Story Apps as Didactic Multimodal Resources for Multiliteracies Practices. A Case in Point

Aplicativos de histórias digitais multimodais como recursos didáticos para práticas de multiletramentos. Um caso em foco

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Abstract: This article aims to contribute to the understanding of the use of interactive story apps as didactic resources for fostering the learning and teaching of multiliteracies. It presents the multimodal discourse analysis of an interactive story app showing a dense net of intermodal meaning relations, such as convergence, complementarity, and divergence, in the representation of ideational and interpersonal meanings. The results allow the characterization of the story app as a complex multimodal ensemble and point to the need of a renewed readers and teacher's agency in the pedagogical use of interactive story apps in the learning and teaching of multiliteracies. The article finishes by identifying the limitations of the study and some future developments.

Keywords: multiliteracies; multimodality; story app; didactic resources; agency.

Resumo: Este artigo tem como objetivo contribuir para a compreensão do uso de aplicativos interativos de histórias como recursos didáticos para promover a aprendizagem e o ensino de multiletramentos. Apresenta a análise do discurso multimodal de uma aplicação interativa de histórias, que mostra a densa rede de relações de significado intermodais, como a convergência, a complementaridade e a divergência, na representação de significados ideacionais e interpessoais. Os resultados permitem a caraterização desta aplicação de histórias como um conjunto multimodal complexo e apontam para a necessidade de uma renovada agência do leitor e do professor na utilização pedagógica de aplicações interativas de histórias na aprendizagem e no ensino dos multiletramentos. O artigo termina identificando as limitações do estudo e alguns desenvolvimentos futuros.

Palavras-chave: multiletramentos; multimodalidade; aplicativos de histórias digitais interativas; recursos didáticos; agência.

1 Introduction

This article aims to contribute to the understanding of interactive story apps as multimodal didactic resources for fostering multiliteracies practices. It presents a study of a story app as its main object of inquiry and discussion. The app "Mobeybou in Brazil" (Sylla; Gil; Pereira, 2022) is part of a kit of tools for young children's digital storytelling. The kit comprises a digital manipulative, composed by a set of physical blocks with embedded computational properties that allow the manipulation of the digital content (Resnick et al., 1998), and a storyMaker, which is full digital version of the digital manipulative. Both are authoring tools for digital storytelling (and story writing) and are complemented with a set of digital apps that present interactive stories situated in specific social, geographical, and cultural settings. All the apps follow the same design principle, i.e., each app presents a geographical map that locates the culture in the world map, a story unfolding in such social, geographical, and cultural context, a page with a 360º environment that encourages the children to move their device around to explore and visualize the full environment, a puzzle or a small game involving some of the represented cultural elements, an augmented reality (AR) page that offers children the

possibility to print their own AR markers and bring the protagonists to life in their own environment, and an incorporated glossary with keywords from the story and detailed information about the represented culture.

The study presented here focuses on a specific story app that integrates the set of interactive stories. The app presents an animated narrative for children's meaning making about Brazil. It aims to (i) inform about Brazil's cultural, historical, and geographical (bio)diversity and to (ii) promote positive feelings towards such diversity. The app narrates and shows the experience and reactions of a Brazilian child on an imaginative travel through her country while reading an illustrated book that she finds among her toys. The story has two layers of meaning: The first comprises the step by step reading of the book, culminating in the announcement of future travels. This meaning is explicitly or implicitly present in the 11 episodes that make up the story. The second layer includes the imagined experiences of the protagonist during the step-by-step reading, each located in a different Brazilian region/place. The reading of the app requires the reader's interactions (e.g., dragging elements, clicking on objects, etc.) in key moments to trigger animations and the main character's reactions[1].

