Universal Access in the Information Society
https://doi.org/10.1007/s10209-023-01031-9

LONG PAPER

Bridging the gap between website accessibility and lexicography: information access in online dictionaries

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Accepted: 25 July 2023

Abstract
Information access has been one of the main concerns of lexicography since the first dictionaries were compiled. This paper draws an explicit link between the proposals made from the fields of applied linguistics and website accessibility to enhance the users' experience in consulting online dictionaries. The paper starts with a reflection on two intertwined notions that are relevant for the discussion: Access and accessibility. After that, it focuses on elements connected to two Web Content Accessibility Guidelines principles, namely perceivability and understandability. It reflects on real practices regarding the way in which information is structured in today's dictionaries, the use of text alternatives, typographic choice, the writing of definitions, and the use of abbreviations, and proposes measures to tackle the identified challenges. The implementation of easy-to-understand language is highlighted as a relevant resource for prospective lexicographic projects.

Keywords Website accessibility · Lexicography · Online dictionaries · Information access · Understandability · Perceivability · WCAG principles · Easy-to-understand content

1 Introduction

Online dictionaries and encyclopaedias are a pervasive resource for linguistic information. They are important tools for language learning and for professional development in a global context in which communication skills are largely demanded in a wide variety of careers. Dictionaries also support entertainment—in the case of the Catalan language, an increase in dictionary consultation triggered by the recent popularity of game applications such as *Wordle* or *Paraulògic* has been reported [1]. Online dictionaries have practically replaced traditional, printed dictionaries, and this has led to a radical change in the way in which we interact with dictionaries. While the latter had even been conceived as "objects of contemplation", websites are more "utilitarian" and "users will only pay attention to [them] for a limited amount of time" [2]. This idea seems to be supported by the latest data on patterns of dictionary use online, according to which most users spend from two to five minutes on this kind of sites when looking up information [3].

These data on online dictionary use are not enough for researchers to know whether linguistic information is *found* by the users visiting these websites, that is, whether the dictionary is serving its informative purpose. They are, however, telling about the interest in exploring how the linguistic information contained in dictionaries may be presented and made readily available to facilitate a fast, effective access to users who do not want to spend longer than five minutes looking up information. From an accessibility perspective, this includes users with diverse profiles and needs.

In this context, this paper offers a reflection on website accessibility and dictionary use that draws an explicit link between two intertwined notions belonging to the specialised fields of lexicography and accessibility studies: Access and accessibility. As will be explained in Sect. 2, these concepts have been used differently in these two areas of specialisation, but there is a vast ground in which they overlap. After the theoretical introduction, the article goes on to describe current practices in dictionary making. For this purpose, the websites of six relevant dictionaries in English and Spanish are considered, as summarised in Table 1.

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Published online: 16 September 2023

Table 1 Dictionaries used to illustrate accessibility features in this paper

Dictionary	Publisher	Link to website
Cambridge English Dictionary	Cambridge University Press	<https://dictionary.cambridge.org/dictionary/english/>
Diccionario de la lengua española	Spanish Royal Academy	<https://dle.rae.es/>
Diccionario fácil	Plena Inclusión Madrid	<http://diccionariofacil.org/>
Macmillan English Dictionary	Macmillan Education Limited	<https://www.macmillandictionary.com/>
Merriam-Webster	Merriam-Webster, Inc	<https://www.merriam-webster.com/>
Oxford Learner's Dictionary	Oxford University Press	<https://www.oxfordlearnersdictionaries.com/>

Automatic web accessibility tests were run on these online dictionaries using the AccessibilityChecker tool[1] in June 2022—the results of the tests related to the accessibility features under analysis are integrated in the discussion.

Beyond the descriptive analysis of these sources, this paper aims to make practical proposals that could be implemented in prospective lexicographic works (or in the ones already available) to enhance two of the main principles of web accessibility design: Perceivability and understandability.

2 Access and accessibility in dictionaries

When referring to texts, webpages and any kind of content documents, access and accessibility are terms that in a broad sense allude to the ability of users to retrieve information. In a more restricted technical sense, however, these terms are used differently in meta-lexicography and in accessibility studies. On the one hand, lexicography accessibility is concerned with the path users follow to find the information they are looking up in dictionaries [15, 16, 36, 54]. Dictionaries distribute information about lexical units in an extensive list of articles, which in turn are internally structured in different sections. Signposts or other types of marks are used to guide users to the most suitable articles and sections to retrieve the needed data. The way in which information is structured and any guiding elements act in the service of access to information. Accessibility is, thus, a property of dictionaries whereby information is arranged and structured in such a way that it can be accessed.

On the other hand, accessibility studies are concerned with catering for diverse users' needs so that equal access to any kind of resources (be it drinking water, transportation, or information) is achieved. Accessibility studies analyse how access must be designed to guarantee that any person—and crucially persons with disabilities or those belonging to social minorities—reaches such a resource, regardless of their personal features [4]. From the perspective of accessibility studies, thus making dictionaries accessible means granting equal opportunities to access lexical information for any potential user.

There is extensive literature on information access regarding dictionaries and in accessibility studies. However, there are no scientific works—to the best of our knowledge—which analyse the extent to which the decisions made by lexicographers to allow effective information access in online dictionaries are designed by taking website accessibility standards into consideration. This paper is a first step in this direction.

Dictionaries are contents of knowledge [5] the main feature of which is that information is not presented linearly but segmented and spread in atomised items. To enable users to meet their linguistic information needs, data must be both ordered and structured [6]. Consequently, dictionaries have a complex structure, with several kinds of subjacent interrelated structures [7]. Two main structures contribute to the ordering of information in dictionaries: Macrostructure and microstructure.

Macrostructure is the internal structure of the list of lemmas included in the dictionary [8]. Prototypically, the macrostructure of general dictionaries consists of an alphabetically ordered list of words, where each word is the lemma heading a dictionary article. Macrostructure provides both a structural principle—information is presented associated with lemmas—and an ordering principle—prototypically alphabetical order, but also systematic order in some specialised dictionaries. In most cases, dictionary entries include subentries headed by sublemmas, because some lexical units such as compounds or idioms do not constitute dictionary entries by themselves. In those cases, dictionaries have a complex macrostructure, with a principal word list for lemmas and a nested macrostructure for sublemmas.

Microstructure, in turn, is the internal structure of dictionary articles [9]. Dictionaries offer a large amount of information about lemmas, such as part of speech, register, sense explanations, examples, or etymology, among many others. To structure this information, articles are divided into fields, each one containing a particular type of information. Therefore, as a structuring element microstructure is based on a previously established categorisation of the different types of information that a dictionary would offer, and

[1] <www.accessibilitychecker.org>.

an abstract schema for articles to accommodate this varied information and present it consistently.

The purpose of macro and microstructure is, thus, to structure and order information. To enable the user to access this structured information, a third kind of structure is needed, namely access structure [10]. In terms of Nielsen, "access structure may be explained as the structure of the lexicographical indicators directing the user to the information required" [6]. Thus, heading words at the top of the page in printed dictionaries are part of the access structure, as well as numbers, colours, or typographical marks inside articles, in that their function is to guide users to help them to find information. Access structure, in turn, may be divided in two substructures [11]: Outer and inner access structures. Outer access structure consists of the set of indicators to allow users to navigate through the macrostructure to find the lemma under which they can find the information looked up; inner access structure comprises the indicators to guide user's queries inside articles to the right section of the dictionary entry.

In printed dictionaries, outer access structure is typically the straight-alphabetical order, which operates top-down on the page or text column [10]. Additionally, it may be reinforced by other marks or devices to guide user's queries, the most common of them being running lemmas at the top of the page, colour pages to identify different parts of the dictionary, flaps to indicate the beginning of letter sections, and indexes. In electronic dictionaries, in contrast, "users typically don't see an ordered lemma stretch when consulting [them]" [12], so that access structure is improved with rapid access devices [13]. The most usual device is a text input box. These boxes present different possibilities to make queries easier. On the one hand, lemma searches may be supported by different means. First, predictable text may be used, so that while the user introduces the text, a list of lemmas beginning by the segment of text introduced in the box is displayed. Second, approximate searches may be provided, which is especially useful to find lemmas when the introduced text has typographical or orthographic mistakes. Third, advanced searches such as "begin with," "end with," or "contain" may be used. Finally, intermediate results may be provided, in such a way that a short list of lemmas, which satisfy the query is provided, for the user to select the correct article among them. On the other hand, in advanced searches the text in the text box may be searched inside the articles, in some selected sections such as definitions or examples, not only in the list of lemmas. Moreover, in electronic dictionaries, a rich cross-reference structure is usually offered by means of links, through which users can navigate across articles.

