Lingue e Linguaggi

40/2020

Numero speciale

SPECIALISED LANGUAGES AND MULTIMEDIA

LINGUISTIC AND CROSS-CULTURAL ISSUES

a cura di

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LINGUE E LINGUAGGI

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KNOWLEDGE DISSEMINATION IN THE DINOSAUR TRAIN ANIMATED SERIES
How to popularise palaeontology for pre-school children

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Abstract – Paleontology is "the science of prehistoric life – of the fauna and flora of the geologic past" (Schindewolf 1993, p. 1), thus it is a complex, hybrid domain that combines methods of analysis from a wide range of disciplines, from the hard sciences (ex., biology, zoology, geology, chemistry, etcetera). Paleontology is also a discipline that is extremely popular among the general public, since "dinosaurs embody the drastic changes that life on Earth has undergone. Chasing after dinosaurs is really a quest to fill in part of our own backstory […]" (Switek 2014). Such popularity creates specific expectations in the public, who wants to receive reliable as well as enjoyable representations of their favorite prehistoric creatures. Children in particular are enthusiastic about dinosaurs as it is demonstrated by merchandise of all sorts, dedicated exhibitions, narrative and syllabus books, movies, websites, and TV shows. The present study investigates the animated series *Dinosaur Train*, chosen since it contains animated episodes and live action segments in which a real paleontologist gives scientific facts about the dinosaurs seen in each episode. Sample episodes are analysed verbally and visually: the verbal features are examined to identify the strategies of knowledge dissemination (KD) present in the series, while visual patterns were investigated through a multimodal analysis (Kress, van Leeuwen 2006; Baldry, Thibault 2006). In particular, the study considers the way(s) in which the series presents dinosaurs that are already well-known and those that are more unfamiliar. Results show that the popularity of the series is due to the structure of the episodes, composed of several phases, which make the series dynamic, thus suitable to young children's attention span, as well as to an accessible language that makes the stories interesting, also thanks to the representation of everyday situations lived by the dinosaurs that are already familiar to the viewers.

Keywords: knowledge dissemination; Palaeontology; multimodal discourse analysis; pre-school children; dinosaurs; ESP.

1. Introduction

Palaeontology is defined as "the science of prehistoric life–of the fauna and flora of the geologic past" (Schindewolf 1993, p. 1); it is thus a complex,

hybrid domain combining methods of analysis from a wide range of disciplines that include biology, zoology, geology, chemistry as well as the Arts, and even computer science, given its core concern with realistic reconstructions of the appearance and living environment of dinosaurs.

Palaeontology has always been extremely popular with the general public, since "dinosaurs embody the drastic changes that life on Earth has undergone. Chasing after dinosaurs is really a quest to fill in part of our own backstory […]" (Switek 2014). This popularity creates specific expectations in the public, who wants reliable as well as enjoyable representations of these prehistoric creatures. Children, in particular, are enthusiastic about dinosaurs as demonstrated by merchandise of all sorts: dedicated exhibitions, books, movies, websites, and TV shows. In many cases, dinosaurs are anthropomorphised and cartoonised so that children can follow the stories and learn scientific facts easily and readily. This type of presentation of dinosaurs typically involves collaboration between artists and palaeontologists, who dig out the fossils, reconstruct and study the appearance and life cycles of these extinct animals scientifically, but who also work as consultants[1] in the edutainment[2] industry.

KD practices, especially when targeting lay audiences, consist in "a vast class of various types of communicative events or genres that involve the transformation of specialised knowledge into 'everyday' or 'lay' knowledge, as well as a recontextualisation of scientific discourse" (Calsamiglia, Van Dijk 2004, p. 370). The recourse to those resources is also known as popularisation. The state of the art investigating KD aimed at adults is quite abundant. However, the study of popularisation aimed at children is still in its infancy and, thus, the existing literature is relatively limited. Some studies have investigated the strategies employed to disseminate legal knowledge to young audiences (e.g., Engberg, Luttermann 2014; Sorrentino 2014; Diani 2015, 2018; Diani, Sezzi 2019), while Djonov (2008) has considered how to popularise expert knowledge in web-based educational environments. Other existing literature addresses methods on how to teach the theoretical aspects of the hard sciences (such as mathematics, physics, chemistry, biology, and so forth; cf. Myers 1989; Unsworth 2005) as well as their practical application to experiments and in real life (Curtis 1998; Hong, Diamond 2012; Fusaro, Smith 2018). Finally,

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[1] An example is Prof Jack Horner, Palaeontology Professor at Montana State University (USA). He was a scientific consultant for the 1993 film *Jurassic Park* film directed by Steven Spielberg, as well as for the other films and books in the *Jurassic Park* franchise (http://www.jackhornersworldofdinosaurs.com/).

