

AUGMENTED REALITY TO ENHANCE NON- OPPOSITE REALITY AWARENESS: LEXICAL RELATIONS AMONGST PRIMARY TEACHING

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Abstract

Lexicon allows particular cosmovisions built up with varied semantic, formal and pragmatic-discursive relations (Coseriu, 1991; Teixeira, 2005). In teaching context, these variations are often replaced by dichotomous and decontextualized proposals of lexical organisation (Baptista et al., 2017). We hope changing some teaching practices, based on complex lexical relationships research, and on new didactic resources.

Firstly, we account for the diversity of existing lexical relations (Choupina et al., 2013), considering different linguistic criteria (Lehmann & Martin-Berthet, 2008). Then, we present an exploratory study to see if primary school pupils' mental lexicon is intuitively organised in a dichotomous way. Departing from three bimodal narratives where words show opposition relations, although not exclusive, within the story, sometimes oppositional relations become similarity relations. These relationships allow to group words such as word class, worldviews, sociocultural references.

Although this approach starts with antonyms and synonyms in second grade classes (according to Portuguese primary school curriculum, Buescu et al., 2015), we registered varied students' responses, reflecting a mental lexicon escaping the dichotomy of certain oppositions taught in a decontextualized way.

Thirdly, we propose an augmented reality tool that allows children (and adults) to watch visual narrative representing actions from written narratives. As a matter of fact, within particular contexts, words may not relate to each other in an opposite way. If intuitive knowledge on words isn't confined to rigid perspectives, teaching shouldn't lead that way, but to promote a critical thinking approach supporting education for citizenship.

Keywords: lexical relationships; antonymy; digital didactic resources; lexical teaching.

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Preliminary remarks

From our experience as Portuguese teachers and as primary school teachers and educators trainers in the area of Linguistics and Portuguese Didactics, and following scientific and pedagogical research, we noticed that the didactic approach of Portuguese lexical units and of semantic and morphological relations they establish defines and sometimes hinders the acquisition of scientifically correct knowledge and the development of language skills and citizenship competences in children, from very early stages. The way these contents on semantic lexical relations and on mental lexicon organisation strategies are presented in the official documents of Portuguese teaching does not always reflect the scientific advances within Linguistics and several interface areas. This was the perspective that led us to consider the various dimensions involved in the study of lexicon and of lexical relations and, consequently, to design a project that had as its ultimate goal the availability of scientifically based pedagogical material. This project involved the construction of a didactic proposal for teaching lexicon and the accomplishment of an exploratory study with primary school Portuguese pupils (to be presented in section 4), so that we may evaluate strategies of mental lexicon organisation by children and validate the didactic proposal mentioned above.

Semantic relations between words display a significant set of possibilities, involving the opposition, hierarchy, inclusion and similarity, described some decades ago within different theoretical frames, as we shall see. We will try to integrate these contributions in this article, considering the research conducted in several areas of Linguistics and which is not always reinvested in pedagogical context. In fact, in spite of the heterogeneity and complexity that characterize lexical relations, the teaching of this subject begins, at primary school, with a narrowed approach of antonymy and synonymy. This reductive approach is present not only in textbooks and school practices, but also in some auxiliary materials, partly

as a consequence of what can be found in teaching official documents in Portugal. These practices of a dichotomous and linguistically decontextualized approach to opposition relations begin implicitly in activities directed towards pre-school education, which are sometimes based upon games involving contrasts such as dominoes and puzzles. In these materials, the terms for which contrasts are requested appear decontextualized, without any clear evocation of specific contexts of possible use, certainly more significant for the target audience. On the other hand, iconic support is not always unequivocal, mainly when many children (who are the target of these products) do not yet master rules of the written code, which is likely to confine access to the referent and to its properties when only visual information is provided.

Thus, one of the first studies we carried out was the analysis of grammars and school textbooks. 409 materials (both physical and digital) were consulted and analysed, being 164 grammars and 245 textbooks. First results allowed us to notice that the greatest number of occurrences on word relationships concerns binary antonyms and synonyms (semantic relations) and word families (morphological relations). Such items are often presented in a decontextualized way, in lists or columns (Baptista, Choupina, Costa, Querido & Oliveira, 2017). This problem shows up in several didactic resources, but it is also promoted by the regulatory documents of education, namely in *Programas e Metas Curriculares de Português para o Ensino Básico* (Buescu, Morais, Rocha & Magalhães, 2015), still in force, despite the adoption of *Aprendizagens Essenciais* (DGE-MEC, 2018). The latter, however, presents a different scenario, having incorporated some suggestions that we, as teacher trainers, included in a formal opinion to the Direção-Geral de Educação (DGE) during public consultation. We valued a reference to multiple relationships between words, within a complexity we will approach later on this article, by collecting information from an interdisciplinary research in the field of Linguistics.

We therefore assume that there is a need for the elaboration of didactic materials that contextualize the lexical items in multiple relations, not in binary opposites. It was under this alternative perspective that we carried on our research, in order to make lexicon available within a context of a narrative, with a syntagmatic complexity, rather than in lists, tables or columns, unrelated to the semantic and the morphosyntactic context which a statement or a text, namely narrative, provide.