In previous studies, we developed partial analyses of this story app focusing on the multimodal meaning representation of ideational (Pereira; Gil; Sylla, 2022) and interpersonal (Gil; Pereira; Sylla, 2023) meanings. In each case, we used our findings to argue that the app instantiates fundamental assumptions of Multiliteracies concerning texts as essentially multimodal signs. Here, we present a study developed to approach the following comprehensive research question: To what extent may the multimodal design of interactive story apps impact the learning and teaching of Multiliteracies? This question is underpinned by the understanding that "typography, image, writing and layout contribute to meaning in text in ways significant for social relations within and across its makers and users" (Bezemer; Kress, 2010, p. 25), having implications to the users' engagement and, therefore, their learning processes. Situated in a social semiotic approach to multimodality, our study also calls attention to the acknowledgement that the semiotic changes in didactic resources and contemporary learning environments more generally "go

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[1] A demonstration video of the reading can be accessed at: https://www.youtube.com/watch?v=d495PU-PP6Y, or https://www.youtube.com/@mobeybou/videos.

hand-in-hand with profound social changes" (Bezemer; Kress, 2016a, p. 477). That is, while some decades ago the didactic materials were designed for audiences that were relatively fixed and known, nowadays - although there are general competences and age as reference points - students are socially and culturally more diverse than before.

We begin by briefly presenting the theoretical framework sustaining the study. We then introduce our study, presenting and illustrating our findings, which evidence that the app is a complex multimodal didactic ensemble. The discussion, in which we distill some major implications that can be derived from our findings, is developed with reference to the major question leading the study and the theoretical underpinnings. We end up by identifying the limitations of our study and some future developments.

2 Theoretical framework

2.1 Multiliteracies

Considering the diversity of the new social contexts, especially those related to the development of digital communication and cultural diversity resulting from new migration flows, the New London Group (1996) proposed the concept of Multiliteracies. The concept, aiming to account for this new reality, is understood as the multiplicity of communicative practices situated in the new and complex social contexts (Kalantzis; Cope, 2012; New London Group, 1996, 2000).

The genesis of the concept of Multiliteracies lies in the recognition of how emerging technologies were influencing and modifying the whole understanding of the world, enabling other ways of communicating, informing, and interacting. New digital technologies originated new and diverse textual compositions. The multimedia texts became increasingly popular and, therefore, the need to understand the meanings represented by different modes is seen as essential in the education of citizens who can communicate and interact with others, engaging in different social practices mediated by technology.

Another central aspect of this approach is the acknowledgement of the increasing local diversity, on the one hand, and the global connectedness, on the other. In this sense, dealing with linguistic

and cultural differences has become a central aspect of our private, professional and citizens' lives (New London Group, 1996, P. 19).

In this context, the Group put forward a set of conditions - a new pedagogy - to educate citizens with the knowledge and skills necessary to participate in these new multiliteracies in contemporary society (Cope; Kalantzis, 2009; Kalantzis; Cope, 2012). The Multiliteracies Pedagogy poses two major challenges to educational contexts, namely: (i) the need to create learning contexts in which students learn to make multimodal meanings; and (ii) the need to make cultural diversity a mandatory learning object (Cope; Kalantzis, 2009). In this scenario, multimodality and intercultural dialogue become increasingly prominent in the educational settings. The app that is the focus of our attention offers itself as a potentially relevant resource to address both educational concerns.

2.2 The socio-semiotic approach to multimodality

Textual transformations are a basic assumption of the Multiliteracies pedagogy (New London Group, 1996), and multimodality is arguably the most prominent dimension in the discussions about this transformation (Jewitt, 2005; 2008; Kress, 2010; Pereira, 2019; Pereira; Gil; Sylla, 2023; Rowsell; Kress; Pahl; Street, 2013; Walsh, 2006; 2008).

Social Semiotics (Kress, 2010) laid the ground for the understanding of multimodality as assumed by Multiliteracies (Gee, 2017). According to Social Semiotics, the representation of meanings implies the use of modes, understood as "socially shaped and culturally given" (Kress, 2010, p. 79) semiotic resources. Social Semiotics further assumes that each mode has its own specific grammar, comprising units and rules for representing ideational, interpersonal, and textual meanings. These grammars "have led to a stability and predictability in the construction of meaning" being "the product of the history of previous semiotic work of the members of a community" (Bezemer; Kress, 2016b, p. 22). It is important to understand that these grammars are a set of possibilities or resources constantly redrawn and never arbitrarily. That is, these resources present relatively stable regularities, yet they are not fixed (Gualberto; Santos, 2019).