[2] Edutainment is defined as "a hybrid mix of education and entertainment that relies heavily on visual material, on narrative or game-like formats, and on more informal, less didactic styles of address" (Buckingham, Scanlon 2005, p. 46).

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other studies focus on the dissemination of scientific knowledge on environmental issues (Bruti, Manca 2019) or in the domain of tourism communication (Cappelli 2016; Cappelli, Masi 2019).

So far, no linguistic study – to the knowledge of the present author – has yet attempted at investigating the linguistic, discursive, or pragmatic features that characterise the popularisation of scientific discourse in the domain of Palaeontology to preschoolers or to children in primary school. Two notable exceptions are a pilot study (Cesiri 2019) and this Chapter. Given that Palaeontology, with its concern with studying a lost species, is a visual science *par excellence,* it is important for research in general, and for ESP researchers in particular, to develop methods of analysis that allow conclusions to be drawn about the interplay between visual and verbal resources in the transmission of scientific knowledge. It is especially important for such methods to be applicable across the wide range of children's genres mentioned above which include a comparison of the strategies used in online edutainment and those used in classroom teaching.

The preliminary study mentioned earlier (Cesiri 2019) analysed how specialist knowledge in the field of Palaeontology, mostly concerned with dinosaurs, is disseminated to pre-school children. To this end, the animated series *Dinosaur Train* (Bartlett 2009-2017) was chosen, as it contains animated episodes and live-action segments in which a real palaeontologist presents scientific facts about the specific dinosaur depicted in each episode. A sample episode from one of the seasons in the series was analysed, both verbally and visually, in order to identify the knowledge dissemination (KD) strategies employed.

The results of this preliminary investigation led to the conclusion that further investigation was warranted. The present study thus investigates the series more extensively, systematically applying the same methods of analysis of the tie-up between verbal and visual resources but contrasting two kinds of episodes, namely those that present familiar species of dinosaur and those introducing unfamiliar, or recently discovered, species, and which therefore represent a greater challenge to young viewers in terms of their acquisition of the units of information/scientific facts involved. Indeed, the study is designed to conduct a fine-grained investigation into the KD strategies adopted throughout the series. The goal is to frame the series within a theoretical-methodological background in which the KD strategies identified are compared to teaching strategies. These techniques were already considered in the pilot study, and were thought to be one of the reasons behind the series' international popularity.

The Chapter is structured as follows: Section 2 offers an overview of the results from the previous study. Section 3 describes the structure of the live-action segment analysed, while Sections 4 and 5 present fine-grained

visual and verbal analyses of the live-action segment. In both cases, a comparison with the previous study is drawn in order to highlight differences and similarities in the KD strategies identified in the two case studies. For the sake of brevity and clarity, the live-action segment investigated in the pilot study (Cesiri 2019) will henceforth be referred to as 'CS1' (Case Study 1), while the live-action segment analysed here will be called 'CS2' (Case Study 2). Finally, Section 6 compares the structure of a Montessori lesson to the structure of the live-action segment, highlighting the significance that the similarities have in enhancing the edutainment aspect of the series.

2. Preliminary results

Dinosaur Train is a US television series broadcast by the PBS (Public Broadcasting Service) that seeks to disseminate specialist knowledge in the field of Palaeontology to pre-school children. The series was chosen because every episode contains animated stories and live-action segments in which a real palaeontologist provides scientific facts about the dinosaurs seen in the animated part.

At present, the series comprises four Seasons, each with 89 episodes. The structure of each episode, which lasts around 30 minutes, is the same in every Season. The main topic in the episode is presented in two animated stories, each lasting 11 minutes but separated from each other by a short live-action segment (lasting around 90 seconds) featuring Dr. Scott Sampson, a real palaeontologist, who describes the aspect, behaviour and natural habitat of the dinosaurs seen in each episode.