The project *Língua e Cidadania: das relações entre palavras ao conhecimento do mundo*

The results and the pedagogical materials presented in this article are the outcome of a research project called *Língua e Cidadania: das relações entre palavras ao conhecimento do mundo* [Language and citizenship: from lexical relationships to world knowledge] (Referência: LIN/145558/2016), which has been financed by the Programa Gulbenkian 2016, in the area of *Projetos de Investigação em Estudos Avançados em Língua e Cultura Portuguesas*, from Calouste Gulbenkian Foundation. The research team gathers researchers from two schools of the Polytechnic of Porto and from Minho University¹.

The starting point for this project was the concept of the word family and its indefinite borders with the concepts of semantic field and lexical field, given that these are contents and / or forms of lexicon organisation explicitly addressed at primary school (Buescu *et al.*, 2015) and often raise questions for teachers and students. Thus, in Choupina, Baptista and Costa (2013), we have tackled some problems related to the word family concept and its possible association with semantic lexical relations. In a dialogue between Linguistics, Applied Linguistics and Historical Linguistics, we have tried to combine synchronic and diachronic information and to

reflect on the implications that those contributions may bring to the teaching of Portuguese.

With the publication of *Metas Curriculares de Português* (Buescu *et al.*, 2012) and subsequently *Programa e Metas Curriculares de Português* (Buescu *et al.*, 2015), there was a greater need to specify some concepts such as antonyms, meronyms and hyperonyms, either because of their importance in the structuring of lexical information (within the mental lexicon) or because of the role they play in the development of world conceptions and in behavior and / or thoughts in citizenship. This search for the specification of these concepts and the defense of a didactic approach to semantic relations focused on multiple relations, to the detriment of binary antonyms and synonyms, were the pillars that guided our analysis of the documents in public discussion entitled *Aprendizagens Essenciais do Português* (DGE-MEC, 2018), from the 1st to the 6th school grades (see the formal opinion written by Morgado, Baptista, Costa, Querido & Oliveira, 2018).

The research aims within the project are the following:

- i) to analyse the linguistic and pedagogical dimensions of lexical relationships, addressing semantic, morphological and etymological relations, by considering the interaction between lexicon, culture and citizenship.
- ii) to realize how mental lexicon interferes with world(s) cognitive processing and with people interactions with objects that are part of these real or fictional worlds.
- iii) to reduce dichotomous thinking and fixed social representations, through teachers and educators growth of self-consciousness.
- iv) to promote the awareness of how early manipulation of meronyms and hyponyms has cognitive benefits.

¹ Research team: Adriana Baptista (director), João Azevedo and Luís Leite, teachers from *Escola Superior de Média Artes e Design* from *Politécnico do Porto*, Celda Morgado, Inês Oliveira, José António Costa and Joana Querido, from *Escola Superior de Educação* of the same Polytechnic, and Iolanda Ribeiro, teacher and researcher at *Universidade do Minho*.

In order to accomplish these goals, we decided to identify strategies present in textbooks and other teaching material as far as antonyms approach is concerned; and to analyse the Portuguese curriculum to see how and when lexical relations show up. We therefore collected some useful information to reinvest on the exploratory study and the didactic proposal we will be presenting in section 4.

These are some of the conclusions and the outcomes of this project so far. We will move further with a theoretical reflection on lexical relations, mainly as far as opposition and antonymy are concerned.

Semantic relations of opposition: a brief theoretical reflection

As we have already stated in other works within the scope of this project (Baptista et al., 2017; 2018; 2019), oppositeness is a crucial notion to deal with, as it helps to clarify different types of semantic relations other than antonymy. Two synonyms, for instance, have several traits in common, but they differ at least in one. The same goes for hyponyms, which share a common root with their hyperonym, but lay on some specificities that distinguish them.

When contrasting two or more words or semantic features, opposition is closely related to antonymy. Some authors see them as equivalent terms (Vilela, 1994, Gagné, 2015), although the latter could be used in a narrower sense, while others (Coseriu, 1991; Gutierrez-Ordoñez, 1996; Cruse, 2001) use antonymy as a subtype of opposition, which is a *broad band* term.

In order to *grasp* the (sometimes slight) differences between opposite words and to distinguish what needs to be distinguished, we tried to summarize their types and subtypes (see Baptista et al., 2018) within a proposal inspired by some seminal works (Lyons, 1977; Coseriu, 1991) and other summaries

by Ostrá (1987), Vilela (1994), Gutierrez-Ordoñez (1996), Cruse (2001) and Gagné (2015). To build up this proposal, we combined semantic, morphological, syntactic, pragmatic and cognitive criteria, in order to analyse the opposite words in real use contexts and to discover some particularities that may be hidden under a decontextualized approach.