A socio-semiotic perspective on multimodality considers all modes on the same level of importance, the effects of choosing one mode over another being relevant to the analyses. As highlighted by Bezemer

and Kress, a "text designed for readers to engage with aspects of the world cannot be fully understood without due attention to all modes operating in that text" (2010, p. 25). In this sense, texts are multimodal ensembles, in which the signs constructed by each mode are integrated into each other, forming laminations of meanings (Bezemer; Kress, 2016b; Kress, 2010). In the multimodal ensembles, modes do not duplicate or ornament each other; rather, each mode performs different functions, each making "distinct, specific, and potent contributions to the multimodal whole" (Kress, 2010, p. 23). In the present study, we readdress our previous findings with this specific assumption in mind.

The social semiotic approach to multimodality also draws attention to the ways in which the choices of modes are shaped by the "wider material, social and semiotic environment in which they were produced" (Bezemer; Kress, 2016b, p. 31). Since each mode has significant effects on what can be communicated (and consequently learned) (Bezemer; Kress, 2016b, p. 31), the material affordances of each mode, that is, its potentials and limitations for the representation of meanings, dictate their specialization in the representation of certain types of meanings. The major implication concerns the acknowledgement that specific semiotic work, i.e., attending, engaging, transforming, integrating, etc., is necessary, bringing meaning makers' and their teachers' *agency* to the forefront in the meaning making process.

2.3 Story apps

In recent years, and as part of the digital communication society, e-books and story apps have gradually become part of children's literature universe (Al-Yaqout; Nikolajva, 2015; Hagen, 2020). This is not surprising given the availability and widespread use of mobile and touch screen devices, and the appealing combination of multimedia resources with elements from traditional printed picture books (Yokota; Teale, 2014).

Research investigating interactive features in story apps for children has highlighted that these can potentially contribute to children's literacy development (Bus; Takacs; Kegel, 2015), when they are congruent with the narrative. Also animated illustrations that are well matched to the text are important for understanding the story (Takacs; Bus, 2016), and have a beneficial impact on reading, since the cognitive cost of switching between the interaction and the reading itself is small (Takacs; Swart;

Bus, 2015, p. 701). On the contrary, these features, together with poorly designed interactive areas (hotspots), especially if they are not connected to the storyline, may interrupt the story flow, drawing away children's attention and compromising the reading activity and children's literacy acquisition (Menegazzi; Sylla, 2020; Takacs; Swart; Bus, 2015, p. 700).

Considering that the multimodal affordances of digital technologies have turned multimodality into a prominent feature of digital meaning representation (Kress, 2010; Stein, 2008; Rowsell; Kress; Pahl; Street, 2013), analyses of the semiotic design of such digital interactive narratives is needed to better characterize their potential use as a didactic resource for Multiliteracies practices. Our study addresses this specific claim.

3 The study

The present study builds on the results of our previous inquiries evidencing the multimodal representation of ideational and interpersonal meanings in the above-mentioned story app.

In the study about the representation of ideational meanings, we described how verbal, visual (static and moving images) and aural modes are used to represent the meanings associated with Brazil's cultural, historical, and geographical (bio)diversity (Pereira; Gil; Sylla, 2022). We used processes, participants and circumstances, dimensions of the system of experiential meanings assumed in SFL (Halliday; Matthiessen, 2004) and in the Grammar of Visual Design (Kress; Van Leeuwen, 2006), as our main analytical categories.

The study of multimodal interpersonal representation, showing how the positive positioning of the reader towards the Brazilian diversity is constructed, involved two major analytical categories, namely attitudes and sources of attitudes (Martin; Rose, 2007), with different subcategories according to modes.