All the episodes in the series follow the same structural pattern. The pilot study chose a representative episode, specifically the one presenting the Velociraptor species, assumed to be familiar to the young audience, since it appears various times in the series before the CS1 episode (Bartlett 2009-2017). Baldry, Thibault's (2006) phasal analysis technique was used to identify the part of the episode in which KD is most prominent, namely the live-action segment in which the real palaeontologist provides scientific facts on dinosaurs and a group of children interacts with the palaeontologist by answering his questions or by reacting to his statements. This part of the episode is defined 'live-action segment', since it features real persons, while the rest of the episode shows CGI characters and is referred to as the 'animated part'.

The pilot study focussed on the live-action segment: the verbal features were examined to identify the KD strategies present in the live-action segment, while visual patterns were investigated through multimodal analysis (Kress, van Leeuwen 2006; Baldry, Thibault 2006) in order to

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determine how the visual component integrated with the verbal KD strategies. Further analysis showed that the structure of the episodes, despite being relatively short, consists of several phases, which make the series dynamic and thus consistent with young children's attention span. The phasal structure is illustrated in Table 1. The episode starts with Phase 1, the opening phase, showing the opening credits, the series' theme song and an animation that introduces the main characters (a family of dinosaurs). The subsequent phase (Phase 2) shows the train conductor, another recurrent character, who introduces the story, anticipating the new characters appearing in the episode. Phase 3 shows the first events in the episode that lead to Phase 4 in which the family boards the train, going on an adventure initiated by events in Phase 3. Phase 5 shows the first part of the adventure, in which the family meets old and new friends and explores their world. This phase is interrupted by Phase 6, the live-action segment, in which Dr Sampson talks about the dinosaurs that the family meets in the episode. Phase 7 contains the second part of the animated episode, in which the story initiated in Phases 3 to 5 is completed and the family boards the train for the journey back home. Phase 8 ends the episode with the closing credits and closing theme song.

Phases	Description of Phases	Macrophases
Phase 1 (1 min. 10 secs.)	Opening theme song with specific animation and opening credits.	Macrophase 1
Phase 2 (1 min 10 secs.)	The Train Conductor anticipates the topic of the episode.	
Phase 3 (49 secs.)	The family starts the day with an everyday event/activity. This prompts the journey depicted in the episode.	
Phase 4 (4 mins. 25 secs.)	The family boards the train and the Train Conductor introduces their journey (essential information on era, species, etc.).	
Phase 5 (11 mins.)	First animated story.	Macrophase 2
Phase 6 (1 min. 30 secs.)	Dr Scott (with real children and animations) gives more detailed information on dinosaurs/eras/species evolution.	Macrophase 3
Phase 7 (11 mins.)	Second animated story with funny conclusion to the episode	Macrophase 4
Phase 8 (29 secs.)	Closing theme song with end credits	Endphase

Table 1
Phasal Analysis of CS1.

The structure of the live-action segment and the discoursal choices in the script were critically assessed in terms of teaching techniques that were considered similar to the Montessori Method (Montessori 1912), whereby children/pupils are at the centre of the class and are stimulated to master the learning goals for their age thanks to direct interaction with the teacher and

the materials used for the lesson. The structure of the live-action segment was compared to a typical Montessori lesson, and some interesting similarities were found. The Montessori lesson is generally divided into three 'periods'. In the first two periods, the teacher names and indicates items ('naming period') that the children are subsequently asked to recognise and associate them to similar items in real life ('recognition period'). In the live-action segment, these periods correspond to the subphases where Dr. Sampson presents the dinosaur and describes its main physical features and then asks the children to name present-day animals with similar characteristics.

In the third period of a Montessori lesson, the 'testing period', the children are stimulated by the teacher to revise the concept acquired in the first two periods through specific questions. This period corresponds, in the live-action segment, to the subphase where Dr. Sampson further remarks on the dinosaur's features or behaviour, waits for the children's reaction and, then, provides more feedback after their reaction (see Cesiri 2019).

3. The present study

The rigid repetition of the same phases in each episode indicates the emergence of a genre structure that characterises this edutainment series, concerned with "encouraging basic scientific thinking skills as the audience learns about science, natural history and palaeontology" (http://www.pbs.org/parents/dinosaurtrain/about/).