Inner access structure, in turn, is codified in dictionary entries. Dictionary entries contain two types of text: information about the lemma and indicators [9]. Indicators are guiding elements to identify the sections in which the article is divided. They comprise numbers and letters to identify senses and subsenses, typographical variation to identify types of information—e.g. italics to signal examples, or boldface to highlight grammatical implicit information, text arrangement to identify sections of the article, a great diversity of symbols, and especially in electronic dictionaries, colours.

A specific feature of electronic dictionaries is that their microstructure may be more complex than it is in printed dictionaries [11, 13]. Opposite to printed dictionaries, they may include information in a non-verbal, dynamic format, such as video, sound, or graphics [14]. Sometimes, this kind of information is not provided upon consultation of the entry, but to access it users must click on buttons or on links to pop-up windows. As has been pointed out in the literature, "the dynamic nature of e-dictionaries enables lexicographers to move away from a static to a dynamic data display" [13]. Dynamic articles do not display the whole content directly, but on the first screen present a schema of the article, with layers identifying the different sections, which users can expand in accordance with their specific needs.

As Gouws states, "in this consultation it is clear that accessibility, that is the access capability and the possibility to look something up, differs from the corresponding capability in a printed dictionary" [12]. Search structure is then more complex, allowing different routes to access information. This increased complexity brings about new search options, while they demand new abilities on the part of users. As far as the subject matter of this article is concerned, it must be highlighted that this complexity may affect website accessibility to lexicographic information, since access information involves a more active interaction with the consultation interface of dictionaries.

Accessing information on web dictionaries depends on the way information is structured, as well as on the routes that lexicographers have designed to find information. What follows is an overview of the way in which these structural features interact with accessibility principles. Since the object of study in this paper are online dictionaries, the focus shall be on this kind of resources.

3 Making elements perceivable in online dictionaries

In accordance with W3C/WAI [15], when navigating a website,

> information and user interface components must be presentable to users in ways they can perceive. This means that users must be able to perceive the infor-

mation being presented (it can't be invisible to all of their senses).

This section is devoted to three website accessibility features covered by the WCAG standards in relation to the WCAG principle of perceivability that have also been objects of concern in dictionary making. Specifically, the section reports about (heading) structure, text alternatives for pictures, and other images, as well as about a key feature to make content distinguishable, i.e. typography. Ensuring the accessibility of the different elements with which the user interacts when browsing a dictionary affects access to information in different ways. On the one hand, some elements of dictionary design are related to the access structure to information—designing them in an accessible way allows the user to find the information. In this sense, we analyse heading structure, as well as buttons that guide navigation and typographic choice. On the other hand, some elements provide the information the user is looking for, as is the case with images or phonetic information, so making these elements accessible allows the user to understand the information once they have reached it.

3.1 Heading structure

Websites are marked-up by using formatted headings, which convey the structure of the page. Therefore, headings are a fundamental feature to ensure the accessibility of a website for screen reader users—navigation with this kind of assistive technology is based on the way in which the website is coded. Thus, if a website does not include proper, clearly ordered headings, blind users must navigate the entire web page to retrieve the information they need [16]. According to the AccessibilityChecker tool, heading elements, which do not appear in a sequentially descending order or skip levels within the website structure are one of the main critical accessibility issues in widely used dictionaries today, such as the *Diccionario de la lengua española* (Spanish Royal Academy).

In an online dictionary, it is convenient to explore ways to bypass repetitive information to improve efficiency in navigation through different meanings or in other parts of the dictionary entry with assistive technology (e.g. headings, skip links, or landmark regions)—currently available dictionaries such as the *Cambridge English Dictionary* or the *Oxford Learner's Dictionary* contain these mark-up elements.

3.2 Text alternatives

Graphic, non-verbal information is present in most online dictionaries today, in different ways. Following the WCAG principles, different approaches must be adopted regarding the use of text alternatives, i.e. "written descriptions of an image or other nontext content, included as an attribute in HTML code and rendered as text in place of the image or other element" [17], to make this type of information accessible for screen reader users, in accordance with their intended purpose on the website (informative, decorative, functional, images of text, complex images, groups of images, image maps). Beyond screen reader users, it must be noted that text alternatives are useful for users navigating with poor Internet connection and facing problems for the loading of images on websites, as well as for website indexing purposes. Let us consider some contexts in which graphic information is present in dictionaries and means to render this visual content more accessible.

3.2.1 Images accompanying definitions in the dictionary entry

Dictionary entries devoted to words that lexicographers understand as typically unfamiliar for the average user are sometimes accompanied by illustrative images. These pictures are mainly static. In fact, negative effects have been found in empirical research proposing animated pictures in dictionary entries [18] and are intended to complement linguistic information [19]. That is, the semantic explanation about lemmas is provided with a combination of verbal definitions and illustrations, which means that not having access to either of the two components may hinder the comprehension of some aspects related to the meaning of words.

Such is the case of the word *platypus* in English or *ornitorrinco* in Spanish, the definition of which comes with a photograph on the *Macmillan English Dictionary* (Fig. 1) and the *Cambridge English Dictionary* (Fig. 2), or a drawing on *Merriam-Webster* (Fig. 3) and the *Diccionario fácil* (Fig. 4). In these four instances, accessibility evaluation tools such as AccessibilityChecker show that an alternative text is provided: The first two dictionaries show "platypus" and "picture of platypus", respectively, as the alternative text for their photographs; *Merriam-Webster* provides "illustration of platypus" as the alternative text for its image—note that the same string of text is provided as a title for the image; and the *Diccionario fácil* renders "ornitorrinco".

The display of images in these four dictionary entries does not have a decorative purpose. It is also not casual that images are provided in the definition of *platypus*, an animal, which is geographically restricted and may be unknown for many dictionary users. Note that the definition of a better-known animal like the *bear* is not accompanied by an illustration in some of the dictionaries above. According to Faber et al. [19], visual representation is helpful in specialised knowledge fields—images facilitate textual comprehension and complement the linguistic information provided in other data fields.