We assumed affect (the expression of feelings) and appreciation (the appraisal of qualities and composition of the setting) as our key analytical categories in the analysis of attitudes expressed in the verbal mode (Martin; Rose, 2007). In the analysis of the attitudes represented in the visual mode, we used information coming from the same meaning systems reoriented for the grammar of visual narratives, adapted from Painter, Martin and Unsworth (2012). Accordingly, we used the categories of *pathos*

(depiction style and facial expressions), affect (appreciative, empathetic, or personalized meanings inferred from depiction), social distance (ample, medium, or close up frame), involvement (horizontal oblique or frontal plane), power (lower or upper vertical angle) and eye contact (existent or not). In the analysis of the attitudes towards the context/environment, we were guided by the variation, the temperature, and the saturation of colors. The generic style in representing the characters (i.e., the representation of traits common to human beings) and the affect inferred from such depiction were especially relevant in the construction of the interpersonal meanings since they allow the viewer's perception of the protagonist as friendly, thus encouraging readers (especially children) to place themselves in the role of protagonist and establish an affective relationship with the character (Painter; Martin; Unsworth, 2012).

We also analyzed the source of the attitudes according to narrative focalization theory (Bal, 2017; O'Brien, 2014). In narratology, focalization captures who sees/experiences/feels and the evaluations he/she makes (how he/she evaluates what he/she sees/experiences), which is distinguished from who tells/shows a story, always performed by the narrator. In our studies, this distinction became especially relevant because children, who are the target of the story app, tend to align with the focalizer's evaluations, receiving their attention and sympathy (Bal, 2017). We classified the focalizer according to the following categories: external focalizer, existing by omission and performed by the narrator (in the verbal mode) or the viewer (in the visual mode); internal focalizer, when it is the character who sees, in which case it is the character who feels, decides, sees, listens, observes, experiences (and not the narrator), the reader or viewer being aligned with the character; and double focalizer, when the narrator and the viewer "see with the character" (Bal, 2017, p. 144), "as if peeking over his shoulder" (Bal, 2017, p. 146). In the later, it is the character who is the actual responsible for the evaluation.

In each of our previous the studies, each episode was the analytical unit. In our studies, the results revealed that either the ideational or the interpersonal meanings are realized through verbal, visual and aural modes, allowing us to argue that the app instantiates fundamental assumptions of Multiliteracies concerning texts as essentially multimodal.

In the study reported here, we have revisited our previous findings with the following specific research question: To what extent is the app a multimodal ensemble? By answering to it, we aimed to offer our

contribution to answer to the following major research question: To what extent may the multimodal design of story apps impact the learning and teaching of Multiliteracies?

3.1 Methodology

We developed a multimodal discourse analysis (Low; Pandya, 2019) to answer the specific question. We have again assumed each narrative episode as the analytical unit, but now focusing on the identification of meaning units. We proceeded both inductively and deductively in three phases, as we describe next.

We firstly grouped the ideational and interpersonal meanings represented in the app and identified the modes – verbal, visual (static and moving image) and aural – in which they are represented. This allowed us to distinguish intermodal meanings represented by two or more modes from meanings represented by a single mode. Accordingly, we created two categories: *intermodal meaning relations*, in which case we adopted Unsworth's (2006) designation, and *monomodal meaning representations*, comprising the instances which meanings were prominently, though perhaps not exclusively (Kress, 2010), represented by a single mode.

Secondly, we classified the intermodal meaning relations. We first classified the *ideational intermodal relations* according to *convergence*, *complementarity,* and *connection*, as suggested by Unsworth (2006). *Convergence* designates the cases in which equivalent information is represented by two or more modes. It is divided into four subtypes: *redundancy* (the represented meanings are the same), *exposition* (the represented meanings have the same level of generality), *instantiation* (a mode indicates an instance/an example of an element represented by another), and *homospatiality* (co-occurrence of different modes in a homogeneous entity, for instance, when the text is integrated in the image). *Complementarity* comprises relations in which each mode contributes to the construction of the whole coherence with different meanings. We considered the two subtypes suggested by Unsworth: *amplification* (when additional and consistent meanings are represented in the different modes) and *divergence* (when opposing information in the different modes, together, generate a new meaning). *Connection* comprises relations in which the information presented by each mode is connected either by projection or conjunction (causal, temporal, or spatial).

