 0\cdot51$) showed that more anaphors were produced in the narration task than in the explanatory task, particularly by the older group, as shown by the significant interaction between age and task ($F(1, 82) = 4\cdot34$, $p = 0\cdot04$, $\eta_\mathrm{p}^2 = 0\cdot05$). The higher rate of anaphors in narratives than in explanations can be explained by the fact that there is a greater need to track referents through the story in long monologic discourses, such as narratives, than there is in explanations such as ours, which were typically short discourse fragments focusing on a single event and giving more concise information. The rates of the three types of anaphor (personal pronouns, relative pronouns and definite NPs) were calculated, and the means for each age group are shown in Table 3.

The results presented in Table 3 were also processed by means of a two-way ANOVA: age (2) × task (2). Concerning the number of personal pronouns per clause, only age had a significant effect ($F(1, 82) = 6\cdot23$, $p = 0\cdot01$, $\eta_\mathrm{p}^2 = 0\cdot07$): as was the case with anaphors in general, older children produced more personal pronouns per clause than younger children in their construction of a cohesive discourse, across tasks. Task had a significant effect on the rate of NPs ($F(1, 82) = 111\cdot35$, $p < 0\cdot001$, $\eta_\mathrm{p}^2 = 0\cdot57$), showing that there were more NPs per clause overall in the narrative task than in the explanatory task, and a significant interaction effect ($F(1, 82) = 11\cdot33$, $p = 0\cdot001$, $\eta_\mathrm{p}^2 = 0\cdot12$): the ten-years-olds produced more NPs than the six-year-olds in the narrative task, and vice-versa in the explanatory task.

Anaphoric NPs are typically used to switch topics and reintroduce elements, operations more frequently required in narratives, as the explanations were shorter and the characters referred to were often introduced in the adult's questions. The more frequent use of NPs in narratives than in explanations by ten-year-olds, but not by six-year-olds, suggests that older children are sensitive to the task particularities regarding the reintroduction of referents by NPs.

Effects of age and task on gesture measures

Table 4 shows the means and standard deviations (*SD*) of the gesture measures included in the analysis: gesture rate (number of co-speech

TABLE 4. *Mean number per clause (SD) for each gesture measure in six- and ten-year-olds' narratives and explanations*

		Gesture rate	Represen-tational gesture rate	Discursive gesture rate	Framing gesture rate	Other gesture rate
Narratives	six-year-olds	0·28 (0·23)	0·12 (0·16)	0·01 (0·03)	0·04 (0·05)	0·10 (0·12)
	ten-year-olds	0·47 (0·34)	0·26 (0·25)	0·06 (0·07)	0·08 (0·09)	0·06 (0·06)
Explanations	six-year-olds	0·53 (0·38)	0·13 (0·19)	0·02 (0·05)	0·15 (0·23)	0·22 (0·22)
	ten-year-olds	0·58 (0·44)	0·19 (0·19)	0·04 (0·07)	0·24 (0·29)	0·11 (0·16)

gestures per clause) and rates of representational gestures, discursive gestures, framing gestures, and interactive and performative gestures (included under 'other gestures'), for both tasks and both groups of children.

In the analysis of the gesture rate, only task was found to have a significant effect ($F(1, 82) = 17\cdot18$, $p < 0\cdot001$, $\eta_p^2 = 0\cdot17$), showing that the gesture rate was higher in the explanatory task than in the narrative task across the two age groups. A closer look at the different types of gestures yielded interesting information about the effects of task and age on the children's use of co-speech gestures.

For the representational gesture rate, only the age effect was significant ($F(1, 82) = 6\cdot34$, $p = 0\cdot01$, $\eta_p^2 = 0\cdot07$), indicating that the ten-year-old children produced more representational gestures per clause in both tasks.