Even when the same term is used with different meanings or scopes (such as *antonymy* in the second paragraph), all the opposites may be placed in two major groups: binary and non-binary opposites. Binary opposites are contradictory, since the affirmation of one term implies the negation of the other one and vice-versa: if someone is *present*, it means that it is *not absent* and if someone is *absent*, it means that it is *not present*. Non-binary contrasts are contrary, as to state one of them implies to deny another one, but not the other way around: if someone is *tall*, s/he is *not small*; but if s/he is *not small*, that does not mean s/he is *tall*. This explanation, inspired by the Aristotelian Logic, leads to a linguistic criterium that distinguishes the two main groups: binary opposites are ungradable, while non-binary ones are gradable. As we will see later, under certain pragmatic circumstances, even binary opposites may be graduated.

We will now take a deeper look inside each one of the two groups. In the binary group, there are five types: complementary, privative, equipollent, converse (or symmetric) and directional.

The idea of complementarity underlies the first three subtypes, being *dead/alive* (**complementary**), *usual/unusual* (**privative**) and *male/female* (**equipollent**) examples for each one of them. The first one is a typical pair, the second one depends on the presence or absence of a certain feature, morphologically marked in this case (with prefixes such as *un-*, *in-*, *a-*, *non-*) as a sign of grammaticalization (Lyons, 1977), and the equipollent opposites imply a particular trace acting differently in both items of the pair. Private and equipollent

opposites may be discarded in certain contexts. It is possible to contrast *public*, *semi-public* and *private* (graduation), as it is also likely to find other categories between *male* and *female* these days, which enhances the importance of pragmatic and discursive criteria to better analyse lexical relations. The two last subtypes deal with a certain perspective. **Converse opposites** concern the same relation under two different perspectives, as in *father/son*, *sell/buy*, within a 2 or 3-place relation. **Directional opposites** concern movement (*enter/leave*) and again perspective (in this case, the point of perspective) is crucial, because we are talking about the same action seen from different points: when migrants are considered (see narratives in section 4), for instance, we say that they *enter* our country (immigrants), while someone in the country they abandon may say they are *leaving* this country (emigrants).

Binary types are far more diversified than non-binary ones, following this general tendency in languages. Non-binary opposites involve **true antonyms**, but also two other categories: **ordering and ranking**; and **cycles**. Members of these two groups are often equipollent because each one of them has the same statute. In *ordering and ranking*, we find examples such as colours (*blue*, *red*, *green*), a case where language makes discrete something that in reality falls into a *continuum*; and ordinals like *first*, *second*... *Cycles* concern days of the week or seasons.

True antonyms are contraries, because there is no a mutual implication between them, but not all the contraries are usually seen as antonyms (*tree/dog*). This group is formed by adjectives that can be modified (*taller*, *less interesting*, *biggest*) and are most of the times morphologically unrelated (*tall/short*, *big/small*), which means that there is several terms allowed in the same sequence (*huge*, *tall*, *short*, *tiny*...), a linguistic feature that should be taught in the classroom from the very beginning, in order not to make some confusions with complementary opposites.

Cruse (2001) relates true antonyms and the fact they are gradable with a *subjectification* movement, because one or two items of a certain pair may involve a commitment to what is being asserted and therefore it involves the speaker's point of view. Lyons (1977) tries to explain this situation by recalling that "gradable opposites manifest the property of polarity more strikingly than do other opposites" (Lyons, 1977, p. 279). They seem to follow a process of lexicalisation that strengthens the opposition between the two morphologically unrelated terms. The *good/bad* pair suggests a more intense polarisation than *good/not good*, which helps us understand why dichotomisation appears so often in teaching practices concerning antonymy. According to Lyons, this is probably due to a conversational implicature: if it is not good, then it is bad.

To sum up what has been said, we may assume the existence of two main groups of opposite relations:

- i) Binary: complementary, private, equipollent, converse, directional
- ii) Non-binary: true antonyms; ordering and ranking; cycles

When trying to define antonymy, it is useful to consider different linguistic criteria, that may "be lexical as well as semantic" (Gao & Zheng, 2014, p. 235), but also from a different origin, as stated by José Teixeira, when he considers that we are dealing with a relation that "doesn't rely on logical and complex mechanisms, but rather on cognitive and therefore *basic* ones" (Teixeira, 2005, p. 23). That's how we can understand some linguistic particularities along several synchronies. For instance, in Latin, the idea of *old/not old* follows equipollent oppositions inside each pair of the following sequence: *senex*, *vetulus*, *vetus* vs *iuvenis*, *novellus*, *novus* being related to people, animals or non-animates. This distinction is not present the same way in modern English, but there is still a difference between *young* and *new*.

After having considered the complexity behind semantic relations, specifically behind opposite relations, we will now present the exploratory study we undertook in four second grade Portuguese classes, as a part of our project concerning teaching multiple lexical relations at primary school, with appropriate strategies and resources.

