

The interplay between interpersonal and compositional meanings in multimodal texts about animals for young children

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Contemporary science books for preschool children are multimodal texts since they combine different semiotic systems in meaning production. Along with their representational meaning (presentation of processes and participants), image and language in these books realize equally important levels of meaning: the interpersonal (nature of the relationship between writer-reader and reader–represented participants) and the compositional (composition of elements on the page). The study attempts a comparative analysis of two multimodal texts about animals for preschool children, to examine the meanings created visually and verbally at the interpersonal (address, social distance) and compositional (information value, salience) level. The analysis indicates that the two texts differ regarding the role gradually assigned to the reader (address) and the nature of the relationship developed between the reader and the represented animals (social distance). Additionally, these interpersonal meanings are reinforced or weakened through the positioning of the elements on the page (information value) and their relative emphasis (salience). The different possibilities of combining visual and verbal means for communicating interpersonal and compositional meanings that emerged through the analysis, are discussed with regard to their pedagogical appropriateness and may support teachers in the selection, design, and use of multimodal science texts to promote science literacy.

KEYWORDS compositional meaning; interpersonal meaning; multimodal science texts; preschool children

1. Introduction

1.1. *Multimodality and contemporary children science books*

Contemporary science books for preschool children are multimodal texts since they combine different semiotic systems, mainly the verbal and the visual, in meaning production (Kress et al. 2001; Royce 2002; Unsworth 2006). Understanding of these texts presupposes the ability to decode the semiotic systems integrated into their design. This view is consistent with the pedagogy of multiliteracies, according to which the reader needs to develop the ability to analyze and interpret the different semiotic codes, which, independently and interactively, contribute in the presentation and communication of meanings (Avgerinou and Pettersson 2011; Cope and Kalantzis 2009; New London Group 2000). Additionally, the reader should be able to think critically of the intentions of the writer of the text who purposively chooses to present information in particular ways according to the messages (s)he wishes to communicate. Lastly, readers are expected to be able to transform meanings and transfer their knowledge to new contexts to produce their own texts (Kress 2000; New London Group 2000). The aforementioned abilities are expected to be developed from the preschool age when children start to interact with multimodal educational material about science (Coleman and Dantzer 2016; Hall 1998; Gonitsioti et al. 2013; Papadopoulou and Christidou 2004).

According to the Grammar of Visual Design (Kress and Van Leeuwen 2006), which was based on the three metafunctions of language as proposed by the Systemic Functional Grammar (Halliday and Matthiessen 2004), a multimodal text realizes simultaneously three kinds of meaning: representational, interpersonal and compositional. Representational meaning refers to the processes constructed verbally and visually, the participants involved in them and the circumstances in which they occur. Interpersonal meaning refers to the verbal and visual choices determining the nature of relationships between writer-reader and reader-represented participants. Compositional meaning is concerned with the composition of verbal and visual elements on the page. Consequently, a multimodal text performs a variety of functions and its meaning is not restricted to its representational content, but incorporates the construction of additional and equally important levels of meaning concerning the reader's interaction with the text and the way the elements are composed in order to form a coherent whole (Eco 1984; Halliday and Matthiessen 2004; Lemke 2000).

A large part of science books addressed to preschool children concern biological concepts, especially topics on the characteristics, structure, and behavior of animals and are widely used during instruction by preschool teachers (Ford 2006; Kelly 2018; Yopp and Yopp 2012). Along with their representational content, these books utilize a variety of techniques serving the communication of interpersonal and compositional meaning. These two kinds of meaning in science books have pedagogical implications on children's learning as they concern the

role assigned to the young readers in relation to the represented elements, and the extent to which they become associated with what is represented, the information value of certain elements and the attraction of readers' attention on them (Guo 2004; Mantzicopoulos and Patrick 2011; Wignel 2011).

While few studies have focused on the dimensions of interpersonal and compositional meaning in multimodal science texts (Christidou et al. 2005; Hatzinikita et al. 2008; Koulaidis et al. 2002; Unsworth 2004), these meanings are of particular importance, as they relate to the pedagogical appropriateness of the material in question, the nature and the content of the represented knowledge (Matsagouras and Helmis 2003). According to contemporary pedagogical principles, from a young age, children "build" their understanding of science concepts, processes, and phenomena based on their personal experiences and abilities. Knowledge is closely associated with children's lives and knowledge construction presupposes their active engagement (Driver et al. 1994). Therefore, at the interpersonal level, to meet contemporary pedagogical principles, science educational material should directly address the readers recognizing them as active knowledge constructors and closely connecting them with the represented knowledge to be acquired, building a relationship of intimacy between readers and represented elements (Matsagouras 2009; Matsagouras and Helmis, 2003; Oliver 2000). Likewise, at the compositional level, the above interpersonal meanings are reinforced when the corresponding visual or verbal elements producing them are presented in a position of great information value and when they receive a high degree of salience attracting readers' attention (Guijarro and Pinar 2008; Painter et al. 2013). The basic dimensions of the two levels of meaning -interpersonal and compositional- and the means of their verbal and visual realization are analyzed below.

1.2. Interpersonal meaning

Address

Address concerns the way the writer addresses the reader and is verbally realized by the type of sentence and the person of the verb (Halliday and Matthiesen 2004; Kress and Van Leeuwen 2006). When imperative sentences and second person are used, something is demanded from the reader (high address), interrogative sentences and first-person denote medium address, while by indicative sentences information is offered (low address) (Halliday and Matthiesen 2004). Address is visually realized by the represented participant's gaze. When the participant looks directly at the reader, something is demanded from her/him, while when the participant's gaze is directed elsewhere, information is simply offered to the reader (Kress and Van Leeuwen 2006).

Social distance

Social distance refers to the nature of the relationship constructed between reader – represented participants and is verbally realized by the use of nominalizations, the voice of the verb and the type of relationship between clauses. The use of nominalization, namely the use of nouns instead of verbs to convey processes, the use of passive voice and hypotaxis correspond to an elaborated linguistic code and suggest a remote relationship, while the absence of nominalization, the use of active voice and parataxis of clauses are used in informal writing and indicate a relationship of intimacy. Balance of use of verbs and nouns, namely the use of the same number of verbs and nouns, for the description of processes, balance of parataxis – hypotaxis, namely the use of the same number of paratactic and hypotactic relationships between clauses and balance of active–passive voice, namely the use of the same number of verbs in active and passive voice or the use of middle/neutral voice of verb indicate a neutral relationship between reader – represented participants (Halliday and Matthiesen 2004; Koulaïdis et al. 2002). Social distance is visually realized by the size of the frame, in other words, the distance of the shot, which determines the extent of the depiction of a participant's body. A long shot, namely when the full body is depicted, establishes a sense of remoteness, a medium shot, that is when most of the body is depicted, suggests a neutral relationship and a close shot, namely when only part of the body is depicted, an intimate relationship is indicated (Christidou et al. 2005; Kress and Van Leeuwen 2006).