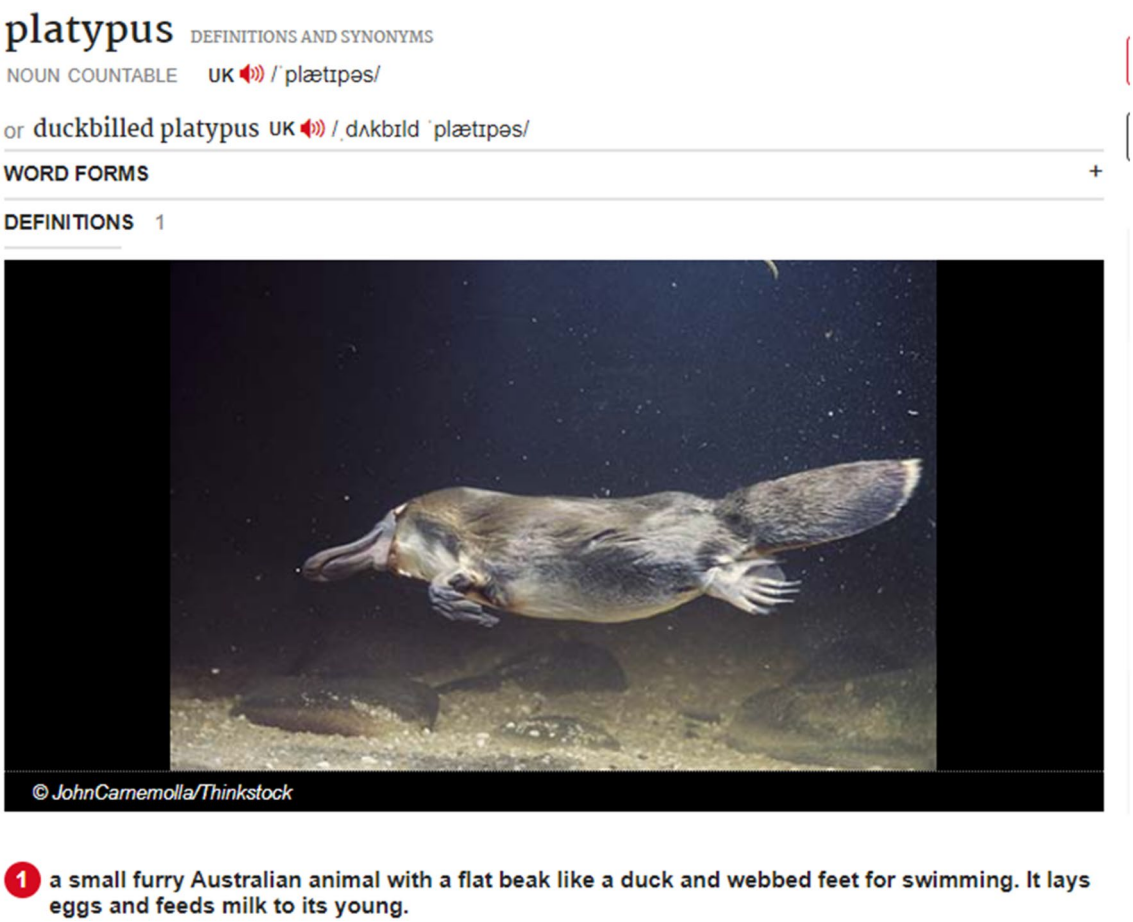


Fig. 1 Entry of the word *platypus*. Source: *Macmillan English Dictionary*

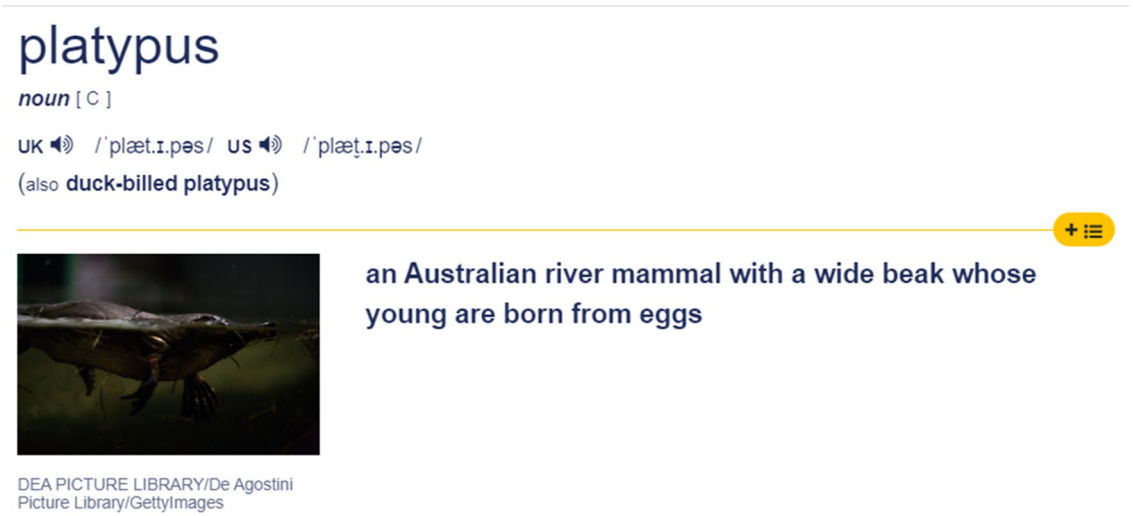


Fig. 2 Entry of the word *platypus*. Source: *Cambridge English Dictionary*

In this case, images complement dictionary definitions to make users aware of the physical features of platypuses and the environments in which they are typically found. Other images of the same animal could provide information regarding the type of food eaten by this animal, for example. All this information is not systematically found in the

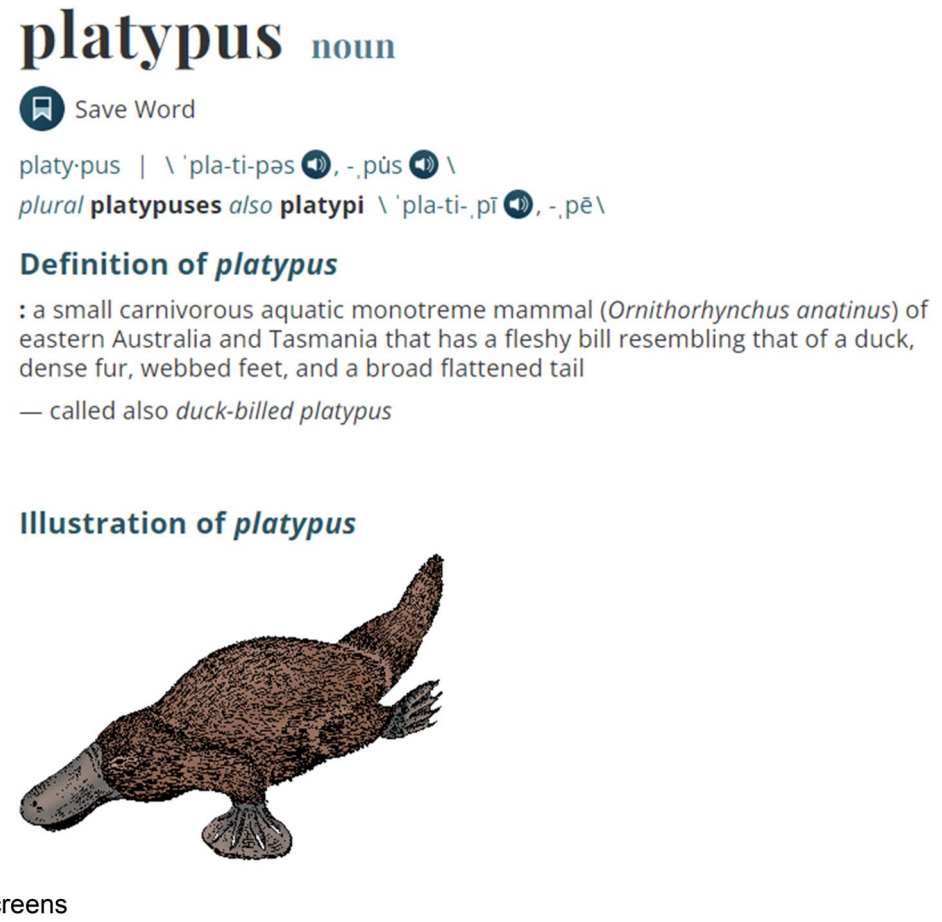


Fig. 3 Entry of the word *platypus*. Source: *Merriam-Webster dictionary*

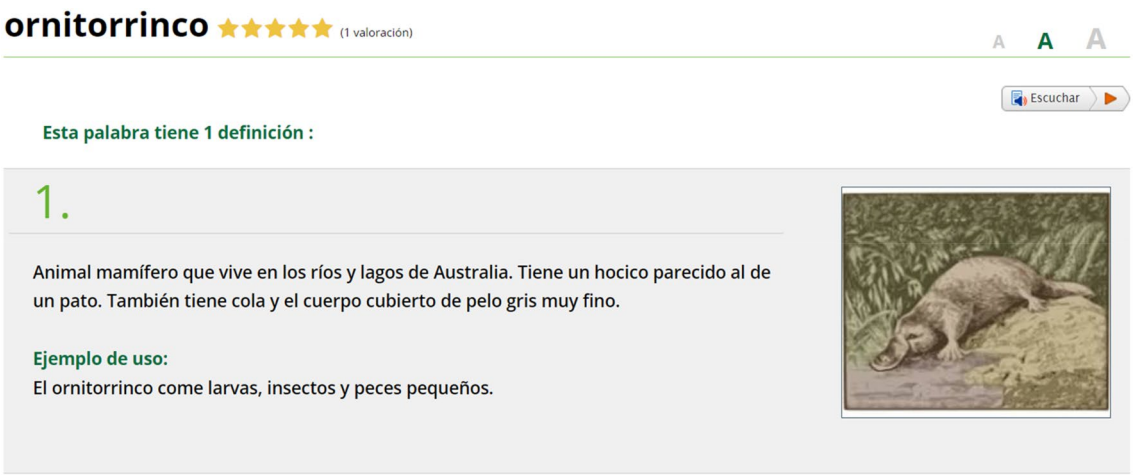


Fig. 4 Entry of the word *platypus*. Source: *Diccionario fácil*

dictionary entry in the verbal definition but is conveyed visually to users who access the image. We can therefore assert that these are instances of informative images. According to W3C/WAI [20], informative images are those "that graphically represent concepts and information, typically pictures, photos, and illustrations." Website accessibility standards draw attention to the fact that the inclusion of these images makes content easier to understand "for many people, but particularly for those with cognitive and learning disabilities" [20]. This is the reason why the *Diccionario fácil*, a