In the categorization of *interpersonal intermodal meanings*, we used a typology comprising two categories, which we adapted from Painter, Martin and Unsworth (2012) and Unsworth (2006): *Convergence*, which occurs when there is an affinity in the meanings represented in different modes, and *complementarity*, which was also subdivided into *amplification* and *divergence*. In the analysis, two types of convergence emerged, namely *resonance* (in the representation of attitudes) and *alignment* (in the representation of sources of attitudes/ focalization).

Finally, we quantified the instances in each analytical category to obtain a finer view of the way in which the meanings were constructed in the text and the way each mode contributed to it. Our analytical grid can be found in Table 1 (see 4.2).

The analysis was performed by two of the authors independently. It involved some adjustments in our previous findings. The preliminary results were discussed by all authors, and the following analytical categories were eliminated: redundancy, connection, and homospatiality, as they were not frequent or not found in the app.

4 Findings

The analysis shows a dense interrelationship of the verbal, visual and aural modes in the representation of both ideational and interpersonal meanings. We begin by evidencing our results through the descriptive analysis of two episodes (the complete descriptive analysis of each episode can be found as Appendix), and then we present a quantitative synthesis of the findings. We chose these episodes because of the high number of ideational and interpersonal meaning units.

4.1 Two episodes, two multimodal ensembles

4.1.1 Pampas: starting the tour around Brazil

In episode 2, the protagonist starts her tour around Brazil. This is the episode in which we have identified the second highest number of ideational and interpersonal meaning units (17 – see the Appendix). The verbal text says:

(1) After turning the page, Iara was taken to vast plains and hills: The pampas welcomed her to a tour around Brazil. Southern lapwings, horses and oxen were walking in the fields...What a beautiful place to rest and drink a *chimarrão* ("mate - tea drunk from a gourd through a metal straw").

The static image shows a landscape inspired by the pampas' habitat*,* with a picnic basket in the foreground, and southern lapwings and horses represented in the background. The moving image introduces the protagonist. The reader's touch on the picnic basket activates an animation and reveals the picnic, as captured in the sequences of screen shots in Figure 1.

Figure 1 – Episode 2

Source: The story app.

The realization of ideational meanings is very intense: participants, processes and circumstances are represented through different intermodal meaning relations. There are 4 instances of intermodal exposition (e.g., the character is verbally referred and shown (visual mode); the "walking" is verbally referred and shown through the vectors formed in the animals' bodies; the "pampas" is verbally referred and shown) and 3 of intermodal instantiation (e.g., southern lapwings and horses are verbally referred, shown (visual mode) and heard (aural mode)). The amplification is the dominant intermodal relation (e.g., the visual mode (moving images) shows the opening of the basket, which displays more objects than the

verbally referred *chimarrão*). Introducing the episode, the verbal mode (monomodally) refers to the character's reading ("After turning the page") and introduces a personification ("The pampas welcomed her to a tour around Brazil").

The realization of interpersonal meanings is relatively less intense. We have identified an instance of intermodal resonance, in which the appraised geographical forms ("vast"; "beautiful place") are visually shown (in forms and colors). We have also identified two instances of complementarity as amplification, namely one in which the visual mode (facial expression in moving image) shows the character's reaction that is not verbally mentioned (joyfulness), and another in which the generic style in depicting the character amplifies the verbal naming ("Iara"). These intermodal relations, which can be found in other episodes, are all relevant in the construction of the character's positive attitudes towards what she discovers and experiences. Finally, we identified an instance of complementarity as divergence through the construction of the source of attitudes. Indeed, while the visual mode positions the viewer as observer (external focalization), the verbal mode positions the reader as character, thus constructing a different focalizer (internal focalization and double focalization).

4.1.2 Northeast: experiencing new landscapes and cultural practices

In episode 7, the character arrives at the *Nordeste* ("Northeast part of Brazil"), well known for its landscape and culture. In this episode we have identified the highest number of ideational and interpersonal meaning units (18 – see the Appendix). The verbal text says:

(2) Back to the book, she found herself on a sunny beach in the Northeast. Sports, culture, dance, and the sound of the berimbau: Iara had fun in a *roda de capoeira* ("capoeira dance")!