Didactical proposal for teaching multiple lexical relations at primary school

Bearing in mind that teaching lexical relations deals with the contributions of several areas, as we have already seen, we decided to undergo a three-step didactical proposal, allowing us to get to know a bit more of how children structure their mental lexicon and, therefore, which are the possible and suitable ways to teach them semantic word relations. As these strategies involve a different approach, we valued words within a real context of use, rather than a decontextualized presentation. So, during our experiment, we needed to have both a control and an experimental group: the first one had to do some tasks with words listed according to different criteria; the second one had the same list, but was also put in contact with three bimodal narratives (containing these words) that provided a real and meaningful context of word use.

The bimodal narratives: *Pensar muito com poucas palavras* (Baptista & Fernandes, 2017)

As we have already explained, the three narratives (text by Adriana Baptista) were created in order to provide a context of use to the words pupils would have to deal with, considering different semantic areas that may be familiar to second grade pupils. The narratives' general title *Pensar muito com poucas palavras* [To think a lot with few words] suggests already that we want to foster pupils' reflection about language and about the complexity behind lexical relations.

Each of the narratives was thought and constructed around distinct semantic areas. As we can tell from the items within each lexical field (see Figure 1), there was, in each narrative, a sequence that aggregated the words intended to be placed in contexts of occurrence displaying multiple semantic relationships, thus inhibiting an exclusively antonymic interpretation and therefore a binary opposite relation. This happens because specific situations in which words occur have been suggested in all the narratives: in the first one, the common seme is "age"; in the second one, it is "aesthetics," and in the third one, words are related by the semes "location" and "movement".

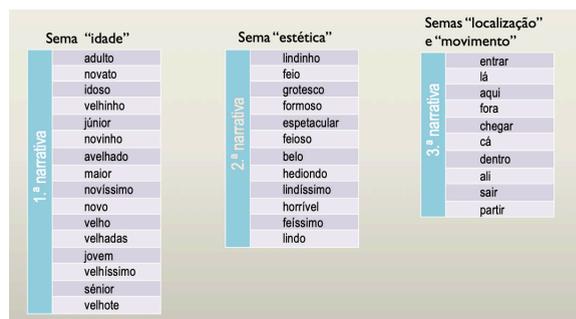


Fig. 1 Lexical fields behind the three narratives

We then ask Nicolau Fernandes to illustrate these narratives, which made them bimodal narratives. The illustration was intended to broaden the strategies pupils may use when thinking and trying to mentally organise the words within a rhizomatic association. Moreover, it was also our aim to continue to raise the diversity of contexts of their occurrence already promoted by the verbal text. Thus, the visual text takes advantage of the semantic plasticity of the lexical items, expanding the concepts and the multiples relations of similarity and / or opposition that can be established between words that are illusorily taken, in the teaching area, as pairs of opposites likely to illustrate contrary real situations.

In the first narrative, for instance, the “age” seme was the motto to question many dichotomous oppositions that arise in didactic resources (see Baptista, Choupina, Costa, Querido, & Oliveira, 2017), such as *novo/velho* (*young/old*), since the idea of *old* depends, most of the times, upon different criteria such as age, spirit, health problems... Besides, we may oppose old to very old, young, childish and many other words. Here is an excerpt from the first narrative:

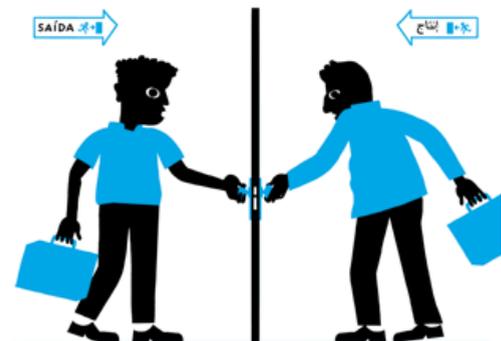
Às vezes, parece que, por delicadeza, não se deve usar a palavra *velho*, a não ser quando se quer dizer de alguma coisa que já não está em condições de ser usada, mas, se assim fosse, não se podia nunca utilizar *velho* para as pessoas.

Ao Rui não lhe parece mal dizer que é *novo* ou *jovem*, que a Rita é *jovem* ou *crescida*, que o pai é *adulto* e que o avô já é *velho*

A mãe não gosta que ele diga que o avô Afonso é *velho*. Está sempre a dizer que o avô é um *velhinho* muito *jovem* e o Rui percebe que ele não é como certos *velhinhos* que estão muito doentes e não se mexem.

Adriana Baptista,
Pensar muito com poucas palavras...(excerto)

In the third narrative, we consider traditional pairs such as *entrar/sair* (*to go in, to go out*) or *cá/lá* (*here/there*), whose interpretation depends upon a physical perspective, in a way that the same action may be seen as *to go in* or *to go out*, according to where we are. When we go inside a place, we come out of another one at the same time. Here is an excerpt from the third narrative:



Parece-nos que os países, como as casas, têm um lado de dentro e um lado de fora, mas o lado de dentro de um país é o lado de fora do outro.

Aqui, a mãe do Rui teve que ajudar a Rita e explicou que a ação de *entrar* e *sair* é fisicamente a mesma, mas normalmente pensamos que alguém está a entrar num país quando essa pessoa se aproxima de nós e que está a sair quando se afasta de nós.