We had predicted that there would be more representational gestures in narratives than in explanations, but the lack of a task effect can be explained by the fact that the explanations elicited here involved a certain degree of narration, unlike other explanatory tasks, such as explaining the rules of a game (Evans & Rubin, 1983) or giving explanations in the classroom (Colletta & Pellenq, 2009). Representational gestures were therefore the most frequent type of gesture in both tasks, produced at comparable rates in both the narratives and the explanations, and more frequently by the ten-year-olds than by the six-year-olds.

In the analysis of the discursive gesture rate, only the age effect was significant ($F(1, 82) = 11\cdot34$, $p = 0\cdot001$, $\eta_p^2 = 0\cdot12$), indicating that, overall, the ten-year-old children produced more discursive gestures (i.e. gestures helping to structure speech or mark cohesion) per clause than the six-year-olds across tasks.

Rather unexpectedly, there was no significant effect of task on the use of discursive gestures. Even though the length of the discourses and the subordination, connective and anaphor rates differed between tasks, the proportion of discursive gestures per clause in both tasks remained comparable, suggesting that children resort to discursive gestures to a

similar extent whatever the linguistic complexity of their discourse. It should be noted, nevertheless, that in childhood, scant use is generally made of gestures that mark discourse cohesion, even by ten-year-olds, with the rate rising significantly for adult speech (Colletta *et al.*, 2010).

For the framing gesture rate, both effects were significant. The age effect $(F(1, 82) = 4 \cdot 07, \, p = 0 \cdot 04, \, \eta_{\mathrm{p}}^2 = 0 \cdot 04)$, showed that, overall, the ten-year-olds produced more framing gestures per clause than the six-year-olds. The task effect $(F(1, 82) = 26 \cdot 73, \, p < 0 \cdot 001, \, \eta_{\mathrm{p}}^2 = 0 \cdot 24)$, showed that these gestures were more frequently produced in the explanatory task than in the narrative task, across both age groups.

In the analysis of performative and interactive gestures ('other gestures'), the effects of both age and task were found to be significant. The age effect $(F(1, 82) = 9 \cdot 02, \, p = 0 \cdot 003, \, \eta_{\mathrm{p}}^2 = 0 \cdot 09)$, showed that the six-year-old children produced more of these types of gestures per clause than the ten-year-olds, and the lack of an interaction indicated that this occurred across tasks. The task effect $(F(1, 82) = 15 \cdot 99, \, p = 0 \cdot 0001, \, \eta_{\mathrm{p}}^2 = 0 \cdot 16)$, showed that these gestures were more frequently produced in the explanatory task than in the narrative task in both age groups.

Even though the total numbers of performative and interactive gestures were low (157 for the six-year-olds and 110 for the ten-year-olds, in both tasks), the analysis suggested that the younger children not only relied more on co-speech gestures in the interactive construction of discourse (here, the explanatory task) than in the monologic task, but also used gestures that typically perform pragmatic and interactive functions – performative and interactive gestures – more frequently than the older children did, especially in the more interactive task.

Summary of the results

The analyses presented in this section indicate that age effects (developmental changes between six and ten years) are more evident in gestural behaviour than in the linguistic components included in our analysis, and that the linguistic and gestural behaviour of French children varies according to the linguistic task they are engaged in.

Regarding age effects, the only linguistic measures that changed with age across tasks were the anaphor rate and the syntactic subordination rate when the initial 'because' was removed from the analysis, which increased in the ten-year-olds. A further linguistic effect of age was the higher number of clauses in the ten-year-olds' narratives compared with those of the six-year-olds, a difference not found in the explanations. As for gesture measures, age had an effect on all the gesture rates included in the analysis, with older children producing more gestures per clause than younger children in every case, except for the 'other gestures' category. In the case

of performative and interactive gestures ('other gestures'), the age effect was reversed, that is to say, the gesture rate was higher for the younger children's narratives and explanations than for those of the ten-year-olds.

Several task effects were found in our data: for linguistic behaviour, narratives were found to contain more clauses and more anaphors per clause in both age groups, as well as more connectives, though only in the six-year-olds' productions, whereas explanations contained more subordinate markers than narratives across both age groups. Regarding gesture behaviour, the gesture rate and the rates of framing gestures and other gestures were higher for explanations across both age groups, although the rates of representational and discursive gestures did not differ between tasks.