The static image shows a landscape inspired by the beach of *Farol da Barra,* in Salvador, the protagonist holding a berimbau and another character by her side. The reader's touch on the protagonist activates the moving image and the music, so that the protagonist starts playing the berimbau while the other character plays *capoeira*, as captured in the sequences of screen shots in Figure 2.

Figure 2 – Episode 7
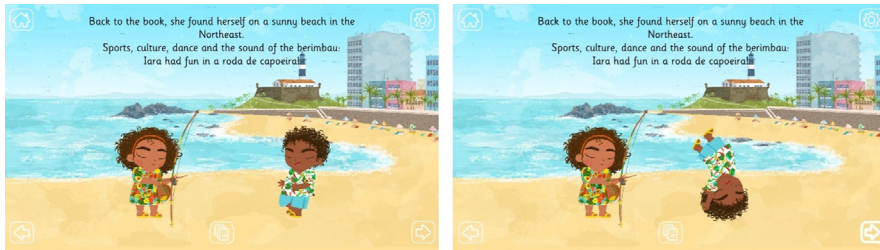
Source: The story app.

The realization of ideational meanings is again very intense: as in episode two, participants, processes and circumstances are also represented through different intermodal meaning relations. There are 2 instances of intermodal exposition (e.g., the Northeast is verbally referred and shown (visual mode)) and 3 of intermodal instantiation (e.g., a berimbau is verbally referred, illustrated (visual mode) and heard (aural mode)). The amplification is the dominant intermodal relation in the realization of ideational meanings in this episode (e.g., the aural mode introduces the sea sound, represented visually; the visual mode shows a boy in the verbally referred *roda de capoeira*). Introducing the episode, the verbal mode (monomodally) refers to the character's reading ["Back to reading"].

The realization of interpersonal meanings is again relatively less intense. We have identified an instance of intermodal resonance, in which the visual mode (facial expression) and aural mode (laughter) show the character's fun referred to in the verbal mode; 2 instances of complementarity as amplification, namely one in which the generic style in depicting the character amplifies the verbal naming of the character ('Iara'), and another in which the visual mode shows the color in the verbally referred scenery. As in episode two, these intermodal relations are relevant in the construction of the character's positive attitudes towards what she discovers and experiences. Finally, we identified another instance in the intermodal relationship of complementarity as divergence in the construction of the focalizer: While the visual mode positions the viewer as observer (external focalization), the verbal mode positions the reader as character (internal focalization and double focalization).

4.2 The story app: synthesis of results

In the 11 story episodes, we identified a total of 146 instances of ideational and interpersonal meaning units, distributed among a maximum of 18 instances (in episode 7) and a minimum of 6 (in episode 11). Table 1 summarizes the data set resulting from our analysis (See full descriptive analysis in the Appendix).

Table 1 – Summary of the analysis

Meanings	Monomodal and intermodal meaning units									
	Ideational: . processes . participants . circumstances				Interpersonal meanings . attitudes . sources of attitudes					
Modes	Two or more (Intermodal)			One	Two or more (Intermodal)				One	
Inter-modal meaning relation	Convergence		Complementarity		Convergence		Complementarity			
	Exposition	Instantiation	Amplification		Resonance	Alignment	Amplification	Divergence		
Mono-modal and inter-modal meaning relation: numbers	23	18	38		14	5	22	6	5	
	42				19		28			
	80			14	47					
	94				52					
	146									

Source: The authors.

The analysis revealed that both the representation of ideational and interpersonal meanings is dominantly realized through intermodal meaning relations (n =127) involving the verbal, the visual and (less) the aural mode. The representation of meanings in which only one mode is involved, either the verbal or the visual, is considerably lower (n=19). These results points to the complexity of the multimodal meaning representation in the story app.

The analysis further revealed that (i) there is a global equilibrium in the number of instances of complementary (n = 66) and convergence (n= 61) in the intermodal meaning relations; (ii) amplification is the most frequent intermodal meaning relation (n=60); (iii) alignment (n=5) and divergence (n=6) are the less frequent intermodal meaning relations. These results show the diversity of intermodal meaning relations that can be found in the app, revealing the processes that sustain the text's global coherence.