As próprias pessoas quando só pensam em fugir, dizem que saíram, mas quando acalmam por já terem saído dizem que entraram.

Parece-nos que os países, como as casas, têm um lado de *dentro* e um lado de *fora*, mas o lado de dentro de um país é o lado de fora do outro.

Adriana Baptista,
Pensar muito com poucas palavras...(excerto)

Exploratory study

In order to understand how children intuitively organize words and how they structure and relate them linguistically, we develop an exploratory study, trying to answer two main questions: *Do children tend to structure their mental lexicon in a dichotomous way?* and *Do children tend to organize their mental lexicon only with opposite items?* The first question could be answered by a thorough analysis of the strategies used to register some words in different diagrammatic spaces. The second one involves the criteria behind the way words are grouped into different sets.

In this study, four second grade Portuguese primary school classes participated, organized in two working groups. In one group, children were given the basic words used in the construction of the narratives (cf. lexical fields presented in Figure 1) decontextualized and in a list, without any contact with the narratives. To another group of children were given the same out-of-context and listed words; however, they were exposed to the bimodal narratives presented above, through a data show to watch the images while listening to

the researcher reading narratives aloud. During the reading, children were asked some questions about the content of the narratives and the contextual meaning of some words, prior to the accomplishment of the given tasks.

The task for both groups of children consisted in arranging the words of each lexical field in a given diagrammatic space (Figure 2), according to three different graphic strategies: [1] two bags; [2] ten sets of hangers with two ends each; [3] a staircase with several steps.

The bags and the hangers were used in each of the three stories, while the staircase was only used in the first and the second ones because there were no gradable words in the third one.

Firstly, we will take a look at how these diagrams are filled in. Children follow different graphic strategies, arranging the words of the lexical fields in very different ways, besides placing a variable number of words in each space, regardless of having been previously exposed to our didactic path. As we

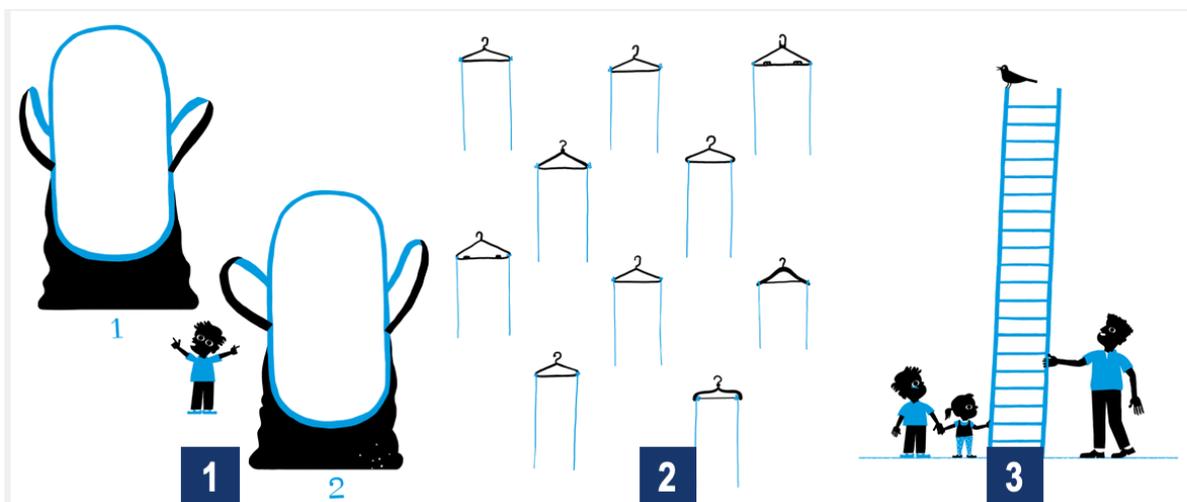


Fig. 2 Diagrammatic strategies available for pupils to write down the given words (source: Baptista et al., 2019)

may see in Figure 3 (representing the two-bag diagram), even pupils who have never been in contact with the narratives write down the words according to different strategies: they don't intuitively distribute the words in pairs, nor do they put the same number of words in each bag.

In Figures 4 and 5, we present examples of the task resolution with words in the hangers and the two bags. These children have been listening to the narratives (and watching the illustrations) and have participated in the comprehension session afterwards, which gave them the opportunity to reflect on words contextualized uses.

In Figure 4, we may see that children register a variable number of words in the hangers and in different places: in [1] they only fill in three hangers (one with four words, one with three and one with two); in [2] they use five hangers (all with two words); in [3] they place words on seven hangers, leaving the first and the second blank (five hangers with one word, one with four words and one with three); only in [1] the words are placed at the hangers' ends.

In Figure 5, we also observe a great variety in the use of the graphic space available to the child and in the number of words registered: in [1], the child fills both bags; however, bag 1 has a greater number of words; in [2], the child leaves the bag 2 blank, placing words in and out of bag 1; in [3], the child fills both bags (with the highest number of words in bag 1) and gives a justification of his/her choice out of the bags below.