lexicographic project specifically aimed at persons with intellectual disabilities, makes use of illustrations as a relevant complement to dictionary definitions [21]. The general W3C/WAI recommendation for these images is that "the text alternative should be at least a short description conveying the essential information presented by the image" [20].

The instances presented for the word *platypus* in different dictionaries meet this WCAG standard in that they offer some form of alternative text. However, it would be convenient for dictionary entry images (i.e. informative images) to incorporate a richer alternative text than the one offered on the cited websites to enhance accessibility. A full sentence, instead of an isolated noun phrase, may suffice to improve the screen reader user experience. Thus, for example, the photograph on the *Macmillan English Dictionary* (Fig. 1) could be described as "A brown platypus swims under the surface of water." The drawing on the *Diccionario fácil* (Fig. 4), in turn, could provide the information that the platypus approaches water, but is standing on land, and so on.

3.2.2 Images included in user guides

Beyond entries, informative images can be found in further sections of an online dictionary. Online dictionaries have been described as "visually busy" sites, which "provide much more than just the entry information" [2]. This section is devoted to a part of online dictionaries in which visual information is key to grant other accessibility principles, namely operability and understandability: User guides. User guides provide explicit information about access structure (typically focusing on inner access structure), so making them accessible contributes to helping any potential user to find information.

The literature has emphasised the need for online dictionaries to incorporate user's guides, which provide the basic instructions for users to navigate content and know what to expect from the dictionary they are consulting [22]. As instructive texts, these guides should be designed to grant the pragmatic conditions for users to fulfil a practical need [23], i.e. using the dictionary and retrieving the linguistic information they are looking up. Therefore, when envisaging instructions, the needs of end users should be put at the centre and information should be provided in the clearest way possible. Section 4 will discuss the convenience of using easy-to-understand language in dictionary writing, which is also relevant in connection to the writing of user's guides. Here, the focus is placed on the images accompanying the information given to users to instruct them on how to navigate the dictionary.

Like in the case of images accompanying dictionary definitions, screenshots, or other graphics illustrating instructions are important to foster content understandability. To date, however, even dictionaries, which score high in accessibility evaluation tools, such as the *Macmillan English Dictionary*, fail to include elaborated text alternatives that account for the information conveyed visually in user's guides. Consider Fig. 5, taken from the user guide of this dictionary.

Verbal text follows from the image and information about the parts of an entry is connected to the figure by means of numbering. The alternative text, however, reads "dictionary entry." From an accessibility perspective, it would be advisable to enrich such an alternative text so that the figure can be useful for those who cannot perceive the visuals. A way to approach this could be, for example, explicitly stating that "number 1 signals de headword *determine*, number 2 signals the entry definitions 'to control what something will be' and 'to officially decide something'", et cetera.

3.2.3 Other relevant images: Phonetic transcription, buttons, and promotional materials

This subsection aims to briefly mention three other elements present in most online dictionaries, which are worth considering in terms of accessibility, namely phonetic transcriptions, buttons, and promotional materials.

First, many dictionaries include a phonetic transcription of the consulted word in their entries, written in the International Phonetic Alphabet (IPA), which helps learners understand how the word is pronounced. This is sometimes accompanied by an icon telling the user that the pronunciation can be heard by clicking on it. From an accessibility point of view, this is interesting for two reasons: On the one hand, for d/Deaf and hard-of-hearing users, the inclusion of the IPA transcription is useful to identify sounds, but accessibility could be improved by including a video of a speaker pronouncing the word. Note that there are pedagogical proposals for speech perception in d/Deaf children (such as Cued Speech), which are based on learning, which phonemes correspond to specific mouth shapes [24]. On the other hand, screen readers struggle to pronounce text strings written in IPA—if the assistive device can identify the language of the website, this should not be an accessibility issue, since screen reader users will be read the lemma on top of the dictionary entry. This is related to a relevant recommendation in the WCAG standards: The primary language of all websites needs to be coded. In lexicography, this poses a challenge in the case of bilingual and multilingual dictionaries.

Second, buttons (including the icon for a pronunciation demo as described above) help users navigate any website. Therefore, when presented as images, these elements should also incorporate text alternatives. Today, the lack of alt text in buttons is a repeated visual issue across frequently used dictionaries, such as *Merriam-Webster*, the *Cambridge English Dictionary*, or the *Diccionario de la lengua española*.