The analysis revealed that intermodal meaning relations are more frequent in the representation of ideational than in the interpersonal meanings, clearly pointing into the high density of 'information' about Brazil that the story app offers. The approximation in the numbers of convergence and complementary intermodal relations, noted above in general terms, is reproduced in the representation of ideational meanings (n= 42 vs 38, respectively). The analysis also reveals that most of the ideational intermodal relations represent processes and circumstances, as most of the participants in the verbal mode become circumstances in the visual mode (e.g., in episode 2, the pampas is verbally referred as a participant ["The pampas welcomed her to a tour around Brazil"] and visually shown as the context of the character's actions).

The intermodal interpersonal meanings are relatively less intense. We identified a total of 52 instances. We identified 19 instances of convergent interpersonal meaning units. Among these, 14 are convergence as resonance, involving the representation of the character's feelings or appreciations, and 5 instances are convergence as alignment in the focalizer. In the later, the verbal and visual mode align in representing external focalization in 3 episodes (namely, 1, 10, and 11); in the 2 other cases, the verbal and the visual modes represent internal focalization, positioning the viewer as character. This is the case of episode 6 (during the making of the juice) and of episode 4, which presents a big Avenue in a 360º environment. We have identified a relatively higher number of complimentary intermodal relations (than resonance) in the representation of interpersonal meanings (n= 28). Among these, there is a dominant number of amplification (n= 22) than divergence (n= 6), some of which were illustrated in the previous section. While resonance and amplification are used to represent the positive attitudes towards the represented world, affinity and divergence are used to display the sources of such attitudes. The findings per representation of meaning suggest a higher complexity in the representation of interpersonal meanings than in the ideational.

The analysis shows that the contribution of the aural mode is subsidiary in the intermodal construction of ideational and interpersonal meanings. It contributes with realistic sounds and music to both convergence and complementary ideational and interpersonal meanings. In some cases, the intermodal relation involves the verbal and the visual mode (e.g., when southern lapwings and horses (verbally referred) are illustrated (visual mode) and heard (aural mode) in episode 2); in other, just one of them (e.g., when the visual mode (static image) and the aural mode signals the sea sound in episode 7).

Finally, the analysis of monomodal representations revealed the existence of meaning units in which each mode contributes with the representation of specific meanings clearly relating to its affordances. In these cases, the verbal mode 'represents or suggests what could not be easily shown' (e.g., mental processes such as reading, understanding, and learning (episodes 2-11)); the character's reactions when she is not visually represented (episode 1); or the information about the cultural origins of the *boi-bumbá* (episode 9).

5 Discussion

In this study, we performed an extensive multimodal discourse analysis of the story app to address the following specific research question leading the analysis: To what extent is the app a multimodal ensemble? The results revealed that, in the app, the ideational meanings (informing about Brazil's cultural, historical, and geographical (bio) diversity) and the interpersonal meanings (positive feelings towards such diversity) are realized through a complex orchestration of meanings represented by the verbal, visual and aural modes, either intermodally or, less often, monomodally.

In effect, our findings, which were also illustrated in the descriptive analysis of the examples, show that the different meanings represented in the verbal, aural and visual modes add different layers of meaning – about participants, processes, circumstances; attitudes and sources of attitudes that are integrated into the meanings constructed by the other modes through different meaning processes, such as convergence (as exposition and instantiation) and complementarity (as amplification and divergence). As such, our results suggest that the story app is a full-fledge multimodal ensemble (Bezemer; Kress, 2016b; Kress,

2010). The results presented here add to former findings (Gil; Pereira; Sylla, 2023; Pereira; Gil; Sylla, 2022) in that they show that the app encompasses several modes that establish a dense net of ideational and interpersonal meaning relations among themselves. Our results converge with extant research emphasizing the multimodal nature of story apps (e.g. Hagen, 2020) but, to the best of our knowledge, they contribute to their expansion by providing a finer-grade dimension of intermodal meaning construction that can be found in story apps.