1.3. *Compositional meaning*

Information value

Information value refers to the placement of the elements –verbal and visual- in specific positions of the page (Kress and Van Leeuwen 2006). There are three organizational structures regarding information value: the horizontal, the vertical and the center - margins structure. On the horizontal structure the elements -verbal or visual- placed on the right are presented as the New, unknown information, or the information at issue (high information value) and the elements positioned on the left are presented as the Given, as information assumed to be already familiar to the reader (low information value). When elements are structured on the vertical axis, those placed at the top of the page are presented as the Ideal, the idealized essence of information (high information value), while elements placed at the bottom of the page are presented as the Real, providing more specific or practical information (i.e. consequences, directions for action) (low information value). On the center - margins structure, the elements appearing at the center are presented as the nucleus of information (high information value), while the marginal elements are presented as independent or subservient to the center (low information value) (Clark and Lyons 2011; Jewitt and Oyama 2001; Kress and Van

Leeuwen 2006). In a multimodal composition, however, different organization structures are usually combined –i.e. horizontal with vertical. Therefore, the total information value of an element results from the combination of the information value it receives in relation to each of the combined structures (Veel 1998).

Saliency

Saliency concerns the creation of a hierarchy of importance between the represented elements which defines some of them as more important and worthy of attention than others (Kress and Van Leeuwen 2006). In both language and image, saliency is realized through a combination of a variety of techniques that attract the reader's attention. Such techniques include the size of the verbal and visual elements, that is the amount of space they occupy on the page and the presence or absence of distinctive textures (namely manipulative features, e.g. the use of a different material at some points on the page that the child is invited to touch) (Cope and Kalantzis 2009; Kress et al. 2001; Unsworth 2014; Wignel 2011). The large size of an element –verbal or visual- and the presence of distinctive texture in it contribute to its high saliency, while the small size and the absence of distinctive texture attribute low saliency to it. Balance in the options related to these two features indicates moderate saliency of an element (Guijarro 2011; Kress and Van Leeuwen 2006; Kress et al. 2001; Wignel 2011). Besides, saliency is verbally realized by distinctive writing characteristics (such as the size or type of font used), which attribute high saliency to the verbal text (Kress and Van Leeuwen 2006; Serafini and Clausen 2012; Van Leeuwen 2005).

1.4. Aim of the study

The most relevant studies concerning the analysis of children's science books have focused on the representational meaning which carries the most "evident" content of a text (e.g. Royce 2002; Unsworth 2006; Chan 2011). However, picture books addressed to preschool age readers, are characterized by very short and simple plots, pertinent to their cognitive development. Therefore, attention to the representational meaning is not a primary focus of the particular books (Wignel 2011). Instead, the writers of picture books addressed to preschool children tend to focus mainly on the interpersonal and compositional level of meaning of a text using various verbal and visual techniques, as their primary objective –determined by the readers' early age- is the attraction of the children's attention, the children's engagement with the text, the retention of children's interest and their ease of understanding of the plot (Guijarro 2011; Wignel 2011). Despite the importance of interpersonal and compositional meaning in multimodal science texts for young children, though, the studies that have focused on the relevant dimensions, are limited (Christidou et al. 2005; Hatzinikita et al. 2008; Koulaidis et al. 2002; Unsworth 2004) and concern books addressed to primary or secondary school children.

This study attempts a comparative analysis of two multimodal texts about animals for preschool children, to answer the following questions:

- What are the meanings created visually and verbally at the interpersonal level concerning the dimensions of address and social distance?
- What are the meanings created visually and verbally at the compositional level concerning the dimensions of information value and salience?

Based on contemporary pedagogical perceptions, the reader is not considered as a passive receiver of information but has an active role in the learning process and learning is not seen as an accumulation of objective events, but as a personal construction process (Duit, 1996). Therefore, in order to actively involve the reader in knowledge construction, the educational material, through its verbal and visual choices, is expected to promote high address, that is to encourage the reader to act in some way in relation to the information to be acquired. Furthermore, on the basis of modern pedagogical principles, knowledge is not seen as independent of human existence, but closely related to the individual so the concepts, processes, and phenomena are expected to be presented in the educational material as something accessible and closely related to the reader (Elliot et al. 2000; Halliday and Martin 1996; Veel 1998). Consequently, through its verbal and visual choices, the educational material is expected to establish a small social distance between the reader and the represented elements, building a personal and intimate relationship between them. In addition, the way the verbal and visual elements are positioned on the page (compositional meaning), is expected to reinforce the aforementioned desirable interpersonal meanings by endowing with high information value and high salience those elements that create high address and small social distance.

2. Method

2.1. Sample

This study is part of an extensive research concerning the analysis of a large number of multimodal texts from children's picture books about science, available in the Greek market and originally written or translated in Greek from other languages. Two books about animals addressed to preschool children were selected. On the one hand, the specific books were selected because they meet the criterion of the presence of animate beings in the image, which is a prerequisite for the examination of the dimension of address (Kress and Van Leeuwen, 2006). On the other hand, biological concepts especially topics about animals constitute a large part of science books for preschool children and are particularly popular to the young readers (Ford 2006; Kelly 2018; Yopp and Yopp 2012). The sample of this study consisted of two multimodal texts (double spreads), one from each of the aforementioned books for

preschool children titled *Lampera kai apala Agria Zoakia* [Touch and Sparkle – Wild Animals] (Collective work 2016) and *Gializei! Ta zoa* [Baby Sparkle, Animals] (Sirett 2015). The former will be referred to as Text A and the latter as Text B. These two texts are excerpts from books originally written in English and translated in Greek. The two texts constituting the sample are extracted from the Greek editions of the books and they were analyzed in the Greek language¹. As far as the verbal mode is concerned, a sentence was defined as the unit of analysis. As far as the visual mode is concerned, the unit of analysis consisted of an image. Overall, the sample consisted of four verbal units (two for each text) and three visual units (two for Text A and one for Text B). The selection of one double-spread from each book derives from the nature of the current study and the particular characteristics of the material. Specifically, on the one hand, this study focuses on an in-depth, multidimensional analysis that attempts through the comparison of different multimodal texts to reveal the complexities and diverse possibilities of combining visual and verbal means for communicating interpersonal and compositional meanings. On the other hand, both books have two common characteristics of the books addressed to young children: they are very short and repetitive (Guijarro 2011). More particularly, the two books consist of very few pages and are organized in a small number of double-spreads (the book *Lampera kai apala Agria Zoakia* consists of 5 double-spreads and the book *Gializei! Ta zoa* consists of 6 double-spreads), each of them presenting a different animal. The double-spreads in each book do not substantially differ from each other regarding the interpersonal and compositional dimensions of meaning, as each book consistently follows the same pattern of information presentation visually and verbally across the double-spreads.