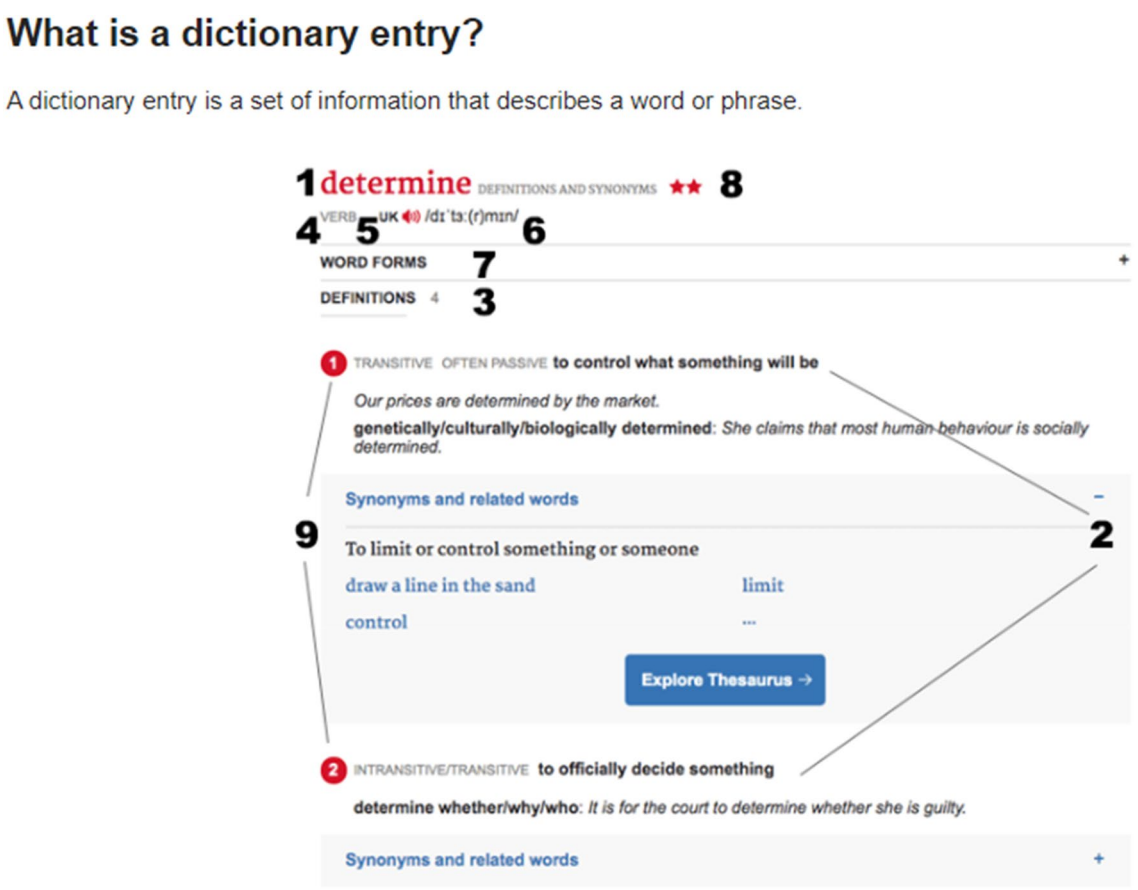


Fig. 5 User guide excerpt. Source: *Macmillan English Dictionary*

Finally, promotional and commercial materials are another kind of visual information that deserves consideration from an accessibility point of view. Although granting the accessibility of these features may escape the scope of the lexicographic task, they should not be overlooked by website developers working on dictionaries, since they are already described as prototypical visual elements of online dictionaries with which users interact [2]. On the one hand, the wrong coding of advertisement in an online resource may hinder access to such a resource, e.g. a pop-up window that prevents a screen reader user from reading the content they are looking up. On the other hand, advertising in the form of static or moving banners in dictionaries may be regarded as noise for many users and has been reported as distractive in the literature [25], but it must be noted that access to advertising campaigns is also a means to grant equal access to consumption choices and opportunities for all users. The lack of accessibility in television advertising is a major issue that has been explored in accessibility studies [26, 27].

This section has focused on monolingual dictionaries mainly aimed at language learners. As a final remark, it is worth noting that lexicographers working on other types of dictionaries, such as visual dictionaries, will face greater challenges when it comes to conveying lexicosemantic information by means of text alternatives. This issue deserves further exploration in future studies.

3.3 Typographic choice

Section 2 in this paper has explained that structuring information in a clear, usable manner is a major concern for lexicographers. Different parameters of typography, namely font, size, weight, colour, spacing, and paragraphing [2], have been traditionally used to serve a structural function in dictionaries, i.e. "to articulate their structure" [2]. From an accessibility point of view, it is worth highlighting that text presented in an electronic format can be more easily manipulated, which is an advantage when it comes to fitting content to diverse users' needs [28].

There are some aspects that should be considered when making typographic choices in online dictionaries: In terms of font, it is crucial to check that the selected font is readable by screen readers. To foster readability, especially in the case of users with dyslexia, sans serif fonts in which letters may appear less crowded (e.g. Arial, Tahoma,

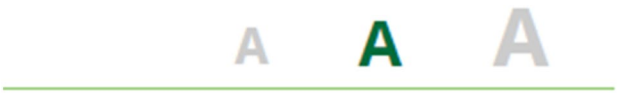


Fig. 6 Typography resizing options on the *Diccionario fácil*

Calibri) have been reported to be preferable [29, 30]. Likewise, increasing the space between letters has been shown to foster readability in persons with dyslexia, and crucially in persons with lower levels of literacy [28]. Again, in this case, the space available in the digital format is an advantage [31]. It must be noted, thus, that at this point the WCAG principle of perceivability is tightly linked to the principle of understandability—hindering reading has an impact on comprehension, as demonstrated in previous research involving the use of Wikipedia (a lexicographic resource) by persons with dyslexia [32].

Using typefaces in different colours to identify different types of information has been reported to be convenient to make dictionary consultation more effective [33], since typographic devices act as markers to guide users across inner access structure. In online dictionaries, colour is often used to make a website "more attractive", as well as "for framing, highlighting and contrasting" [2]. In this regard, the WCAG standards recommend ensuring a sufficient contrast ratio between background and foreground colours. This is to make digital content accessible to persons with low vision or colour-blindness. According to the Accessibility-Checker tool, an insufficient contrast ratio is another critical accessibility issue in widely used dictionaries today, such as *Merriam-Webster*, the *Oxford learner's dictionary*, or the *Diccionario de la lengua española*. Typically, a dark-coloured text on a light background is recommended. In the case of persons with dyslexia, a non-white background is preferable [29].

As regards size, typography displayed in an electronic format should adapt to different devices [2] and allow user customisation. Some browsers already incorporate resizing applications [34], but it would be desirable for the dictionaries to include them buttons, as is done in the *Diccionario fácil*. Notice their as well in easily accessible proposal in Fig. 6, which is a close-up from the heading of the definition for *platypus* as shown in Sect. 3.2.1 (Fig. 4).

Research studies conducted a decade ago already report a tendency towards the increasing use of varied fonts instead of signposts to guide the user in dictionary consultation [35]. As explained in Sect. 3.2.2, if visual information (typefaces) is to convey information that is key to dictionary use, it is crucial for dictionaries to include guides whereby users can become familiar with the typographic choices made in the dictionary. The ideal scenario would be for dictionaries to include style manuals, which explain the typographic conventions by means of glossed model entries [36]. In line with what will be proposed in the next section, it would be desirable for these guides to be written in easy-to-understand language to enhance comprehension.

4 Making online dictionaries more understandable

Dictionaries are tools that describe language. One of their main aims is to make word meanings understandable for a variety of user profiles, including both people with an educational background in languages, such as language learners, translators, or writers, among others, and people with no prior specialised knowledge of languages or with low levels of literacy. Following W3C/WAI [15], when using web content,

> Information and the operation of user interface must be understandable. This means that users must be able to understand the information as well as the operation of the user interface (the content or operation cannot be beyond their understanding).

The WCAG standards regarding website understandability are in line with many of the decisions made in dictionary-making practice to date to enhance understanding of the dictionary content. However, solutions are still inconsistent, and online dictionaries derived from printed publications have inherited lexicographic traditions which go against some of the WCAG proposals. This section focuses on the writing of definitions and briefly reflects on the use of abbreviations in online dictionaries.

4.1 Definitions

One of the main reasons for users to consult dictionaries is to know the meaning of words. Semantic information is provided by several components of dictionary entries, such as examples, illustrations, or synonyms. Nevertheless, the core part of the semantic description of lemmas are definitions [37]. Therefore, in the history of lexicography, special attention has been paid to the clarity of definitions, as the comprehension of the meaning of the word directly depends on the definition being intelligible to users [38].

The most notable advances in thinking about lexicographic definition come from the field of lexicography for second language learners, under the premise that these users have a limited linguistic competence, which may make it difficult for them to understand complex definitions. To make definitions easier to understand, two main aspects have been considered. On the one hand, a long debate originated during the first half of the twentieth century has raised the need to use a controlled vocabulary in the wording of definitions. On the other hand, especially since the late 1980s, new definition models have been introduced.

4.1.1 Controlled vocabulary

The idea to control the vocabulary used in definitions arises from an ancient and rather intuitive general principle of lexicography, which was clearly sated by Johnson in a widely quoted maxim: "To explain requires the use of terms less abstruse than that which is to be explained" [39]. This maxim is as self-evident as difficult to achieve and tries to prevent lexicographers from the common error known as *obscurum per obscuris*, that is, defining an incomprehensible term by using less comprehensible words than the word sense being explained. So, a major aim in dictionary making is to define each lemma with easier and more comprehensible words than the lemma itself. As a response to this challenge, the 1920s and 1930s saw the birth of a long-standing movement to control the vocabulary used in definitions, the main exponents of which were Ernst Horn and Michael West [40], which culminates in 1936 with the publication of the General Service List, a list of words that may be used in definitions based on the criteria of word frequency, structural value, and applicability in different contexts.

The idea of a restricted definition vocabulary was fully applied in 1973 with the publication of the *Longman Dictionary of Contemporary English,* which popularised the use of controlled lists of vocabulary for definitions. Today, most English learner's dictionaries use controlled vocabulary in their definitions [41]. Although there are different approaches to control vocabulary, such as restricting vocabulary used into a list of about 2,000 or 3,000 preselected words, or using the lexicographer's linguistic knowledge to restrict the number of units used for word definitions, the control vocabulary movement is based on some general principles widely followed in all these dictionaries: The vocabulary used in definitions has to be restricted to more frequent words, used in their most general senses, and avoiding words with complex syntax. This way of controlling vocabulary has proven benefits in comprehension tasks by non-native speakers, since in general terms the vocabulary used in definitions matches the core vocabulary of the language that learners acquire in the initial phases of the learning process [41].