Taking into account the data above, we may assume that children don't always organise their mental lexicon in a dichotomous way, following other strategies that may be more helpful. There seems to be a greater diversity of spatial management strategies and a greater number of words in the groups formed by children whose stimuli were presented linguistically contextualized, listening to verbal narratives, observing illustrations and participating in reading comprehension and lexical reflection sessions.

As far as grouping strategies are concerned, we still don't have final results, but a first look at the available data allows us to assume that there were different linguistic criteria

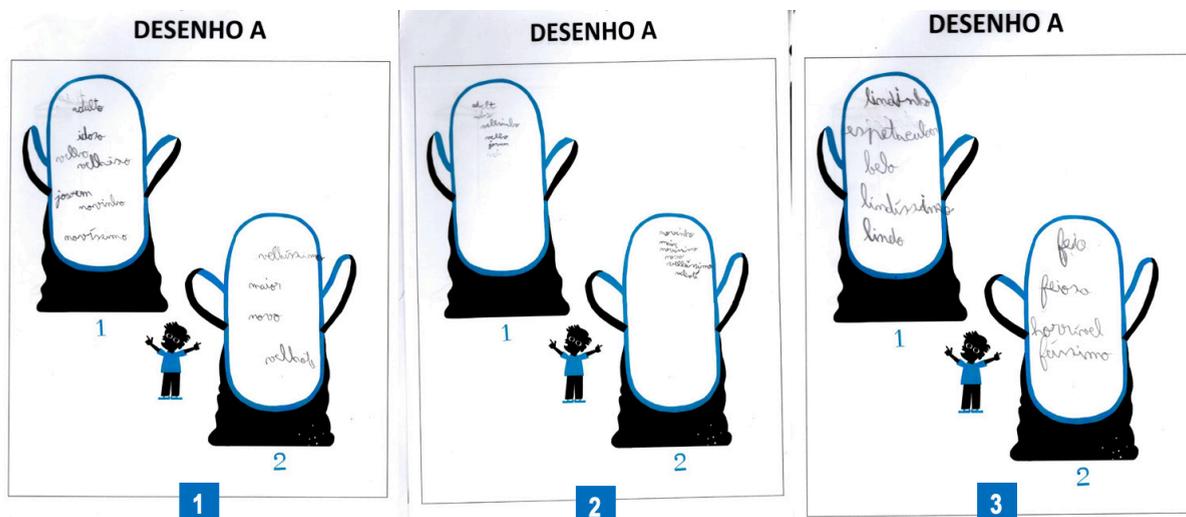


Fig. 3 Examples of the way children registered the words in the two-bag diagram (source: Baptista et al., 2019)

behind each option, which is coherent with what we know about lexical relations and the role of morphology, syntax, semantics, pragmatics and cognition in characterizing them.

Some children grouped words under the same morphological basis and the same *advanced age* (**velho** [old], **velhote** [old man], **velhíssimo** [very old]). Other pupils put together words sharing the same suffix, as in **novíssimo** [very young] and **velhíssimo**, or the same word classes (verbs like *entrar*, *sair*, *ir* [enter, leave, go] and adverbs like *aqui*, *cá* [here]). When having to grade words, for instance, the items *maior* [major] and *adulto* [adult] appear either in a group containing words associated with lower age or in a group linked to more advanced ages, but, in the staircase exercise, they consistently occupy the intermediate places of transition between the *new* and the *old*.

These are the first results of our exploratory study, pointing out that children don't always think dichotomously (question 1) and don't mentally organise words within an opposite perspective

all the time (question 2). However, further data processing will be necessary in order to draw more accurate conclusions.

The augmented reality application

After this exploratory study, we moved on with our didactical proposal by adding another important element within a multi-sensory approach (Arslan, 2009) that values the combination of different stimuli in order to promote learning. The bimodal narratives were then supported by multimedia strategies. To that end, we are using an application for mobile devices that, through the use of augmented reality (AR), becomes capable of enhancing children's thinking about the multiple associative relationships that the lexicon authorizes. An augmented reality environment "allows the user to see the real world with virtual computer-generated objects superimposed or merged with real surroundings" (Martín-Gutierrez, Fabiani, Benesova, Meneses & Mora, 2015, p. 753), which may help users to link the real and the virtual worlds in a more significant way. That