The parallel between the generic structure and the generic structure of the Montessori lesson would appear to confirm what was posited in the pilot study, namely that the resemblance between the two structures is not casual but instead indicates a specific choice on the part of the series creators.

The investigation conducted in the present study seeks to confirm this by examining another episode in the *Dinosaur Train* series, namely the episode with the Ornithomimus species as the protagonist in the live-action segment. This episode was chosen as being representative of the less familiar species of dinosaurs, introduced, that is, to the audience of pre-schoolers for the first time in the series. As in the case of the 'familiar' species of Velociraptor, the live-action segment lasts 90 seconds and is positioned in the middle of the animated story. The phasal analysis of the CS2 episode is illustrated in Table 2.

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Phases	Description of Phases	Macrophases
Phase 1 (1 min. 10 secs.)	Opening theme song with specific animation and opening credits.	Macrophase 1
Phase 2 (1 min 08 secs.)	The Train Conductor anticipates the topic of the episode.	
Phase 3 (51 secs.)	The family starts the day with an everyday event/activity. This prompts the journey depicted in the episode.	
Phase 4 (4 mins. 15 secs.)	The family boards the train and the Train Conductor introduces their journey (essential information on era, species, etc.).	
Phase 5 (11 mins.)	First animated story.	Macrophase 2
Phase 6 (1 min. 28 secs.)	Dr Scott (with real children and animations) gives more detailed information on dinosaurs/eras/species evolution.	Macrophase 3
Phase 7 (11 mins.)	Second animated story with funny conclusion to the episode	Macrophase 4
Phase 8 (29 secs.)	Closing theme song with end credits	Endphase

Table 2
Phasal Analysis of CS2.

Table 2 clearly shows that episode structure in CS2 is identical to that identified in CS1. This reinforces the idea of a genre structure typical of the series as is also demonstrated by the position of the live-action segment. In CS2 too, it coincides with Phase 6, thus confirming its function as the KD phase that marks the centre of the episode and which, according to Cesiri (2019), is pivotal in helping children to assimilate as it contextualises what they see in the episode and associates the dinosaur's features and behaviour to what children are already familiar with.

4. Visual Analysis

The phases identified in Tables 1 and 2 can potentially be analysed in terms of subphases (Baldry, Thibault 2006). While expectations about a rigid structure at the higher level of textual organisation (phases and macrophases) were confirmed, it was less certain whether the organisation of the micro-units would follow a similarly rigid sequencing. To understand this it was necessary to turn up the text microscope to a higher level of magnification.

In the pilot study on CS1, a circular structure in the live-action segment was identified, in which Dr Sampson appears with a small group of children and a static, brightly coloured cartoonised drawing in the background of the dinosaur described in the live-action segment. After a brief salutation, Dr. Sampson proceeds with some facts about the dinosaur, alternating with brief interactions with the children, followed by more facts, the final greetings and

an invitation to watch more episodes in the series. This structure was also identified in CS2, however, with some substantial differences in the central part of the live-action segment. Table 3 illustrates the methodology used to represent this level of text analysis, with a sample from the analysis of CS2.

T	FRAMES	PARTICIPANTS & PROCESSES	ORAL DISCOURSE	SOUND	KINESICS & PROXEMICS
1→6		Dr. Sampson looks at the kids with a picture of Velociraptor in the background. The kids stare in different directions.		Back-ground tune	Dr. Sampson's gaze directed at kids. He stands in a relaxed, friendly position. Kids stare in different directions. They stand distractedly.
7→14		All but one of the kids turn towards Dr. Sampson, while he addresses the viewers	Dr Scott: Hi!		Dr Sampson's and one of the kids' gaze is directed at viewers. The other kids stare at Dr Sampson.

Table 3
Example of the multimodal transcription of the live-action segment.

The following visual analysis describes the structure of CS2, at the same time drawing a parallel analysis with the frames in CS1 in order to highlight the differences and similarities in the two live-action segments. After the salutation, which is present in both live-action segments, the first sequence starts with Dr Sampson who introduces the first, brief facts on the species of dinosaur presented in the episode (Table 4).

Table 4
Dr Sampson and the children: (a) left, CS1 (b) right, CS2.