4.1.2 Innovative definition models

For centuries, the most used definition model in Western lexicographical tradition was based in the so-called analytical Aristotelian definition. In this kind of semantic explanation, the defined item is subsumed under a more general category, which sets the conceptual class to which the lemma belongs, and then is distinguished from other members of that class by the specific features, which identify it. Thus, the prototypical definition takes the form of a hypernym *(genus proximum)* followed by a small set of distinguishing features *(differentiae specificae)*. As a matter of fact, the following definition of a *chair*, taken from the *Merriam-Webster dictionary*, adopts the Aristotelian definition model:

> **chair** a seat *(genus proximum)* typically having four legs and a back for one person *(differentiae specificae)*

Although other kinds of definitions were used in traditional dictionaries [42], the Aristotelian definition prevailed in most dictionaries. The publication of the *Collins COBUILD English Language Dictionary* in 1987 was a turning point in this tradition, with the introduction of the so-called full-sentence definition (FSD). FSD tries to emulate the natural way in which a non-expert explains word senses. In FDS, definition is not a phrase, but a whole sentence in which the lemma is repeated in the definition, which allows to present it in context and demonstrate syntagmatic information (collocational or grammatical patterns, for instance) [43]. The following definition from COBUILD illustrates the FDS model:

> **kill** To kill a person, animal, plant, or other living thing means to cause the person or thing to die.

Notice that the first part of the definition repeats the lemma *(kill),* presenting it in context and providing implicitly information about its grammatical pattern (it is a transitive verb, as it is followed whit an accusative complement) and about the restriction of the lexical class of elements that may be killed ('person, animal, plant or other living thing'). The second part, introduced by the verb *means,* explains what *kill* means.

Several authors have argued that FSDs contribute to the clarity of semantic explanations [43–45] in a simple way, which does not require specific knowledge about lexicographical conventions on the user's part. Therefore, these authors argue for the use of FSD in learner's dictionaries as the main definition model. Indeed, since the publication of the COBUILD, most learners' dictionaries have incorporated this type of definition to a greater or lesser extent. Thus, the arguments provided by Hanks seem to point out that this type of definition is more accessible than Aristotelian definitions, which require a greater effort of abstraction for users [43].

Nevertheless, FSDs have not been universally adopted in learners' dictionaries as the default style of definition and are hardly used in general dictionaries oriented to native speakers [46, 47]. FSD results in longer, more syntactically complex definitions, which critics of FSD adduce as a problem [44]. Several studies have shown that users extract syntactic class information more easily from classical Aristotelian definitions [48–50]. Therefore, it has been argued that combining the Aristotelian definition for non-predicative words (as concrete nouns, for example) with FSD for predicative words in relation to which contextual information must be

provided (mainly adjectives and verbs) is a better solution [46].

4.1.3 Easy-to-understand language as a resource for more accessible definitions in online dictionaries

The adoption of easy-to-understand language principles is recommended as a resource to address the writing of definitions in online dictionaries. Easy-to-understand (E2U) language is an umbrella term encompassing language modalities aimed at enhancing text comprehension [51]. The principles of E2U are based on easy-to-read language guidelines, as well as on plain language guidelines. Easy-to-read language was proposed to adapt texts to the needs of readers with intellectual disabilities and reading difficulties. Easy-to-read language entails structuring texts in a coherent, logical manner; using simple, active clauses, preferably following neuter sentence order (SVO), and conveying one idea per sentence; using frequent, easy-to-pronounce, non-abstract lexicon; including limited complex lexicon to stimulate vocabulary acquisition; and designing documents to enhance the reading experience (with pertinent images, readable typography, adequate spacing, and paragraphing…) [21].

Plain language is another means to make texts more accessible. It originated in the 1970s as an approach to make legal documentation easier to understand to lay readers [52]. Since then, its scope has spread, and its focus is now placed on the clarity of communications from public administrations and private companies to the general public. Therefore, some institutions and researchers refer to this language modality as *clear writing* [53] or *clear communication* [54].

As can be seen, the principles of both easy-to-understand language share a vast ground with the proposals made in dictionary making as described in the previous sections: Using a controlled vocabulary that prioritises frequent lexicon means making sure that the user has access to the meaning of all words in a definition. Likewise, the COBUILD definition model makes use of full sentences to enhance comprehension, by at the same time employing a language that the user may find closer to their daily language use, which is in line with the proposals made in cognitive accessibility. This shows a natural link between both lexicography, especially lexicography aimed at learners, and accessibility, since it has been largely demonstrated that language learners benefit from content written in easy-to-understand language.

As has been mentioned, one of the basic WCAG principles is understandability. Following the Easy-to-Read on the Web Symposium held in 2012, the Research and Development Working Group at W3C published a research report in 2014[2], which discussed the challenges entailed in adopting E2U language on websites. It further described the types of tools available for website developers interested in using easy-to-read language to make their content more accessible, such as text complexity evaluators.

It is common for texts written in E2U language to be accompanied by a brief glossary of difficult terms defined in this language modality: Typically, end user validators decide which words are to be defined by considering the difficulty they have faced to understand the words in the text [21]. This tells us that E2U word definitions are a standard practice in documents aiming to be accessible. Nevertheless, the instances of (whole) online encyclopaedias or dictionaries having opted for this language modality have been scarce to date. Some projects have been launched in this direction by crowdsourcing initiatives and by non-profit organisations working with end users with intellectual disabilities. For example, *Hurraki*[3] is a crowdsourced dictionary including articles in English (193 articles), Spanish (45 articles), German (4,145 articles), Italian (14 articles), and Magyar (10 articles).[4] The structure of its entries closely resembles that of Wikipedia articles. The resource defines both common nouns (like *red* or *appeal* in English) and proper nouns (such as *America* or *Katharine Hepburn*). Entries start with a brief definition of one or two sentences, which is followed by images, lists of words with the same meaning, and a more detailed explanation written in easy-to-read language. Such expanded definition is, again, accompanied by images when necessary. In the case of the definition of the colour red, images are aimed at helping the reader understand the pragmatic conventions of the colour and the meanings with which we associate it (i.e. warnings, instruction to stop), as shown in Fig. 7. It is worth noting that these images are described with text alternatives, and, in this case, it is not necessary to activate a screen reader application to be read the alt text, which facilitates access to visual information.

To the best of our knowledge, the *Diccionario fácil* is the most ambitious endeavour in E2U dictionary making to date. It is an ongoing project carried out by the non-profit organisation Plena Inclusión Madrid and led by Óscar García Muñoz, which is funded by several sponsors from the private and public sectors, including publishing houses, which specialise in dictionary making (VOX, Larousse), the Spanish Royal Academy (FundéuRAE), and the Community of Madrid (i.e. the government of the Madrid autonomous community in Spain). This lexicographic project was proposed as a response to the finding that persons with intellectual disabilities—to whom Plena Inclusión Madrid devotes its activities—reported high

[2] https://www.w3.org/WAI/RD/2012/easy-to-read/note/ED-E2R-20140123.

[3] https://hurraki.org/english/wiki/Main_Page.

[4] Data collected July 10, 2022.

Fig. 7 Detailed definition of the word *red*. Source: *Harruki dictionary*

Fig. 8 Abbreviation to express the type of noun (countable). Source: *Cambridge Advanced Dictionary*

levels of frustration in their use of monolingual dictionaries online: They faced problems to understand word definitions, they found themselves looking up unknown words included in those definitions, which made searches time-consuming, and they could not find definitions for multiple word units or expressions that they encountered daily [21].