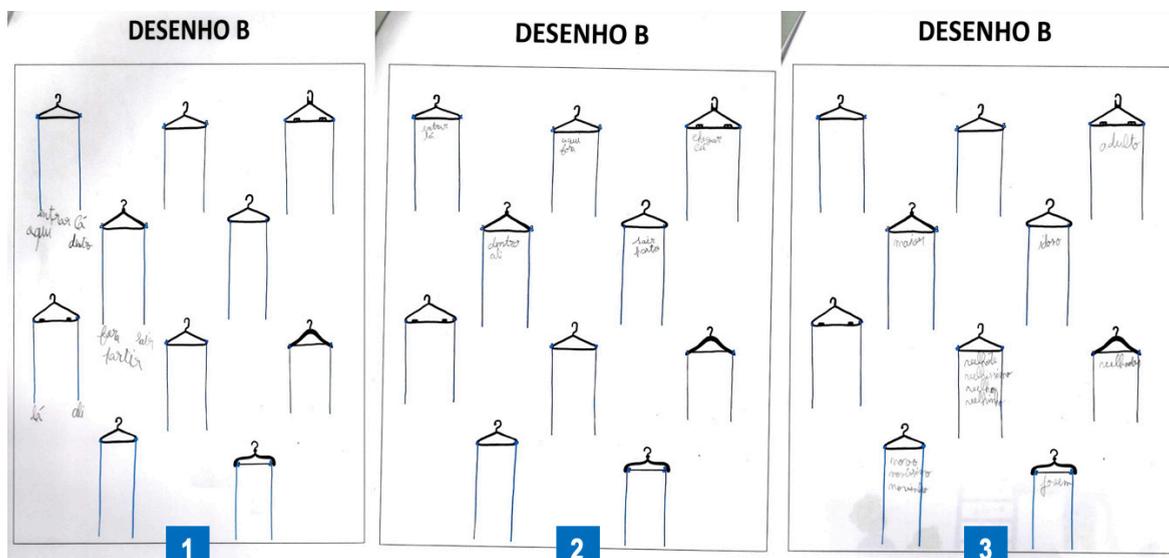


Fig. 4 Graphic strategies children followed to organize the words in the hangers (source: Baptista et al., 2019)

is precisely our aim when bringing to classes three narratives that could replicate everyday life dialogues.

The use of AR devices is widely spread in several areas, including education and language teaching (mainly second language teaching), as it allows the user to keep in touch with the real world while contacting with a virtual environment at the same time (Godwin-Jones, 2016). Competences enhanced within this approach relate not only to more specific abilities in several subjects, but also to transversal competences, such as instrumental (analysis and synthesis skills, planning and organisation skills, solving problems, managing information), personal (collaborative work and critical reasoning, autonomous learning, *social interactivity*, enabling interaction and collaborative learning, and initiative) and the skill to apply theoretical knowledge to practical situations (Bonner & Reinders, 2018; Martín-Gutiérrez et al., 2015).

Moreover, we may find in AR applications an opportunity to diversify teaching methodologies, since they provide "rich contextual learning for individuals" (Arvanitis, 2012, p. 2771) and engage the learner, that will be able to acquire some information in his own personal way. When this happens,

teachers may "provide scaffolding and support experiential learning" (Bonner & Reinders, 2018, p. 37) to their students, by using a device that offers "context sensitivity (they adapt to their location, for example by displaying content in a different language)" (Bonner & Reinders, 2018, p. 37).

Many researchers have been trying to find support for the use of AR devices in different theoretical frameworks. Bitter and Corral (2014) recall some principles of the Cognitive Information Processing Theory and of the Dual Coding Theory to entail an improvement on how memory works and a cognitive mental load with benefits as far as the learning process is concerned. Arvanitis (2012) defends that it is possible, from a constructivist point of view, to create situations "where students take control of their own learning [which] provides opportunities for more authentic learning and appeals to multiple learning styles" (Arvanitis, 2012, p. 2771). We may also admit some benefits within an experiential communicative approach (Fernández-Corbacho, 2014), since students are sometimes involved in collaborative tasks, having to face situations inspired in the real world and in their own experiences.

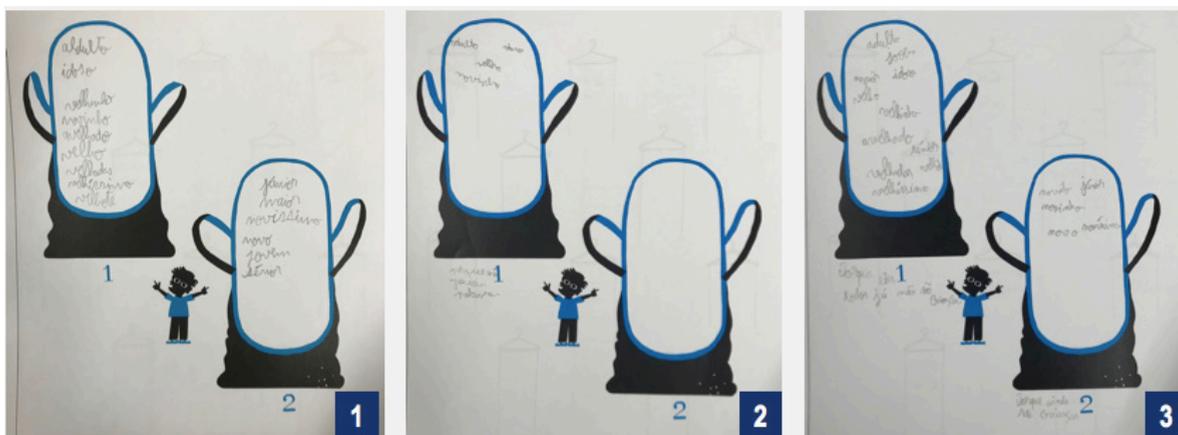


Fig. 5 Graphic strategies children followed to organize the words in the bags (source: Baptista et al., 2018)

In language teaching and learning fields, some work has already been done (Arvanitis, 2012; Godwin-Jones, 2016), with sets of linguistic task based activities and different pedagogical scenarios, that put students in contact with linguistic structures used, for instance, to describe a city, to tell an event or to participate in conversations. This kind of procedure were mobilised in our work with second grade Portuguese pupils and may occur when using the AR device which we are proposing.