2.2. Procedure

Analysis of each verbal and visual unit was conducted based on the Systemic Functional Grammar (Halliday and Matthiesen 2004) and the Grammar of Visual Design (Kress and Van Leeuwen 2006), respectively. In particular, the content of each sentence and each image was classified at the interpersonal level as regards the dimensions of address and social distance and at the compositional level with regard to the dimensions of information value and salience. The analysis process according to these dimensions is described in the following paragraphs.

Interpersonal meaning

Categorization of address in verbal text and images

Regarding the verbal mode, address was assessed on the basis of a combination of sentence type and person of the verb and was evaluated as high when an imperative sentence and second person were combined, as moderate when an interrogative sentence and first-person were combined and as low when there was a combination of an indicative sentence and third person. Visually, address was determined by the participant's gaze and was characterized as

high when the depicted animal looked toward the reader and as low when the animal did not look at the reader (see Figure 1).

Categorization of social distance in verbal text and images

Regarding the verbal mode, social distance was estimated based on the combination of the use of nominalization, the voice of the verb and the type of relationship between clauses. More particularly, social distance was characterized as large when these three features denoted a remote relationship (combination of nominalization, passive voice, and hypotaxis) or two of them indicated remoteness and the third a neutral relationship (e.g. prevalence of nominalization and passive voice and balance between parataxis and hypotaxis of clauses).

Alternatively, social distance was estimated as moderate when these three features denoted a neutral relationship (i.e. balance of use of verbs and nouns for the description of processes, middle/neutral voice and balance of parataxis – hypotaxis), or when the three features signified a combination of remoteness and intimacy (e.g. prevalence of nominalization, active voice, and parataxis).

Otherwise, social distance was characterized as small when the three features denoted an intimate social relationship with the reader (i.e. absence of nominalization, verbs in active voice and parataxis/absence of dependent clauses), or when two of them indicated intimacy and the third signified a neutral relationship (e.g. combination of absence of nominalization, middle/neutral voice and parataxis).

Regarding the visual mode, social distance was determined by the distance of the shot and was estimated as large when there was a long shot (the whole body of the animal was represented), as moderate when there was a medium shot (most of the body of the animal was depicted) and as small when there was a close shot (only part of the animal's body was depicted) (see Figure 1).

Compositional meaning

Categorization of information value in verbal text and images

In both verbal text and images, information value was estimated based on the positioning of each element (unit of analysis) on the double spread. Information value of an element was characterized as high when it was placed at the top, or the right, or the center, or combined some of these positions on the double spread (e.g. top and right), as moderate when it combined a position of high and low information value (e.g. was placed on the top and left or at the center and left) and low when the element was placed at the bottom or the left, or the margins of the page, or it combined at least two of these positions on the double spread (e.g. bottom and left) (see Figure 2).

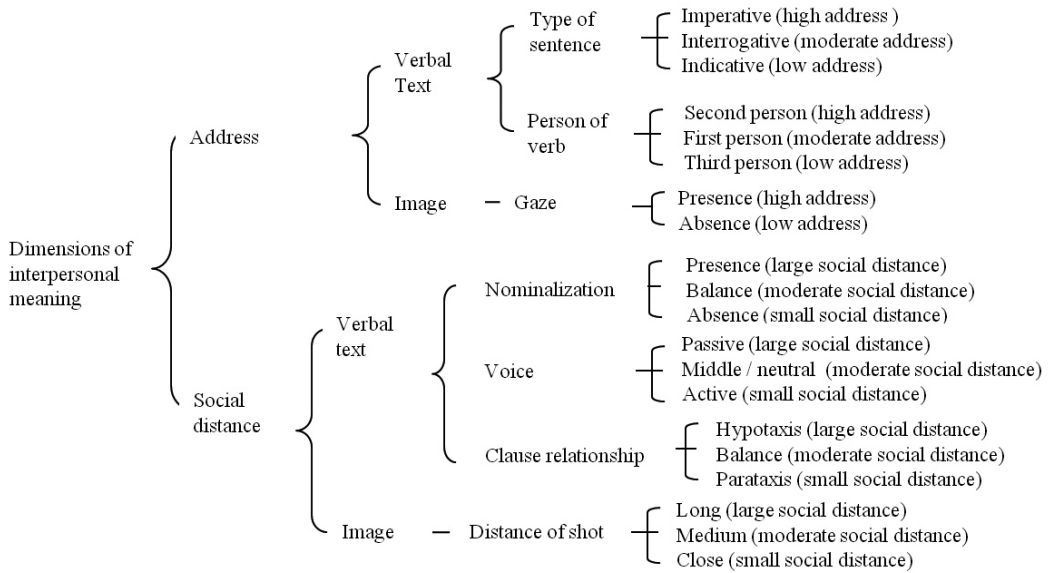


Figure 1. Categories and realization means of interpersonal meaning dimensions

Categorization of salience in verbal text and images

Both verbally and visually, the first feature determining salience involved the size of an element, namely the space it occupied on the page. The size was estimated as large when the element occupied more than half of the page, as moderate when it occupied between one-third and half of the page and as small when it occupied less than one third of the page. Additionally, the salience of the verbal text was estimated based on the presence or absence of distinctive texture and presence or absence of distinctive font in terms of size or type. Therefore, the salience of an element was regarded as high when it combined a large or moderate size, presence of distinctive texture and presence of distinctive font. Otherwise, salience was estimated as moderate when the three features in an element signified a combination of high and low salience (e.g. combination of small size, absence of distinctive texture, presence of distinctive font). Last, salience was assessed as low when there was a combination of small or moderate size, absence of distinctive texture and absence of distinctive font (see Figure 2).

Visually, salience was determined by a combination of the size and the presence or absence of distinctive texture. Thus, for the visual mode, salience was estimated as high when an image combined large or moderate size and presence of distinctive texture, as moderate when it combined a large size and absence of distinctive texture, or a small size and presence of distinctive texture and low when the element combined small or moderate size and absence of distinctive texture.

3. Results

In the following paragraphs, the analysis of Text A and Text B concerning interpersonal and compositional meaning is presented.