In both, Dr Sampson appears full figure, dressed in the same way. The children in the two live-action segments are different, but are dressed in a similar way and, in both live-action segments, belong to the age group that the series targets, namely pre-schoolers (4 to 6 year olds). The frames in Table 3 show the moment when Dr Sampson utters the first scientific facts about the dinosaur: his gaze is directed at the viewers, while the children look

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at him. In (a) and (b) in Table 4, the dinosaur appears in the background, represented by a static drawing that illustrates its physical characteristics but which lessens the impact thanks to the use of pastel colours (pink in CS1 and azure in CS2).

Figure 1
Dr Sampson asks questions and a child replies in CS1.

The next sequence in the two live-action segments contains the first differences. While in CS1 Dr. Sampson asks questions and one of the children replies (Figure 1), in CS2 more details are provided by the palaeontologist alone, who, is shown with a head and shoulders view, staring at the dinosaur and pointing out the features he is describing (Figure 2).
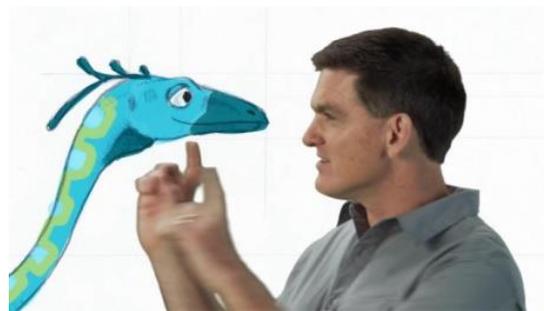
Figure 2.
Dr Sampson describes the 'unfamiliar' species of dinosaur in CS2
instead of asking children questions.

Another difference lies in the enunciation of the name of the dinosaur, which occurs in the next sequence of frames. In CS1, (a) in Table 4, the 'familiar' Velociraptor is named by the palaeontologist when he first describes the animal. In CS2, instead, the palaeontologist states the 'unfamiliar' name of Ornithomimus, but a light-blue inscription then appears in the background in capital letters with the name of the dinosaur and the name gets repeated (slowly and clearly articulated) by all the children appearing in the live-action segment.

Figure 3.
Dr Sampson and the children repeat the name of the dinosaur in CS2.

Figure 3 shows the name repetition sequence, i.e., the dinosaur is named first by Dr Sampson and, then, by the children. In the first frame, Dr Sampson utters the name of the dinosaur, which is repeated in a clear, coloured font in the background. He looks at the viewers, while the two girls look at the dinosaur and its name. In the next frames, Dr Sampson is shown full figure while gazing at the children, who appear in circles while they repeat the name of the dinosaur for the young audience. Even though Figure 3, owing to space constraints, shows just two of the children, all the children shown in Table 3 (b), and thus participating in the live-action segment, re-appear in the green circle when they repeat the name. The dinosaur is only partially shown, its back legs and front paws are a simple metonymic reminder of the rather large protagonist shown full size in the live-action segment.

The next sequence is also consistently different in the two live-action segments. At this point, CS1 shows Dr Sampson asking the children some more questions, such as naming present-day animals with similar characteristics to those of the dinosaur under description (see Figure 1 above and Figure 4 below).

Figure 4.
Dr Sampson asks more questions and one boy replies in CS1.

This sequence is followed by a comic moment in which some funny remarks by Dr Sampson are corrected in a serious manner by a Man with a Hat who enters through a computer-generated door (Figure 5).

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Figure 5.
Dr Sampson and the Man with the Hat's entrance in CS1.

Cesiri (2019) indicated this moment as one of comic relief. The comic effect
was created by the contrast between the palaeontologist's relaxed and
friendly behaviour and the rigidly serious attitude of the Man with the Hat.
The comic moment is further enhanced in the next sequence in which Dr.
Sampson confirms the facts pointed out by the Man but also adds some more
funny remarks to which the children react enthusiastically.

These two sequences are completely absent in CS2. The sequence in
which Dr Sampson asks questions (and the children reply) is replaced by a
sequence in which Dr Sampson is shown alone (in full- or half-figure) with
two different parts of the dinosaur, while he describes these body parts to his
young audience (Figure 6).

Figure 6.
Dr Sampson illustrates more facts in CS2.