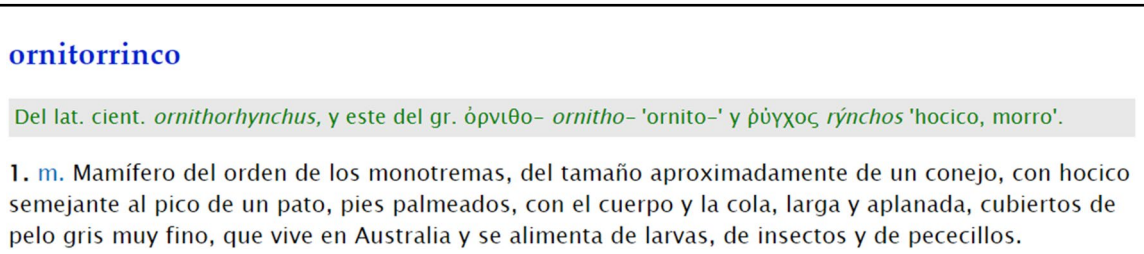
The dictionary is updated regularly—so far, it includes 3,609 words[5] in Spanish. It follows the principles of easy-to-read language both in terms of design and in the writing of definitions. Each word has a maximum of three definitions, since more definitions in polysemous words could hinder comprehension, according to the experts working with end users with intellectual disabilities [21]. As shown in the example in Fig. 4 for the word *platypus*, an introductory sentence tells the reader how many definitions will be provided for the word they are looking up. Definitions are adapted to easy-to-read language from the definitions available for the same lexical items in some of the most used monolingual dictionaries in Spanish, such as the *Diccionario de la lengua española* or the *Diccionario de uso* by María Moliner (Gredos, 2007). In a personal communication with the lexicographers working on this project, Óscar García Muñoz and Elena González Sabín,[6] they reported exchanging different versions of the definition with linguists from FundéuRAE (an agency supported by the Spanish Royal Academy). At two different stages in the process, their definitions are validated by end users. Users are also key in the selection of words included in the dictionary: Decisions on which lemmas are to be included are based on petitions sent to the organisation as well as on an analysis of the most frequent searches made in the dictionary's search bar. All definitions are complemented by an example of the word use in context.

4.2 Use of abbreviations

Abbreviations are a means whereby printed lexicography has traditionally saved space on the page. They are used to indicate different parts of speech (*n* for *noun*; *v* for *verb*) and have been used to make content shorter in definitions (e.g. *sb* for *somebody*) . While it would be natural to believe that in the online context these abbreviations disappear, because

[5] Data collected July 10, 2022.

[6] Interview held March 9, 2022.


ornitorrinco

Del lat. cient. *ornithorhynchus*, y este del gr. ὀρνιθο- *ornitho-* 'ornito-' y ῥύγχος *rýnchos* 'hocico, morro'.

1. m. Mamífero del orden de los monotremas, del tamaño aproximadamente de un conejo, con hocico semejante al pico de un pato, pies palmeados, con el cuerpo y la cola, larga y aplanada, cubiertos de pelo gris muy fino, que vive en Australia y se alimenta de larvas, de insectos y de pececillos.

Fig. 9 Abbreviations to express word origin, part of speech, and grammatical gender. Source: *Diccionario de la lengua española*

there are fewer space constraints, the fact is that many online dictionaries still make use of abbreviations today. Consider Fig. 8, a close-up from Fig. 2 (Sect. 3.2.1), in which *c* stands for *countable* in the *Cambridge English Dictionary*. In this case, a hyperlink is offered on the abbreviation—by clicking on it, the user is taken to a different page in which each abbreviation used in the dictionary is explained on a table.

In Fig. 9, in turn, several abbreviations are used to explain the etymology of the word *ornitorrinco* ('platypus') (*lat. cient.* for *scientific Latin*; *gr.* for *Greek*) and its part of speech (*m.* for *masculine noun*), in the *Diccionario de la lengua española*. In this case, the user is offered the words in full by passing the mouse over the abbreviations.

These practices leave room for improvement in terms of accessibility, for several reasons. First, because they make the consultation process slower: Being sent to a different site within the dictionary to understand an abbreviation is time-consuming. Second, because information presented by means of tables may hinder readability for screen reader users, especially when tables are not correctly coded. Third, because not all users navigate with a mouse, which means that it is important for content to be made keyboard accessible [56]. Finally, if easy-to-understand language principles are to be considered, avoiding abbreviations is recommended to make content more accessible for persons with reading difficulties.

5 Final remarks: Potential impact and future directions

Dictionaries are content documents with a complex structure. When they are designed for the web or adapted from a printed to an online environment, they try to adapt their specific, genre-conventionalised way to structure content to the digital environment. Therefore, analysing website accessibility in online dictionaries entails considering the twofold nature of these resources as dictionaries and websites. Because they are dictionaries, they structure and present information by following well-established conventions in lexicography aimed at facilitating information access—and dictionary users are assumed to be familiar with such conventions (use of abbreviations, language used in definition writing, sections of a dictionary entry). Because they are websites, they should consider the same accessibility features as any other website, and this directly affects features such as typography size, use of colour, or text alternatives.

Making a dictionary accessible means structuring information so that any user can find it and presenting it in a way that is perceivable and understandable. There are at least three layers involved in information access in dictionaries. The first two layers in access to information affect structural organisation, including both the way in which the whole dictionary is structured, and the way in which each entry is structured in different sections. In web pages, content is structured in sections, and an external access structure must be provided to allow an easy and reliable navigation. In dictionaries, this access structure is key to allow navigation across dictionary entries, which make up the dictionary's macrostructure. In this sense, implementing measures to grant the website's accessibility allows users to move autonomously across the website and interact with its different sections.

The second accessibility layer involves the way in which each dictionary entry is structured. In an entry, different marks guide the user to find the section in which the information they are looking up is found (e.g. information related to the words with which a given lemma is typically combined, information about the meaning of a given unit, etc.). Therefore, online dictionaries must provide an accessible inner access structure. This means, for example, addressing issues such as the format of the buttons that give access to audio or video clips, the use of fonts and colours to signal specific types of information, or the interaction with advertising images.

The third layer in access to information in dictionaries is related to the information dictionaries provide about word meanings. Making this information accessible means designing it in such a way that all users can perceive it and understand it. In this sense, it is crucial to use a clear language or to ensure that the images that the dictionaries include as a complement to the information include alternative text, thus addressing the accessibility of this form of multimodal texts.

This paper has focused on means to enhance the perceivability and understandability of online dictionaries, as websites displaying content that is relevant for any language user,

and should, thus, be made accessible for all. The strategies discussed in the paper may have a direct impact on the way in which a large number of users interact with these information sources: According to the British Dyslexia Association, 10% of the world population has dyslexia[7]; according to the World Blind Union, over 6% of the population is blind or has low vision[8]; according to the World Health Organisation, over 5% is d/Deaf or has some degree of hearing loss.[9] This speaks both of the social and of the economic impact of implementing accessibility measures in online dictionaries. On the one hand, as has been mentioned in the introduction to this paper, dictionaries and encyclopaedias are an important resource for language learning. Persons with disabilities are known to have lower levels of literacy than the average population in most countries, and face difficulties to access all kinds of learning materials which are still not accessible. Thus, making a basic information source like dictionaries accessible is essential to work for inclusion in educational contexts. On the other hand, if these websites are not accessible, publishing houses making dictionaries lose customers and the brands advertised in their dictionaries lose them as well.

Finally, the overview presented in this paper calls for future research exploring the two WCAG principles, which have not been covered in the sections above, namely operability and robustness, in connection with online linguistic resources. In this sense, some aspects worth studying are diverse input modalities, search options, and the way in which content is made predictable. The *Diccionario fácil* quoted above, for example, has implemented yet understudied measures to ensure that persons with intellectual disabilities who may face difficulties in typing are provided the results they search for. Likewise, ongoing projects into natural language processing such as the Project Understood[10] explore means to make spoken input by persons with Down Syndrome more understandable by search engines. Multiple opportunities seem to lie ahead. In our view, website accessibility can benefit greatly from the reflection on information access made by lexicographers, and the latter need to delve into website accessibility research to grant equal access to their resources. It is, therefore, high time for a true accessibility turn in lexicography.