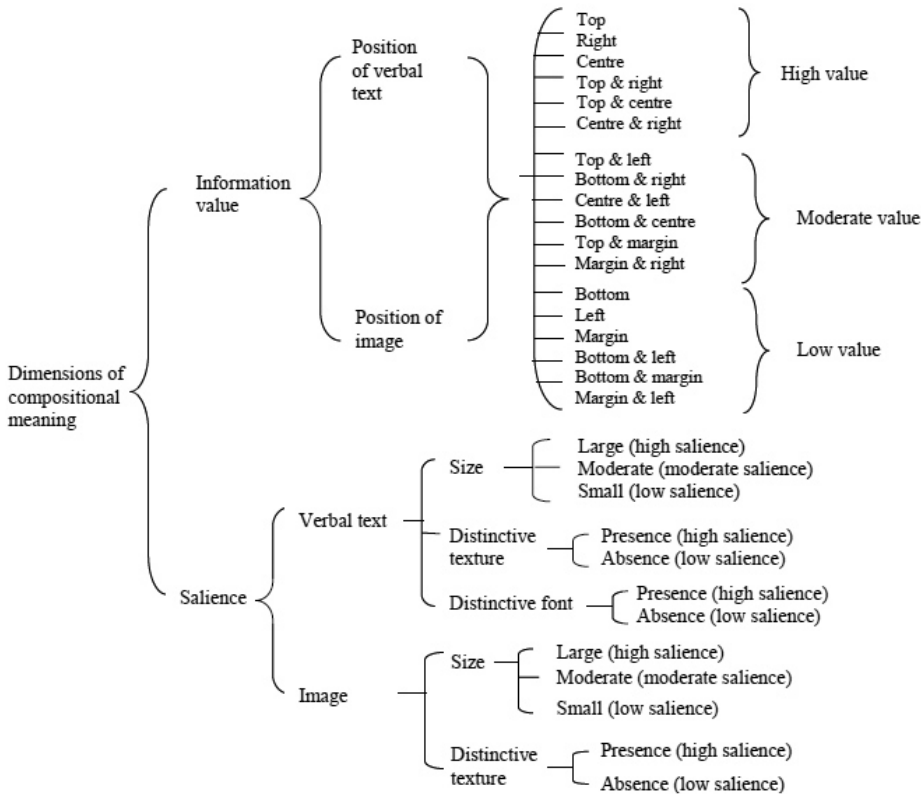


Figure 2. Categories and realization means of compositional meaning dimensions

3.1. Analysis of Text A

Text A is illustrated in Figure 3, followed by a description of the values granted to the dimensions of address and social distance (interpersonal meaning) and the dimensions of information value and salience (compositional meaning).

Interpersonal meaning in Text A

Address in verbal text and images in Text A

With regard to the interpersonal meaning of Text A (see Figure 3), in terms of the dimension of address, the verbal text in the first sentence (*“The tiger is black and orange”*) (Collective

work 2016, p. 5-6) denotes low address as it combines an indicative sentence with a verb in the third person. Therefore, through the first sentence, the verbal text serves a simple offer of information and specifically attempts to inform the reader about the characteristic color of the represented animal. In the second sentence (“*Feel its soft fur!*”) (Collective work 2016, p. 5-6) the verbal text indicates high address resulting from the combination of an imperative sentence with a verb in the second person. That is, in the second sentence the verbal text is used to demand from the reader to act, to touch the depicted animal and specifically the fabric on its nose in the right-hand image.



Figure 3. The double spread of Text A. From *Lampera kai apala agria zoakia* (pp. 5-6), Collective work, 2016, Athens, Greece: Susaeta. Copyright 2016 by Suzaeta. Reprinted with permission.

As far as the visual mode is concerned, both the first image (at the left) and the second (at the right) indicate a high address, as the animal looks toward the reader. That is, both images address the reader directly asking her/him to perform an action in relation to the illustrated animal (see Table 1).

Social distance in verbal text and images in Text A

In terms of social distance, as far as the verbal mode is concerned, both sentences indicate an absence of nominalization, use of active voice and absence of dependent clauses. These three characteristics signify a small social distance between the reader and the represented animal, therefore promoting an intimate relationship between them.

Visually, the first image (on the left) is a long shot, as the full body of the animal is de-

picted. This way the animal is presented away from the child-reader denoting large social distance, thus a relationship of remoteness and alienation between the child-reader and the represented animal is promoted. On the other hand, the second image (on the right) is a close shot, since only the head of the animal is visible. Thus, through the second image, the animal is presented close to the child as connected with her/him, indicating a small social distance between them and therefore a personal and intimate relationship between them is promoted.

Dimension	Category	Text A				Text B		
		1 st sentence	2 nd sentence	1 st image	2 nd image	1 st sentence	2 nd sentence	Image
Address	High		√	√	√	√	√	
	Low	√						√
Social distance	Large			√				√
	Small	√	√		√	√	√	
Information value	High				√			√
	Moderate	√		√		√		
	Low		√				√	
Salience	High				√	√	√	
	Moderate	√		√				
	Low		√					√

Table 1². Address, social distance, information value and salience in the units of analysis of Text A and Text B

Compositional meaning in Text A

Information value in verbal text and images in Text A

Concerning the compositional meaning of Text A text in terms of information value, the arrangement of verbal and visual elements on the double spread combines three structures: the vertical and the center-margins structures within the left page and the horizontal structure (left-right page). Specifically, as far as the verbal mode is concerned, the first sentence is presented as the Ideal but at the same time as the Given, since it is placed at the top and on the left of the double spread and consequently receives moderate information value. The second sentence, through its positioning at the bottom and on the left of the double spread is presented as the Real but also as the Given, thus receiving low information value. Concerning the visual mode, moderate information value is attributed to the first image (left page), since it is placed at the center and on the left, thus it is presented as the central but also already known information. The second image (right page) constitutes the only element in the double spread receiving high information value since it is placed on the right and is therefore presented as the New and the information at issue.

Salience in verbal text and images in Text A

Regarding salience in the verbal text, the two sentences occupy less than one-third of the page and distinctive texture is absent. On the other hand, larger font size is used for the words indicating the name and color of the animal in the first sentence, while the word “soft” characterizing the fur of the animal in the second sentence is written in a different type of font. The two sentences, then, combine small size, the absence of distinctive texture and presence of distinctive font, thus both receiving moderate salience.

With regard to the visual mode, the first image (left page) receives low salience since it combines moderate size (it occupies between one third and half of the page) and absence of distinctive texture. The second image (right page) is the only element of the double spread with high salience, presented as the most prominent: apart from its large size (it extends across the full width of the page), it also includes the fabric of distinctive texture on the animal’s nose.

3.2. Analysis of Text B

The analysis of Text B (Figure 4), appears in the paragraphs that follow, comprising a presentation of the values granted to address and social distance (interpersonal meaning) as well as to information value and salience (compositional meaning).



Figure 4. The double spread of Text B. From *Gializei! Ta zoa* (pp. 3-4), Sirett, 2015, Athens, Greece: Patakis. Copyright 2015 by Patakis/Dorling Kindersley LTD. Reprinted with permission.

*Interpersonal meaning in Text B**Address in verbal text and images in Text B*

With regard to the interpersonal meaning of Text B, in terms of the dimension of address both in the first (“Be a big elephant!”) and the second sentence (“Wave your long trunk!”) (Sirett

2015, p. 3-4) the verbal text denotes high address by means of imperative sentences and second person of verbs. Therefore, through the verbal text, an action is demanded from the reader and specifically to imitate the represented animal.

Visually, though, low address is denoted, due to the lack of gaze of the depicted animal toward the reader, thus the image merely serves to present information.

Social distance in verbal text and images in Text B

With regard to social distance, in both sentences of Text B nominalization is absent, an active verb is used and there are no dependent clauses, therefore low social distance is indicated. Consequently, the animal is verbally represented as being connected to the reader and a sense of intimacy between them is promoted.