DISCUSSION

The study presented in this article contributes to our understanding of multimodal discourse development by providing fresh insights into two aspects of linguistic and gestural behaviour that have seldom been investigated in the past: (i) later multimodal discourse development, a stage we know far less about than the early stages of multimodal development; and (ii) the comparison of children's narrative behaviour with that displayed in other communicative activities, in this case, an oral explanatory task in an exchange situation. The analysis of narratives and explanations elicited from the same group of children offers an excellent opportunity for comparing the effects of different communicative activities on the school-age children's linguistic and gestural development.

Concerning the developmental component of our study, the fact that task was found to affect both age groups most of the time and that we observed few effects of age on the linguistic measures included in the analysis could, at first sight, be interpreted as indicating a lack of significant developmental changes in language use between the ages of six and ten years. It is, nevertheless, well established in the literature that language development continues during the school-age years, and developmental changes in storytelling between six and ten years have been repeatedly reported in the literature (Berman & Verhoeven, 2002; Nippold, 2004; Ravid, 2004). A closer look at three linguistic measures included in our study actually shows that the linguistic behaviour of the six- and ten-year-olds differed more on the narrative task than on the explanatory task, indicating that the cognitive and interactive requirements of the narrative task, compared with the explanatory one, bring the developmental differences at these stages to light.

First, it should be recalled that the six- and ten-year-olds differed considerably on the number of clauses included in their narratives. This age difference was less noticeable in the explanatory task, which required less

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memory effort and prompted the six- and ten-year-olds to provide comparable amounts of information in terms of the number of clauses. That said, the types of information included by both groups of children may well have been very different, and this factor will be examined elsewhere.

The second interesting measure highlighting differences between the six- and ten-year-olds' linguistic behaviour concerns the types of anaphor used. In the explanatory task, where the reintroduction and tracking of referents was less challenging, due to the shorter length of the discourse fragments and the dialogic format, the six-year-olds' use of anaphors was similar to that of the ten-year-olds. In the narrative task, however, where the reference tracking depended exclusively on the children's choices, the ten-year-olds' mastery of referential expression was evident from their greater use of NPs (proper names and definite NPs), needed to successfully reintroduce a referent and avoid ambiguity in anaphoric tracking. The six-year-olds, on the other hand, relied mostly on pronouns to track references through the story.

Lastly, regarding the use of connectives, the interaction between task and age indicated that connectives were more frequent in six-year-olds narratives than in their explanations but that this difference was not found in older children. This difference between six- and ten-year-olds was refined with the qualitative observation of the types of connectives used at these stages, which showed clear age differences in the type of connectives used in the narratives produced by both groups of children (mostly in the frequency of *et* 'and' and *après* 'then'), whereas these changes were very subtle in the explanatory task.

To sum up, in spite of the few overall age differences in linguistic behaviour found in the statistical analysis, the length of discourse and the use of connectives and anaphoric elements indicate that the six-year-olds' use of language was closer to the older children's use in the explanatory task than in the narrative task. It is generally considered in previous literature that monologic narrative discourse requires cognitive and communicative abilities that develop in late childhood (Berman & Slobin, 1994; Berman & Verhoeven, 2002). The analysis of data produced by the same two groups of children in this article indicates that these abilities are not fully developed at six years and, crucially, provides evidence for the assumption – general in the literature (Berman & Nir-Sagiv, 2004; Tolchinsky, 2004; Verhoeven *et al*., 2002) but not sufficiently supported with enough empirical data – that age differences in later language development are less significant in non-narrative discourse activities.