This sequence is followed by another sequence in which the children are
involved in the exposition of scientific facts. The first moment involves
indirect and limited interaction (Figure 7).
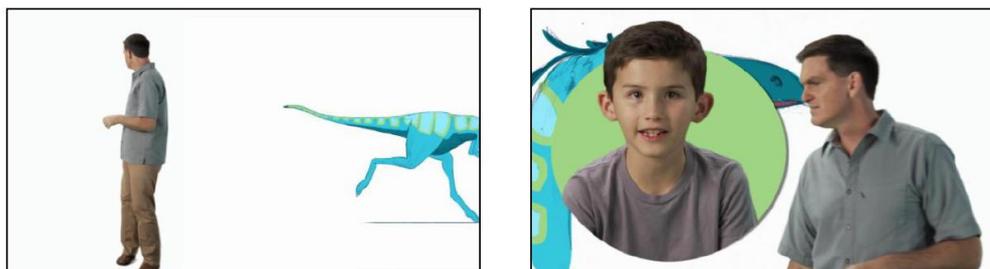
Figure 7.
Dr Sampson and one of the boys interact.

In this sequence, the dinosaur runs off screen, to Dr Sampson's surprise, at the very moment when he is describing its running skills. Dr Sampson asks "where did it go?" and the boy who enters the frame in a green circle utters "here it is!", while the green circle in which the boy's bust is enclosed slides down the frame from the top to the bottom of the screen.

The palaeontologist then starts asking the children questions. For instance, in CS1 he asks the children to name living species of animals that share similar characteristics to Ornithomimus. However, in CS2 (Figure 8) the interaction is more complex than in CS1. While in CS1 only two boys replied and both were shown with pictures of the actual animals in the background (see Figures 1 and 4), in CS2 three children reply. However, only one is shown together with the picture of the 'present-day' animal. In this case, the ostrich is shown to the public because a detailed comparison of the characteristics of both Ornithomimus and ostriches is provided by Dr Sampson in the next sequence, in which he appears alone as in the first frame, top left corner, in Figure 8.

Figure 8.
Dr Sampson asks questions and the children reply.

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A long sequence follows in which Dr Sampson is alone, while he explains
other features of the dinosaur, interrupted only by a very brief sequence in
which all the children appear together (without the palaeontologist) in the
frame shouting "go, ostrich!" as if supporting the ostrich in a sports event. In
this sequence, illustrated in Figure 9, the ostriches are represented as static
images. The fact that they are represented as fast runners is symbolised by a
sound effect that recalls a running movement and which also adds a comic
effect as it indexes the sound effects used in cartoons to indicate characters'
on-screen actions.

Figure 9
The children support the ostrich. A 'running' sound is audible.

The live-action segment then comes to an end with the salutation sequence, in
which Dr Sampson and the children are once more shown together in the
same frame. Dr Sampson greets the viewers while he runs away, trying to
match the dinosaur's speed, while the dinosaur itself runs off screen (Figure
10). In CS1, this sequence is a repetition of the one shown in (a) in Table 4,
in which Dr Sampson looks at the viewers while he stands still and invites the
public to follow more *Dinosaur Train* stories.

Figure 10.

Closing sequence 1.

5. Verbal analysis

The analysis on the verbal component of the live-action segment was conducted by contrasting the discursive features of KD (a.k.a. popularisation) identified in the relevant literature (e.g., to name only a few, Myers 2003; Calsamiglia, Van Dijk 2004; Giannoni 2008; Gotti 2013; Kermas, Christiansen 2013; Bhatia et al. 2015) as generally typical of the popularisation strategies in scientific discourse. In particular, the strategies identified by Gotti (2013) are used in this Section as framework to identify and investigate the KD strategies employed in the live-action segment.

One of the features that helps distinguish a specialised text from a popularised one is the reference to general categories of scholars and concomitant absence of any mention of the names of individual scholars. as is evident in Example (1) from CS2:

(1) In fact **scientists** think that Ornithomimus may have been one of the fastest dinosaurs ever (emphasis added).

This example also contains another feature typical of popularising texts, namely the use of hedging devices that are used to highlight a statement's tentativeness. In Example (1), the modal verb 'may' is used to describe those characteristics of dinosaurs that have been posited or reconstructed by palaeontologists from the observation of their fossilised remains and parallel examination of living creatures with similar characteristics. This strategy is present in the live-action segment in general, when Dr Sampson compares Ornithomimus to ostriches, as illustrated in Example (2):

(2) Most of the time ostriches can easily escape any predators trying to catch them and Ornithomimus was probably the same.