Visually, however, a long shot is used, since the full body of the animal is depicted and thus high social distance is created, so the visual mode establishes a relationship of remoteness between the reader and the animal depicted.

Compositional meaning in Text B

Information value in verbal text and images in Text B

As far as the compositional meaning is concerned, in terms of information value, the arrangement of visual and verbal elements on the Text B double spread combines the horizontal (left-right page) with the vertical structure (within the left page). Regarding the verbal text, the first sentence through its positioning at the top (as the Ideal) and on the left (as the Given) of the double spread receives moderate information value. The second sentence is placed at the bottom and on the left, so it is presented as Real but also as Given, therefore low information value is overall attributed to it. The image of the animal is placed on the right page, a position of high information value and is thus presented as the New information.

Salience in verbal text and images in Text B

Concerning the dimension of salience in the verbal text, each of the two sentences occupies almost half of the available space on the page. In addition, the circular patterns framing the two sentences are made of a glittering material, the texture of which is different from the rest of the page. Besides, the word referring to the name of the animal in the first sentence and the word that refers to its characteristic trunk in the second sentence are written with a font size larger than the rest of the words. Therefore, both sentences are granted high salience as they combine moderate overall size on the one hand and the presence of distinctive texture and distinctive font on the other. Visually, though, the animal receives low salience as it combines moderate size (it occupies between one-third and half of the page) and the absence of distinctive texture.

4. Discussion and conclusion

At the level of interpersonal meaning, in Text A the verbal mode is used initially to simply present information to the reader (first sentence). Subsequently (second sentence) it is used to directly address the reader asking her/him to act towards the illustrated animal. Likewise, both images in the text also achieve high address.

In terms of social distance, the visual mode creates a relationship of remoteness between the reader and the represented animal through the image on the left page, which subsequently develops into a relationship of intimacy through the image on the right page. An intimate relationship is also promoted by the two sentences of the verbal text (Guijarro 2011). Figure 5 represents the level of address and social distance promoted by each verbal and visual unit, indicating the development of interpersonal meanings throughout Text A.

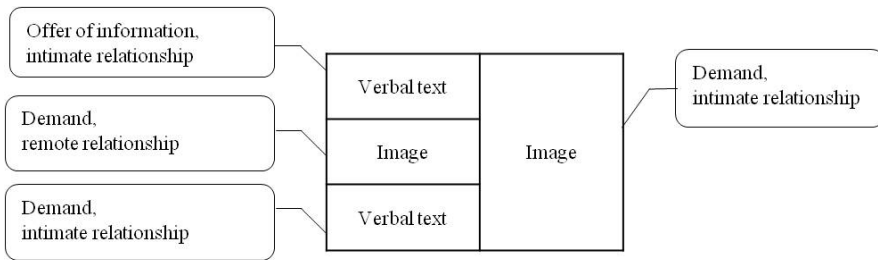


Figure 5. Representation of address and social distance of the verbal and visual elements of Text A.

In contrast, the second multimodal text (Text B), follows a reverse direction in the development of interpersonal meaning both in terms of address and social distance. In particular, concerning address, on the left page, the text verbally requests the reader to act (both sentences), while the image on the right page is merely used to offer information to the reader.

As far as social distance is concerned, while the verbal text creates a relationship of intimacy between the reader and the animal presented, the image which follows creates a sense of remoteness and alienation between them. Figure 6 represents the level of address and social distance promoted by each verbal and visual unit, indicating the development of interpersonal meanings throughout Text B.

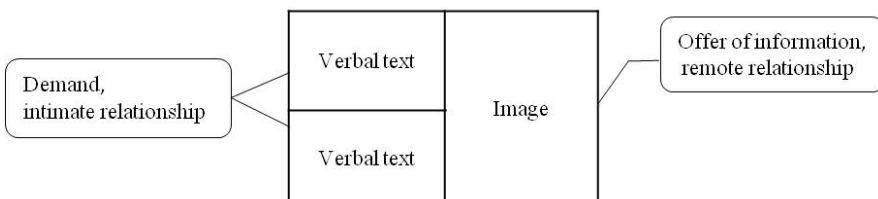


Figure 6. Representation of address and social distance of the verbal and visual elements of Text B.

With regard to the compositional meaning of Text A, in terms of the dimension of information value, the combination of the three organizational structures (horizontal, vertical and center - margins) promotes a transition from Ideal (top) to Real (down) and from Given (left) to New (right) (Kress and Van Leeuwen 2006; Painter et al. 2013), as illustrated in Figure 7. More specifically, on the left page, at the top, the most idealized essence of information is presented in the first sentence, describing the colors of the animal. The image of the animal is presented as the central element and is followed by the most practical verbal information at the bottom of the page, directing the reader to touch the distinctive texture of the animal's nose. At the same time, all the elements on the left page -both visual and verbal- are presented as already known to the reader, contrary to the image on the right page, which introduces the new, highly valued information (Guijarro and Pinar 2008).

This visual element is also presented as the most prominent, by occupying the full space of the right page and by involving the fabric with a distinctive texture on the animal's nose. With these characteristics, the specific image becomes the only element receiving high salience, in contrast with the rest of the elements –visual and verbal- receiving moderate or low salience. That is, both through its special positioning on the double spread and its distinctive features (size and texture), this image functions as the element with the highest value as information but also as the most salient, to which the reader's attention is directed (Wignell 2011).

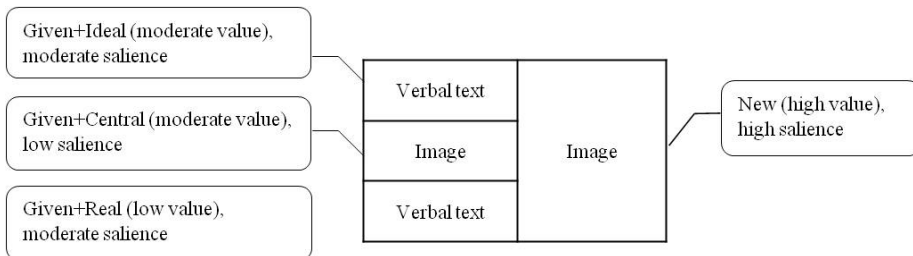


Figure 7. Representation of information value and salience of the verbal and visual elements of Text A.

Regarding the compositional meaning of Text B, in terms of information value, the organization of the elements combines the vertical structure (top–down) across the left page and the horizontal structure (left-right page), following a transition from Ideal to Real and from Given to New (see Figure 8). More specifically, on the left page, the most idealized piece of information related to the child's imagination is presented at the top through the first sentence. Conversely, at the bottom of the page –through the second sentence- the most practical information is presented, referring to the elephant's movement that the child is asked to imitate. At the same time, the two sentences through their placement on the left page are presented as the information the reader already knows, while the image of the animal through its positioning on the right page is presented as the new information to be acquired.