The age effect on gesture measures confirms all in all the results found by Colletta *et al*. (2010), Colletta and Pellenq (2009), Graziano (2009) and Jancovic, Devoe and Wiener (1975) in the same type of narrative task: as children grow up and become more efficient in monologic discourse

production, they also move on to more complex gesture use, increasing the frequency of their representational, discursive and framing gestures. The analysis of our data indicates that the same evolution in gesture behaviour takes place in the explanatory task introduced in this study. In turn, younger children, who are typically more at ease with dialogue and interactive language formats, do not use discursive and framing gestures in the same proportions as older children and, conversely, produce more gestures expressing pragmatic and interactive functions accompanying their speech, in both the narrative and the explanatory tasks. These results add to the relatively scant literature dealing with later gesture development and, more specifically, contribute to the almost non-existent literature on gesture development in non-narrative discourses.

Moving on to the discussion on the task effect, previous studies had mainly investigated the effect of the communicative activity on school-age children's language development by comparing (oral or written) narrative with expository texts (Berman & Nir-Sagiv, 2004) or conversation in school age and adolescence (Dorval & Eckerman, 1984). In this article, we provide additional evidence to support the finding that school-age children are permeable to differences in communicative activities in oral communication, not only in written activities, and show that, in oral discourse, the effect of the communicative activity can be perceived not only in the children's linguistic construction but also in their use of co-speech gestures.

In our study, the differences in the pragmatic goals of the discourse (telling a story or providing an explanation in response to the adult's questions) affected the children's choices for most of the linguistic measures. Interestingly, they affected both age groups in a similar way: constructing a monologic narrative discourse required a greater number of clauses than providing explanatory answers, and participants relied more heavily on cohesive devices – anaphors and connectives – in the narrative task than they did in the more interactive explanatory task. Conversely, the explanatory task involved greater use of subordinate marking by children of both ages. While this was partly due to the children's resorting to logical subordinators to express the causal relations involved in the explanations, it may also have been related to the different cognitive loads involved in remembering and recounting long series of events in chronological order (narrative task) as opposed to providing an answer to a specific question posed by an adult. Whatever the reasons were for favouring subordinate marking in the explanatory tasks, both age groups were equally sensitive to them.

The characteristics of the explanatory task, where the interlocutor and the dialogic exchange played a more central role than they did in the narrative one, also conditioned the children's gestural behaviour. Both age groups modified their gesture use in the same way, namely increasing the rates of

framing, performative and interactive gestures. Framing gestures express the speaker's emotional or mental state, and their frequency in the explanatory task could be related to two facts. First, the explanations elicited from the children dealt with parts of the story whose cause was either not made clear in the cartoon or else involved a comical event, which encouraged the speakers to express their emotional or mental state – uncertainty or amusement – through gestures. Second, this result is probably also related to the more interactive exchange that took place in the explanatory task (vs. the monologic narrative), which naturally involved more frequent expression of the speaker's communicative intentions and pragmatic marking of the speech acts. Similarly, the greater rate of interactive and performative gestures in the explanatory task in both groups of children is intimately linked to the more active role of the interlocutor in this task than in the narrative one.

The results presented in this article are in agreement with previous literature showing that narratives are distinguished from other discourse genres at school age (Berman & Nir-Sagiv, 2004; Dorval & Eckerman, 1984; Verhoeven *et al.*, 2002), but it also makes a significant contribution showing that genre differences in oral speech pertain not only to linguistic but also to gesture behaviour. To sum up, task effects were observed in both age groups for both linguistic and gesture behaviour, but whereas the differences on the linguistic measures seemed to reflect differences in discourse content and complexity, the differences on gesture use seemed to correspond mostly to differences in the extent of the interlocutor's involvement in the task.

In their study analyzing explanations produced by French children aged three to eleven years, Colletta and Pellenq (2009) observed both the multimodal development of their explanatory abilities and the distribution of different gesture types according to different communicative activities (explaining, narrating, describing, debating). Their analysis indicated a neat distribution of gesture types according to the nature of the discursive activity: overall, children used a larger number of concrete representational gestures while describing and narrating; facial expressions and framing gestures were, in turn, the most common gesture type in debating; and representational gestures of the abstract were the most frequent gesture type in explaining. The effects of task on gesture behaviour in our study did not replicate Colletta and Pellenq's findings, a fact that can be attributed to differences in study design and in the topics of the explanations included in the two corpora (see 'Introduction'). If representational gestures were not more frequent in our narratives than in our explanations, it is probably because the content of the explanations elicited in our study was based on a cartoon that was also used for the narrative task, meaning that the content of both tasks often overlapped.