The device allows the use of strategies that are by no means limited to simply expanding, animating, or chromatically transmuting fixed illustration. What is really intended is that the AR makes it possible to make the cognitive complexity of lexical antonyms obvious by manipulating the image so that it exhibits associative relations of the word and the possibility of occurrence of distinct words in the same context and for the same view (or not) of different perspectives. To use this application, one simply has to point the camera of the device to the illustrations (see Fig. 6).

Illustrations work as fiducial markers and as soon as the main references of the image are recognised, virtual images with movement immediately appear on the screen, which, overlapping the fixed illustrations, make it possible to enhance the visual reading to more than a duplication of the verbal text. This makes it possible to think of each word with more than one meaning and, at the same time, illustrates its semantic plasticity, which makes it possible to be used in different contexts (similarity, opposition, inclusion or hierarchy), in their multiple relations with other words, by a quick understanding and appropriation in associative networks.

Acting this way, we are able "to add a narrative to the learning experience, in which the learner must accomplish goals by increasing skills in the subject-matter" (Bitter & Corral, 2014, p. 14), so that this may become a gamified experience (Foncubierta & Rodríguez, 2015), involving children and making them learn in a meaningful way. On the other hand, this product promotes the visualisation of situations (fixed and moving) in which the semantic complexity of the lexicon, in linguistic and situational context (real and imaginary), becomes visible beyond what is thinkable.

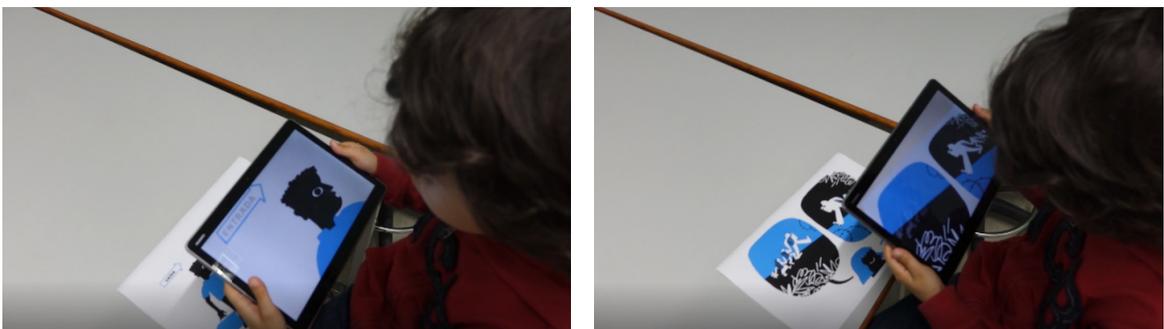


Fig. 6 Examples of use of the Augmented Reality application by means of a tablet in two of the illustrations: in [1], the word *saída*, present in the fixed illustration, is transmuted into *entrada* in the Augmented Reality illustration, with nothing in the fixed illustration that changes or seems paradoxical; in [2], characters present in the fixed image are elided in the image of Augmented Reality so that it is perceived that the pair of words *entrar* and *sair* conform to the same action seen from different perspectives and not to two antagonistic situations, requiring the use of different words.

Final remarks

Lexical relations are complex and change throughout the times, being pragmatic “the chief driving force in processes of regular semantic change” (Traugott & Dasher, 2005, p. 24), because “the context-dependency of abstract structural meaning allows for change in the situation of use, most particularly the speaker’s role in strategizing this dynamic use” (Traugott & Dasher, 2005, p. 24). It is therefore important that teaching practices encompass this changing process, by adjusting strategies and resources to what is more suitable to the students.

We can only reach this level of pedagogical adjustment if scientific knowledge is present and helps us building meaningful and sustained didactic paths. It is therefore important to promote lexical relationships heterogeneity awareness through contextualized and scientifically sustained didactic proposals, considering lexicon uses as a full exercise of pro-active citizenship. As Ullmann stated, “words are surrounded by a net of relations that connect them to other words” (Ullmann, 1964, p. 476). Lexical relationships complexity is not compatible with a lexical-semantic perspective confined to study synonyms and antonyms by themselves and out of their use context, as we see in many pedagogical practices.

We need to address multiple lexical relations as a more suitable notion to explore in teaching fields, by means of approaches that value the learning process and promote the 21st skills. To diversify teaching methodologies and to use meaningful didactic resources is the way to contribute to a more effective language teaching process, provided that contributions from several areas of research are taken into account.

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