Regarding the dimension of salience, though, this image receives low salience, in contrast to the two sentences of the verbal text, which, both through their relative size to the size of the page and through the presence of distinctive texture and font, receive high salience. Therefore, contrary to Text A, where the image positioned at the right besides its high information value is also presented as the most salient element of the double spread, in Text B the verbal elements, although placed in a position of low or moderate information value, are those presented as the most prominent ones, to which the reader's attention is directed.

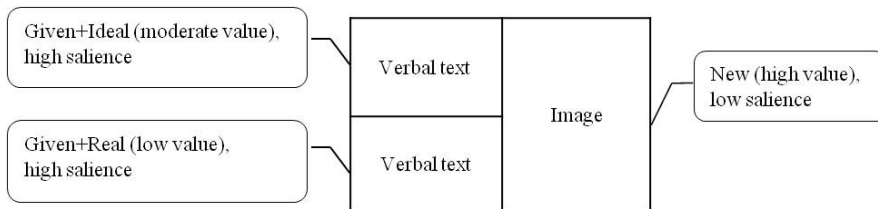


Figure 8. Representation of information value and salience of the verbal and visual elements of Text B.

Therefore, as far as Text A is concerned, the organization of the elements on the double spread not only serves the high information value and salience of the image on the right page but also serves the development of the interpersonal interaction between writer-reader and reader-represented animal through the increase of address verbally and the decrease of social distance visually (Harrison 2003; Unsworth 1997). In other words, the compositional meaning, and more particularly the information value in Text A supports the gradual change in address through the verbal text and therefore the change of the child's role from a simple observer and receiver of information to an active participant being asked to act in relation to the represented animal. At the same time, the compositional meaning –both in terms of information value and salience- serves the gradual decrease of social distance between child and represented animal through the visual mode, by means of transition from alienation and remoteness (image on the left page) to intimacy (image on the right page) (Royce 2007). It is therefore observed that the composition of the elements in Text A serves the development of interpersonal meanings in the pedagogically desirable direction, ending up with a high address and small social distance. This gradual reinforcement of interpersonal meanings is realized through the high information value and salience of the image on the right page (Halliday and Martin 1996; Oliver 2000). This specific semiotic selection regarding the interplay of interpersonal and compositional meanings through the visual mode is in accordance with the early age of the children the text addresses, who mainly rely on images in their attempt to “read” multimodal texts (Papadopoulou and Christidou 2004).

In contrast, in the second multimodal text (Text B), compositional meaning does not serve the development of pedagogically appropriate interpersonal meanings, as the text ends up with a low address and large social distance (Duit 1996; Veel 1998). The organization of elements

on the double spread, through which the information value of the elements increases from the left (verbal text) to the right (image), is not consistent with the development of interpersonal meanings, which follow the opposite direction. That is, the child is initially given an active role and is asked to act like the represented animal through the verbal mode on the left page, while the image on the right page assigns the role of a simple observer and receiver of information to the reader. The relationship between the reader and the represented animal also evolves in the same direction, with the animal being verbally presented as accessible and intimate (left page) and ending up visually represented as remote from the reader (right page). Furthermore, the verbal text which interpersonally indicates a high address and small social distance compositionally receives increased salience, but it is presented in a position of moderate and low information value. Therefore, although the interpersonal meanings promoted by the verbal text are strengthened through their high salience, they are at the same time weakened due to their positioning as trivial information. On the contrary, although the image indicates a low address and large social distance, it is presented in a position of high information value. Therefore, the pedagogically inappropriate interpersonal meanings the image produces, namely the passive role attributed to the reader and her/his distant relationship with the represented animal, are reinforced due to their positioning as highly valued information. Finally, despite the fact that preschool children are expected to rely mainly on the visual mode in order to decode the meaning of a multimodal text, in Text B it is the verbal mode that undertakes the representation of the pedagogically expected meanings at the interpersonal level and receives high salience, contrary to the image, which promotes the opposite interpersonal meanings and receives low salience (Painter et al. 2013; Papadopoulou and Christidou 2004).

The preceding analysis reveals the different possibilities of combining visual and verbal means for communicating interpersonal and compositional meanings, namely the kind of relationship between writer-reader and reader-represented participants and the composition of the elements in contemporary science texts for young children. The use of such texts in kindergarten science activities is suggested, in order for young children to develop the ability to decode and manage not only their representational content, but also their interpersonal and compositional meanings produced through the different semiotic systems (Guo 2004; Hall 1998; Lemke 1998; O'Halloran et al. 2017; Unsworth 1997, 2004). Preschool teachers are expected to systematically guide children towards decoding the verbal and visual semiotic selections made by the authors of such multimodal texts. These selections have to do with how texts address their readers, the relationships established between children and represented elements, the positioning of each element on the page and the emphasis it acquires in relation to other elements (Babalioutas and Papadopoulou 2007; Hassett and Curwood 2009). Furthermore, teachers can encourage children to compare the semiotic selections in the verbal and visual mode in different texts, both in terms of interpersonal and compositional meaning. This familiarization would be expected to subsequently enhance their ability to introduce

relevant verbal and visual conventions in their own multimodal productions (Christidou et al. 2009; Papademetriou and Makri 2015; Papadopoulou and Christidou 2004; Unsworth 1997). The adoption of appropriate teaching practices, could support children in developing those competencies that will allow them to think critically about specific semiotic selections and use them to communicate consciously and intentionally different levels of meaning to the readers of their texts (Avgerinou and Pettersson 2011; Bezemer and Kress 2008; Cope and Kalantzis 2009; Hall 1998; Papadopoulou 2005).

In conclusion, teachers need to be prepared so that they can choose, evaluate and design multimodal texts that support learning, as well as to prepare their pupils in processing and managing such texts effectively (Christidou 2018; Coleman et al. 2011; Royce 2002). The analysis of visual and verbal communication focused on the basic dimensions of interpersonal and compositional meaning presented in this study attempts to contribute to this direction. On the one hand, this analysis, as well as the framework on which it was based, although not exhausting all the dimensions of interpersonal and compositional meaning a multimodal text incorporates, may support teachers in the analysis, interpretation, and production of science multimodal texts (Kress et al. 2001; O'Halloran et al. 2017; Unsworth 2001). On the other, the proposed analysis may provide teachers with valuable tools for using multimodal texts in science teaching. These tools take into account the different semiotic systems, the multiple levels of meaning multimodal texts incorporate and their interplay, thus facilitating the integration of the pedagogy of multiliteracies (Avgerinou and Pettersson 2011; Cope and Kalantzis 2009; New London Group 2000) in science teaching. At the same time, they are expected to support young children in developing multimodal communication competencies that are critical components of their emerging science literacy (Anagnostopoulou et al. 2013; Hatzinikita et al. 2008; Royce 2002).