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Concerning our understanding of multimodal communication, the results of this study contribute some useful data to the discussion about the intricacy and specificity of the relationship between speech and gesture (see Gullberg, de Bot & Volterra, 2008) and its development. Specifically, the effects of task on the linguistic and gestural components measured in our study somehow failed to bring to light the close link between these components: for instance, although task had an effect on the linguistic cohesive devices (more connectives and anaphors in narratives) it did not bring about a parallel difference in the use of discursive gestures that mark cohesion. It should be remembered that linguistic and gestural cohesive devices are not fully developed at this age and that, in fact, considerable changes take place between the ages investigated in this study and adulthood, as shown in Colletta *et al*.'s (2010) study of adults performing the same narrative task. This developmental factor could explain the dissociation between speech and gesture regarding cohesive expression at this stage.

The very close relationship between the gestural and linguistic systems is, nevertheless, supported when one considers that explanations, in our corpus study, were accompanied by significantly more framing, interactive and performative gestures. That is to say, gestures that are characteristic of face-to-face interactions and typically accompany the type of non-narrative speech acts that were performed in our explanatory task, but which are almost non-existent in children's narratives. Let us explain.

In their analysis of the narratives produced by children and adults, Colletta *et al*. (2010) found a very interesting effect of age on the presence of clauses whose function was not merely narrative. The authors coded each clause included in the children's narratives as narrative, explanation, commentary or interpretation, in order to quantify the presence of discourse segments serving functions other than narration within the storytelling act and thereby verifying the common finding that adults tend to spontaneously include more evaluative and explanatory commentaries in their narratives than children (Bamberg & Damrad-Frye, 1991). Results showed that the number of non-narrative clauses increased with age, and their proportion was far higher in the adults' productions than in the children's. Since our explanatory task was expected to elicit mostly explanatory clauses, we did not perform these annotations for the explanation corpus, but the interactive format of this task gave rise to a large number of linguistic expressions indicating epistemic modality (*peut-être* 'maybe'; *sûrement* 'certainly'; *je ne sais pas* 'I don't know'), as well as to assertions or negations responding directly to the adult's questions, alongside the explanatory clauses.

Moving back to the relationship between speech and gesture, the significantly more frequent use of framing, interactive and performative

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gestures in explanations therefore co-occurred with speech acts performing non-narrative functions and signalling either the speaker's attitude towards his or her discourse or his or her interactive relationship with the interlocutor. In the present study, the use of gesture in the children's explanations therefore paralleled the use of speech, providing further evidence for a close link between both components of oral communication.

This study also adds evidence to the intricate relationship between the development of gestural and linguistic abilities. As in previous studies of narratives (Capirci & Volterra, 2008; Colletta, 2009; Graziano, 2009), representational and discursive gestures, together with framing gestures, became more frequent with age, and this trend occurred in parallel with the growing ability to create longer, more cohesive narratives. As for multi-modal development in explanations, the age difference on the number of clauses was very small and, unlike Colletta and Pellenq (2009), we failed to find any significant age-related difference in the number of connectives contained in our explanation corpus. Framing gestures were more frequent in the older children's explanations than in those of the younger children, arguing for a developmental change in gesture expression occurring in parallel with children's increasing ability to comment on their utterances, as also shown in Colletta *et al.* (2010).

In conclusion, the present study shows how school-age children's use of language and gesture is constrained, in important ways, by the characteristics of the communicative activity they are engaged in, and indicates that the developmental changes taking place at late stages more markedly affect the ability to narrate than the construction of explanatory responses to an adult's questions. In summary, these findings add evidence to the subtlety and strength of the relationship between speech, gesture and communicative activity in later language development.

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