Although our conclusions are not representative, because they result from a case study, they do allow their use for theoretical discussion (see also Stake, 2000). As such, we use our findings to address the major question leading the study, namely: To what extent may the multimodal design of story apps impact the learning and teaching of Multiliteracies?, bringing to discussion some specific implications of the complex semiotic design of story apps for students and teachers' practices that might be mediated by their use.

The first implication concerns students. The acknowledgement of the complex multimodal meaning design that can be found in the analyzed story app seems to demand a specific meaning-making agency from the reader. On the one hand, the reader needs to orchestrate the different meanings that are intermodally represented to make a coherent mental representation of the text (Kress, 2010). That is to say, when reading story apps, the reader needs to make extra-layers of meaning by converging and complementing meanings, which is a (quite) different competence from that required by comprehending verbal written or oral texts, in which a single layer of meaning is involved. In addition, intermodal meaning making apparently differs in terms of the level of difficulty. For example, convergence can be assumed as 'facilitating' meaning making, because there is a continuity in the meanings represented by different modes, but complementarity is apparently more demanding, either because they involve representation of related information (amplification) and the representation of different information (divergence). The understanding of the focalizing process is a powerful illustrative example of this later form of complexity. In many episodes, the visual mode positions the viewer as an observer (external focalization) whereas the verbal mode positions the reader as character (internal focalization and double focalization), challenging the meaning maker to mentally reconcile the divergent positions in the efforts to achieve coherent meaning for

him/herself. Additionally, the app readers need to further integrate the meanings that are monomodally represented in the complex intermodal mental representation. As such, the use of story apps as didactic resources demands a renewal of the reader/student's agency, which requires a broad and flexible repertoire of text comprehension processes and an active role in the meaning-making processes. A renewed definition of fluency seems to be involved.

The second implication concerns teachers. Our results suggest that learning to make meaning from the complex semiotic design in story apps also calls for a renewed agency from the teacher in guiding students' situated meaning making mediated by the use of story apps and in the explicit teaching of multimodal meaning making through and in apps. Thus, the use of story apps seems to support the pedagogy of Multiliteracies because they provide both rich resources to support the learning of multimodal meaning making and rich opportunities for the enactment of situated and explicit learning processes (Cope; Kalantzis, 2009; Gil; Pereira; Sylla, 2023; Kalantzis; Cope, 2012; New London Group, 1996; Pereira; Gil; Sylla, 2022; Pereira; Gil; Sylla, 2023). Besides, examples as the analyzed app further emerge as potential resources to learn about diversity, as also assumed in the pedagogy of multiliteracies. These claims are aligned with Bezemer and Kress (2010, p. 26), when they argue that the semiotic design of the contemporary didactic resources needs to be "attended to and understood by all those who wish to understand contemporary environments of learning".

6 Conclusions

This article aims to contribute to the understanding of the use of interactive story apps as multimodal didactic resources for fostering multiliteracies practices. We present the multimodal discourse analysis of a story app characterizing it as a complex multimodal ensemble. Our study provides evidence on the way this complex multimodal ensemble stimulates the reader's agency and impacts the role of teachers in teaching Multiliteracies. However, the study has some limitations. As mentioned, it involves a case study, which does not allow generalizations. Further studies are needed to appreciate the adequacy of the discussed theoretical contributions and to understand the anticipated practical implications more fully. Besides, the analytical tool, which is our first analytical integrated

approximation, might also benefit from refinements (due to its density), and extensions, in order to include the study of touch in the net of intermodal meaning making. In future work, we intend to refine our analytical tool and to use it both to inform the developmert of apps, including the inquiry of the quality of the ideational representations, as well as to carry out other case studies to further validate and strengthen our findings.

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Declaration of Authorship

The first author was responsible for conceptualizing the study, drawing up the methodology and data analysis, as well as writing, revising and editing the text. The second author was co-responsible for conceptualizing the study, drawing up the methodology and data analysis, and was also responsible for writing and revising the text. The third author was co-responsible for conceptualizing the study and drawing up the methodology, and was also responsible for writing and revising the text.

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