Last, it should be noted that even though each level of meaning and each particular dimension conveys specific messages to the reader, their combination and interaction may produce new, different meanings (Unsworth, 2006). The current study focused on particular dimensions of interpersonal and compositional meanings in excerpts from two children's science books and has only covered a small part of this complicated area of research on multimodal semiotic analysis of children's science books.

NOTES

1 As Systemic Functional Grammar has originally been developed for the English language, its application to other languages may vary according to their syntax and grammar and the dimensions involved in the analysis (Halliday and Matthiesen 2004). The verbal part of the materials forming the sample of this study, though, includes a small number of short and simple

clauses regarding their syntax and grammar. Furthermore, these clauses have been translated word for word and representing the precise meaning of the original text. Therefore, if the same analysis had been applied to the original, English version of the books, no differences would be expected in the results, at least concerning the dimensions involved in the current analysis. 2 Units of analysis indicating a moderate address and social distance were not detected in the two texts, hence these categories do not appear in Table 1.

REFERENCES

- Anagnostopoulou, Kyriaki, Vassilia Hatzinikita, Vasilias Christidou and Kostantinos Dimopoulos 2013. PISA test items and school-based examinations in Greece: Exploring the relationship between global and local assessment discourses. *International Journal of Science Education* 35 (4): 636-662.
- Avgerinou, Maria D. and Rune Pettersson 2011. Toward a cohesive theory of visual literacy. *Journal of Visual Literacy* 30 (2): 1-19.
- Babalioutas, Dimitrios and Maria Papadopoulou 2007. Teaching critical literacy through print advertisements: An intervention with 6th grade students (Ages 11-12). *The International Journal of Learning* 14 (7): 119-127.
- <https://www.degruyter.com/view/j/mc.2016.5.issue-2/mc-2016-0025/mc-2016-0025.xml>Bezemer, Jeff and Gunther Kress 2008. Writing in multimodal texts: A social semiotic account of designs for learning. *Written Communication* 25 (2): 166-195.
- Chan, Evelin 2011. Integrating visual and verbal meaning in multiodal text comprehension: Towards a model of intermodal relations. In: Shoshana Dreyfus, Susan Hood and Maree Stenglin (eds), *Semiotic Margins. Meaning in multimodalities*. London, New York : Continuum, 144-167.
- Christidou, Vasilias 2018. Eikona kai ekpaideysi stis fisikes epistimes: To stoixima tou epistimonikou optikou grammatismou [Image and science education: The challenge of science visual literacy]. In: Chrysanthi Skoumbourdi and Michail Skoumios (eds) *Proceedings of the 3rd Panhellenic Conference with international participation "Educational material in mathematics and science: different practices, intersecting learning paths"*. Rhodes, Greece: University of the Aegean, 92-116. Retrieved from <http://ltee.aegean.gr/sekpy.3d>
- Christidou, Vasilias, Vassilia Hatzinikita and Anastasia Dimitriou 2009. Children's drawings about environmental phenomena: the use of visual codes. *International Journal of Science in Society* 1 (1): 107-117.
- Christidou, Vasilias, Vassilia Hatzinikita and Spiridoula Sklaveniti 2005. Oi eikonikes anaparastaseis sta pedika exosholika vivlia gia tis fisikes epistimes: Periexomeno, kodikes kai inonikes allilepidraseis [Visual representations in science childrens' books: Content, codes

- and social interactions]. In: Ourania Semoglou (ed) *Eikona kai paidi* [Image and the child]. Thessaloniki, Greece: Cannot not design Publications, 609-620.
- Clark, Ruth C. and Chopeta Lyons 2011). *Graphics for learning: Proven guidelines for planning, designing, and evaluating visuals in training materials*. San Francisco, USA: John Wiley and Sons, Pfeiffer.
- Coleman, Julianne M. and John A. Dantzler 2016. The frequency and type of graphical representations in science trade books for children. *Journal of Visual Literacy* 35 (1): 24-41.
- Coleman, Julianne, M. Erin M. McTigue and Laura B. Smolkin 2011. Elementary teachers' use of graphical representations in science teaching. *Journal of Science Teacher Education* 22 (7): 613-643.
- Cope, Bill and Mary Kalantzis 2009. A Grammar of multimodality. *The International Journal of Learning*, 16 (2): 361-425.
- Driver, Rosalind, Ann Squires, Peter Rushworth and Valerie Wood-Robinson 1994. *Making sense of secondary science: Research into children's ideas*. London: Routledge.
- Duit, Reinders 1996. The constructivist view in science education - what it has to offer and what should not be expected from it. *Investigações em Ensino de Ciências* 1 (1): 40-75.
- Eco, Umberto 1984. *The role of the reader: Explorations in the semiotics of texts* (Vol. 318). Bloomington, USA: Indiana University Press.
- Elliot, Stephen N., Thomas R. Kratochwill, Joan L. Cook and John F. Travers 2000. *Educational psychology: Effective teaching, effective learning*. Boston: McGraw Hill.
- Ford, Danielle J. 2006. Representations of science within children's trade books. *Journal of Research in Science Teaching* 43 (2): 214-235.
- Gonitsioti, Hara, Vasilias Christidou and Vassilia Hatzinikita 2013. Enhancing scientific visual literacy in kindergarten: Young children 'read' and produce representations of classification. *International Journal of Science, Mathematics, and Technology Learning* 20 (1): 1-15.
- Guijarro, Arsenio J. M. 2011. Engaging readers through language and pictures. A case study. *Journal of Pragmatics* 43: 2982-2991.
- Guijarro, Arsenio J. M. and Maria Jesus Pinar 2008. Compositional, interpersonal and representational meanings in a children's narrative: A multimodal discourse analysis. *Journal of Pragmatics* 40: 1601-1619.
- Guo, Libo 2004. Multimodality in a biology textbook. In: Kay O' Halloran (eds), *Multimodal discourse analysis. Systemic-Functional perspectives*. New York: Continuum, 196-219.
- Hall, Kathy 1998. Critical literacy and the case for it in the early years of school. *Language Culture and Curriculum* 11 (2): 183-194.
- Halliday, Michael A. K., and Christian M. I. M. Matthiessen 2004. *An introduction to functional grammar* (3rd ed.). London: Arnold.
- Halliday, Michael A. K. and James R. Martin 1996. *Writing Science: Literacy and discursive power*. London: The Falmer Press.