We can see in the example that the certainty of the ostriches' running ability ('can easily escape') contrasts with the tentative interpretation of the Ornithomimus's skills ('was probably the same'). As already pointed out in Cesiri (2019), the use of tentative expressions to lessen the force of a statement may be attributed to the informative nature of popularising texts, in which scientific information is presented rather than discussed (cf. Gotti 2013).

Fundamental, as regards conveying complex concepts in the clearest and most concise way, is the recourse to the use of figurative language. However, even though they were used several times in CS1, there are no occurrences of figurative expressions in CS2. There is, instead, just one instance of

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comparison indicated in bold type (emphasis added) in Example (3):

(3) Kangaroos and humans, that is people like you and me, both move around on their back legs but there is one bipedal animal, **a big bird that looks a whole lot like Ornithomimus**.

In this case, the comparison with a living animal is essential in allowing children to understand the abilities and functions of the physical features described for the 'unfamiliar' dinosaur by anchoring this new idea to children's reality and experience.

Another feature typical of popularising texts, found both in CS1 and in CS2, is the use of general terminology, as in Examples (4) to (6) from CS2:

(4) It was really fast;
(5) Both have a small head a long neck and strong legs and they both ran really fast;
(6) Outrunning meat-eaters like T-Rex.

As the examples illustrate, preference is given to a general description such as 'really fast', 'small head', 'long neck', 'strong legs', 'meat-eater', expressions that are preferred over corresponding monoreferential terms (cf. Gotti 2013). This is all the more evident in the use of the technique of juxtaposition (*ibid.*), absent in CS1, to introduce domain-specific expressions that might easily be unknown to pre-schoolers. This is shown in Examples (7) and (8):

(7) Ornithomimus was bipedal **which means that** it moved around on its two back legs and those back legs were very long, great for running fast;
(8) Kangaroos and humans, **that is** people like you and me.

The bold-typed expressions (emphasis added) show that the domain-specific term is, first, introduced ('bipedal' and 'humans') and, then, signalling expressions ('which means that' and 'that is') are used to alert the audience's attention, to the fact that an explanation in more general and simplified terms is about to follow.

6. Discussion

The analysis of the Ornithomimus episode in CS2, along with its comparison to the Velociraptor episode in CS1, has shown that KD strategies are used extensively in the live-action segments, particularly in the case of

'unfamiliar' species. KD is achieved thanks to the use of the juxtaposition technique, "a process whereby the specialised term is followed by its periphrasis" (Gotti 2013, p. 209). In the case of CS2, juxtaposition is used to explain terms and concepts that are presumably unknown to the young audience that the series addresses, as is the case of Examples (7) and (8), in which Dr Sampson first uses the specialised term (bipedal and human, respectively) and subsequently adds a periphrasis that explains children the meaning of these terms. This strategy was not used in the case of the 'familiar' species of dinosaurs in CS1, in which the comparison of present-day animals was more accentuated in order to allow children to draw a more direct connection between extinct animals and living ones.

Moreover, the differences between CS1 and CS2 also involve the relationship between the palaeontologist, the children, and the viewers. In the case of CS1, the interaction between the participants seen in the live-action segment is more limited, since Dr Sampson addresses viewers more frequently than the group of children. In CS2, instead, the viewer takes on the role of a spectator, since the palaeontologist and the children interact with greater frequency. This is further underscored by the direction of the palaeontologist's gaze: in CS1 he looks predominantly at the viewers, engaging with them more directly than in CS2, where he prefers to look at the children next to him. In addition, in CS2, more facts and scientific information are provided by Dr Sampson than in CS1, in which the more serious role of scientific informer is performed by the Man with the Hat, a sequence that is completely absent in CS2. Finally, the children in CS2 are more actively involved in answering Dr Sampson's questions, which he directs to the children in the frame and, unlike CS1, not to the viewers.

If we look at the kind of interaction taking place between the palaeontologists and the children in the live-action segment in CS2, similarities between the Montessori lesson and the live-action segment become all the more apparent than in CS1. The 'naming period' in the lesson coincides with the sequence in which Dr Sampson ('the teacher') names the dinosaur and describes its features. This is illustrated visually, in Figures 4 and 5, verbally as in Example (1), and in the following line at the beginning of the live-action segment:

(9) Dr Sampson: Hi there I'm Dr Scott the palaeontologist and this is Ornithomimus. -- Children take turns in repeating the dinosaur's name -- Dr Sampson: The most important thing to know about Ornithomimus is that it was really fast.