- Harrison, Claire 2003. Visual social semiotics: Understanding how still images make meaning. *Technical Communication* 50 (1): 46-60.
- Hassett, Dawnene D. and Jen Scott Curwood 2009. Theories and practices of multimodal education: The instructional dynamics of picture books and primary classrooms. *The Reading Teacher* 63 (4): 270-282.
- Hatzinikita, Vassilia, Konstantinos Dimopoulos and Vasilía Christidou 2008. PISA test items and school textbooks related to science: A textual comparison. *Science Education* 92 (4): 664-687.
- Jewitt, Carey and Rumiko Oyama. 2001. Visual meaning: A social semiotic approach. In: Theo Van Leeuwen and Carey Jewitt (eds) *Handbook of visual analysis*. London: Sage Publications, 134-156.
- Kelly, Laura B. 2018. An analysis of award winning science trade books for children: Who are the scientists, and what is science? *Journal of Research in Science Teaching* 55 (8): 1188-1210.
- Koulaidis, Vasilis, Kostas Dimopoulos, Spiridoula Sklaveniti and Vasilía Christidou 2002. *Ta keimena tis techno-epistimis sto dimosio choro* [The texts of techno-science in the public domain]. Athens: Metaixmio.
- Kress, Gunther and Theo Van Leeuwen 2006. *Reading images. The grammar of visual design*. London: Routledge.
- Kress, Gunther 2000. Multimodality. In: Mary Kalantzis and Bill Cope (eds), *Multiliteracies: Literacy learning and the design of social futures*. London and New York: Routledge, 182-202.
- Kress, Gunther, Carey Jewitt, Jon Ogborn and Charalampos Tsatsarelis 2001. *Multimodal teaching and learning. The rhetorics of the science classroom*. London and New York: Continuum.
- Lemke, Jay L. 1998. Multiplying meaning: Visual and verbal semiotics in scientific text, In: James R. Martin and Robert Veil (eds) *Reading science*. London and New York: Routledge, 87-113.
- Lemke, Jay 2000. Multimedia literacy demands of the Scientific Curriculum. *Linguistics and Education* 10 (3): 247-271.
- Mantzicopoulos, Panayota and Helen Patrick 2011. Reading picture books and learning science: Engaging young children with informational text. *Theory Into Practice* 50 (4): 269-276.
- Matsagouras, Elias 2009. *Eisagogi stis epistimes tis paidagogikis. Enallaktikes proseggiseis, didaktikes proektaseis*. [Introduction in pedagogical science. Alternative approaches, educational implications]. Athens: Gutenberg.
- Matsagouras, Elias and Sarantis Helmis 2003. *Paragogi ekpaideytikou ilikou stin ekpaideysi: Theoritikes paradoxes kai technikes prodiagrafes*. [Production of educational material: Theoretical principles and technical specifications]. In: *Schediasmos kai paragogi paida-*

- gogikou ilikou gia tin perivallontiki ekpaideysi*. [Panhellenic Symposium Proceedings - Design and production of educational material in environmental education]. Athens: Livani, 1-40.
- New London Group 2000. A pedagogy of Multiliteracies: Designing social futures. In: Mary Kalantzis and Bill Cope (eds) *Multiliteracies: Literacy learning and the design of social futures*. London and New York: Routledge, 9-37.
- O'Halloran, Kay L. Sabine Tan and K. L. E. Marissa 2017. Multimodal analysis for critical thinking. *Learning, Media and Technology* 42 (2): 147-170.
- Oliver, Ron 2000. When teaching meets learning: design principles and strategies for web-based learning environments that support knowledge construction. In: Rod Sims, Meg O'Reilly and Sue Sawkins (eds) *Learning to choose: Choosing to learn. Proceedings of the 17th Annual ASCILITE Conference*. Lismore NSW: Southern Cross University Press, 17-28.
- Painter, Clare, James R. Martin and Len Unsworth 2013. *Reading visual narratives: Image analysis of children's picture books*. London: Equinox.
- Papademetriou, Efi and Demetra Makri 2015. The metalanguage of "visual design" into the classroom for the construction of intermodal meanings. *International Journal of Education and Literacy Studies* 3 (2): 32-43.
- Papadopoulou, Maria and Vasilisa Christidou 2004. Multimodal text comprehension and production by preschool children: An interdisciplinary approach of water conservation. *International Journal of Learning* 11: 917-927.
- Papadopoulou, Maria 2005. Ta politropika keimena os meson proseggisis tis grafis apo paidia prosxolikis ilikias [Multimodal texts as a means for approaching writing for preschool children]. *Ereynontas ton Kosmo tou Paidiou* 6: 120-130.
- Royce, Terry D. 2007. Intersemiotic complementarity: A framework for multimodal discourse analysis. In: Terry Royce and Wendy L. Bowcher (eds) *New directions in the analysis of multimodal discourse*. Mahwah, NJ: Erlbaum, 63-109.
- Royce, Terry D. 2002. Multimodality in the TESOL classroom: Exploring visual-verbal synergy. *TESOL Quarterly* 36 (2): 191-205.
- Serafini, Frank and Jeniffer Clausen 2012. Typography as semiotic resource. *Journal of Visual Literacy* 31 (2): 22-38.
- Collective work 2016. *Lampera kai apala Agria Zoakia* [Touch and Sparkle – Wild Animals]. Athens, Greece: Susaeta.
- Sirett, Dawn 2015. *Gializei! Ta zoa*. [Baby Sparkle, Animals] (Illustration: C. Battuz, Translation: V. Nika). Athens, Greece: Patakis.
- Unsworth, Len 2008. Multiliteracies and metalanguage: Describing image/text relations as a resource for negotiating multimodal texts. In: Jullie Corio, Michelle Knobel, Colin Lankshear and Donald J. Leu (eds) *Handbook of research on new literacies*. New Jersey: Lawrence Erlbaum, 379-409.

- Unsworth, Len 2006. Image/text relations and intersemiosis: Towards multimodal text description for multiliteracies education *Plenary Paper for the International Systemic Functional Linguistics Congress*. San Paulo, Brazil, 1165-1205.
- Unsworth, Len 2004. Comparing school science explanations in books and computer-based formats: The role of images, image/text relations and hyperlinks. *International Journal of Instructional Media* 31 (3): 283-301.
- Unsworth, Len 2001. *Teaching multiliteracies across the curriculum: Changing contexts of text and image in classroom practice*. Buckingham, UK: Open University Press.
- Unsworth, Len 1997. Scaffolding reading of science explanations: Accessing the grammatical and visual forms of specialized knowledge. *Reading* 31: 30-42.
- Van Leeuwen, Theo 2005. Typographic meaning. *Visual Communication* 4 (2): 137-143.
- Unsworth, Len 2014. Interfacing visual and verbal narrative art in paper and digital media: Recontextualising literature and literacies. In: Georgina Barton (ed) *Literacy in the arts*. Switzerland: Springer, Cham, 55-76.
- Veel, Robert 1998. The greening of school science: Ecogenesis in secondary classrooms. In: James R. Martin and Robert Veel (eds) *Reading Science. Critical and functional perspectives on discourses of science*. London and New York: Routledge, 115-151.
- Wignel, Peter 2011. Picture books for young children of different ages: The changing relationships between images and words. In: Kay O' Halloran and Bradley Smith (eds) *Multimodal studies: Exploring issues and domains*. New York: Routledge, 202-219.
- Yopp, Ruth H. and Hallie K. Yopp 2012. Young children's limited and narrow exposure to informational text. *The Reading Teacher* 65 (7): 480-490.

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