The 'recognition period' is represented in the subphases of the live-action segment in which the palaeontologist-teacher asks the children-pupils specific

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questions, and the children eagerly answer, as in Figures 7 and 8 above, and
in the following interaction:

(10) Dr Sampson: Can you think of any bipedal animals alive today? -- Girl
     1: Kangaroos -- Girl 2: Humans.

Dr Sampson then proceeds with his exposition of scientific facts about the
dinosaur and asks further questions, to ascertain whether the children have
really grasped the parallel between Ornithomimus and living animals, as in
the following example:

(11) Dr Sampson: Yup! Kangaroos and humans, that is people like you and
     me, both move around on their back legs but there is one bipedal
     animal, a big bird that looks a whole lot like Ornithomimus… -- Boy:
     Ostrich! -- Dr Sampson: Exactly! The ostrich and Ornithomimus have
     plenty in common: both have a small head a long neck and strong legs
     and they both ran really fast.

In this interaction, the palaeontologist does not ask any questions but lets the
boy finish his sentence, thus ascertaining that his explanations were being
followed by the children, that they could make the correct association
between dinosaurs and living animals, and that they could answer
accordingly. Dr Sampson's subsequent explanation serves as feedback for the
children's answers and builds on what he had already said thanks to the
addition of more facts that complete the children's knowledge on the subject.
This phase can be compared to the 'testing period' of the Montessori lesson,
in which the core topic of the lesson is fixed by the teacher, who also assesses
that the learning goals of the lesson have been reached by the pupils (see
Montessori 1912).

7. Conclusions

The present study has investigated one part of an episode in the *Dinosaur
Train* animated series for pre-school children. The goal was to further
investigate the KD strategies adopted in the series as already analysed in a
pilot study (Cesiri 2019). More specifically, the live-action segment was
investigated, in which a real palaeontologist gives an analytical presentation
of the dinosaur that is the protagonist in the animated parts that make up the
bulk of a specific episode.
      The first study, CS1, ascertained that, when presenting a 'familiar'
species of dinosaur, the KD verbal strategies employed in the live-action

segment are those typical of the language of popularisation of scientific discourse. This further confirms what other studies have recently found out in other genres and media (Bruti, Manca 2019; Masi 2019), namely that these strategies are now commonly used to disseminate scientific knowledge to children. It is unsurprising, then, that the same features were found in the second live-action segment, CS2, investigated in the present study, in which an 'unfamiliar' species of dinosaur is presented to children. The verbal strategies were the same as those found in the first study with the addition of juxtaposition, which is particularly productive in popularising texts since it allows experts in a certain domain to transmit new, specialist concepts to a public of non-experts (see Gotti 2013).

Visually, the two episodes showed some differences. In CS1 the palaeontologist tends to engage the viewers' attention, while in CS2 the children appearing in the live-action segment are involved in an interaction with the adult through direct questions to which they answer as if during a classroom lesson. In general, the live-action segment of the second episode analysed is more educational and less entertaining than the first episode, as demonstrated by the absence of the comic moment with the Man with the Hat. This absence might well indicate that possible 'disruptions' tend to be avoided when a new species of dinosaur is being introduced to the children.

The comparison between the episodes in the *Dinosaur Train* series and the Montessori method of teaching pre-school children is, of course, tentative. Despite the striking resemblance found, first, in CS1 and, then, further confirmed and reinforced in CS2, we would need more evidence to corroborate this hypothesis, such as the analysis of the animated parts in the episodes, to ascertain whether KD strategies are adopted in those parts, and, if so, how they are structured both before and after the live-action 'interlude'. Moreover, considering that both the animated parts before this short interlude each last 11 minutes, it would be interesting to see if the duration of the various parts somehow influences the KD strategies. In addition, other similar series might be analysed with a similar approach to see if this tendency to reproduce a Montessori three-period lesson and to use KD verbal strategies characterises the genre or whether these characteristics are specific to the *Dinosaur Train* series.

Finally, it would also be interesting to interview the creators of the series to see if the similarity to the Montessori lesson was intentional or casual. In this latter case, a first attempt at contacting the creators was undertaken by the author, but so far to no avail.

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