Acknowledgements This publication is an output of the project "New words and dictionaries: Towards dictionary updating in Spanish", funded by the Spanish Ministry of Science and Innovation and the Spanish Research Agency (PID2020-118954RB-I00). The authors are members of TraDiLex, a research group recognised by the Catalan Government under the SGR scheme (2021 SGR 00952).

Funding Open Access funding provided thanks to the CRUE-CSIC agreement with Springer Nature.

Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

References

1. Institute for Catalan Studies: El *Paraulògic* dispara les consultes del DIEC2 en línia (2022). https://www.iec.cat/activitats/noticiasencera.asp?id_noticies=3247 (2022) . Accessed 30 Apr 2022
2. Hao, J., Xu, H., Hu, H.: A multimodal communicative approach to the analysis of typography in online English learner's dictionaries. Int. J. Lexicogr. **35**(2), 234–260 (2022)
3. SimilarWeb: Clasificación de los principales sitios web para Diccionarios y enciclopedias en el mundo (2022). https://www.similarweb.com/es/top-websites/category/reference-materials/dictionaries-and-encyclopedias/. Accessed 24 June 2022
4. Greco, G.M.: The nature of accessibility studies. J Audiov. Transl. **1**(1), 205–232 (2018)
5. McArthur, T.: Worlds of Reference. Cambridge University Press, Cambridge (1986)
6. Nielsen, S.: Access structure. In: Bergenholtz, H., Tarp, S. (eds.) Manual of Specialised Lexicography: The Preparation of Specialised Dictionaries, pp. 219–223. John Benjamins, Amsterdam/Philadelphia (1995)
7. Hausmann, F.J., Wiegand, H.E.: Component parts and structures of general monolingual dictionaries: a survey. In: Hausmann, et al. (eds.) Wörterbücher. Dictionaries. Dictionaries. An International Encyclopedia of Lexicography, pp. 328–360. De Gruyter, Berlin (1989)
8. Wiegand, H.E., Gouws, R.H.: Macrostructures in printed dictionaries. In: Gouws, R.H., Heid, U., Schweickard, W., Wiegand, H.E. (eds.) Dictionaries. An International Encyclopedia of Lexicography. Supplementary volume: Recent Developments with Focus on Electronic and Computational Lexicography, pp. 73–109 (2013)
9. Wiegand, H.E., Smit, M.: Microstructures in printed dictonaries. In: Gouws, R.H., Heid, U., Schweickard, W., Wiegand, H.E. (eds.) Dictionaries. An International Encyclopedia of Lexicography. Supplementary volume: Recent Developments with Focus on Electronic and Computational Lexicography, pp. 149–214 (2013)
10. Wiegand, H.E., Beer, S.: Access structures in printed dictionaries. In: Gouws, R.H., Heid, U., Schweickard, W., Wiegand, H.E. (eds.) Dictionaries. An International Encyclopedia of Lexicography.

[7] <https://www.bdadyslexia.org.uk/dyslexia>.

[8] <https://worldblindunion.org/es/>.

[9] <https://www.who.int/news-room/fact-sheets/detail/deafness-and-hearing-loss>.

[10] <https://projectunderstood.ca/>.

Supplementary volume: Recent Developments with Focus on Electronic and Computational Lexicography, pp. 110–149 (2013)
11. Gouws, R.H.: Accessibility, access structures and access procedures. In: Jesenšek, V., Enčeva, M. (eds.) Wörterbuchstrukturen zwischen Theorie und Praxis, pp. 35–56. De Gruyter, Berlin/Boston (2018)
12. Gouws, R.H.: Dictionaries and access. In: The Routledge Handbook of Lexicography, pp. 43–58. Routledge, London (2018)
13. Gouws, R.H.: Article structures: moving from printed to e-dictionaries. Lexikos **24**(1), 155–177 (2014)
14. Lew, R.: How can we make electronic dictionaries more effective? In: Granger, S., Paquot, M. (eds.) Electronic Lexicography, pp. 343–361. Oxford University Press, Oxford (2012)
15. W3C/WAI: World Wide Web Consortium, Web Accessibility Initiative: Introduction to understanding WCAG (2022a). https://www.w3.org/WAI/WCAG21/Understanding/intro Accessed 30 Apr 2022
16. Bird, D.: Heading structure and accessibility. https://bighack.org/how-to-heading-structure-accessibility/. Accessed 25 May 2022
17. Dictionary.com Alt text. https://www.dictionary.com/browse/alt-text. Accessed 30 Apr 2022
18. Lew, R., Doroszewska, J.: Electronic dictionary entries with animated pictures: lookup preferences and word retention. Int. J. Lexicogr. **22**(3), 239–257 (2009)
19. Faber, P., León Araúz, P., Prieto Velasco, J.A., Reimerink, A.: Linking images and words: the description of specialized concepts. Int. J. Lexicogr. **20**(1), 39–65 (2007)
20. W3C/WAI: World Wide Web Consortium, Web Accessibility Initiative Images tutorial (2022b). https://www.w3.org/WAI/tutorials/images/. Accessed 30 Apr 2022
21. García Muñoz, Ó.: Diccionario Fácil, una propuesta colaborativa para públicos con dificultades de comprensión lectora. In: Blanco Alfonso, I., Fernández-Martínez, L.M., Suárez-Álvarez, R. (eds.) Vulnerabilidad y cultura digital: riesgos y oportunidades de la sociedad hiperconectada, pp. 327–345. Dykinson, Madrid (2019)
22. Almind, R.: Designing internet dictionaries. HERMES J. Linguist. **34**, 37–54 (2005)
23. Montalt, V.: Manual de Traducció Cientificotècnica. Eumo, Vic (2005)
24. Leybaert, J., LaSasso, C.J.: Cued speech for enhancing speech perception and first language development of children with cochlear implants. Trends Amplif. **14**(2), 96–112 (2010)
25. Dziemanko, A.: Smart advertising and online dictionary usefulness. Int. J. Lexicogr. **33**(4), 377–403 (2020)
26. Ocerin, G.: Accesibilidad en la publicidad audiovisual: el caso de los spots televisivos en españa. BA dissertation. University of the Basque Country (2005). https://addi.ehu.es/handle/10810/48393
27. Rai, S.: Making TV ads accessible. Paper presented at the languages and the media conference (Online) (September, 2021)
28. Jackson, J.E.: Towards universally accessible typography: a review of research on dyslexia journal on technology and persons with disabilities. J. Technol. Pers. Disabil. **2**, 155–165 (2014)
29. British Dyslexia Association: Dyslexia friendly style guide (2018). https://www.bdadyslexia.org.uk/advice/employers/creating-a-dyslexia-friendly-workplace/dyslexia-friendly-style-guide. Accessed 1 July 2022
30. Rello, L., Baeza-Yates, R.: The effect of font type on screen readability by people with dyslexia. ACM Trans. Access. Comput. **8**(4), 15 (2016)
31. van Nes, F.L.: Space, colour and typography on visual display terminals. Behav. Inf. Technol. **2**, 99–118 (1986)
32. Rello, L., Pielot, M., Marcos, M.C.: Make it big! The effect of font size and line spacing on online readability. In: Proceedings of CHI 2016, 7–12 May, San José, California, pp. 3637–3648 (2016)
33. Dziemanko, A.: Colours in online dictionaries: a case of functional labels. Int. J. Lexicogr. **28**(1), 27–61 (2015)
34. Nielsen, J.: Let users control font size (2002). https://www.nngroup.com/articles/let-users-control-font-size/. Accessed 10 July 2022
35. Luna, P.: Marks, spaces and boundaries: punctuation (and other effects) in the typography of dictionaries. Vis. Lang. **45**, 139–160 (2011)
36. Svensén, B.: A Handbook of Lexicography: The Theory and Practice of Dictionary-Making. Cambridge University Press, Cambridge (2009)
37. Wiegand, H.E.: Elements of a theory toward a so-called lexicographic definition. In: Immken, A., Wolski, W. (eds.) He Wiegand Semantics and Lexicography. Selected Studies (1976–1996), pp. 203–282. Max Niemeyer, Tübingen (1994)
38. Atkins, S., Rundell, M.: The Oxford Guide to Practical Lexicography. Oxford (2008)
39. Johnson, S.: Preface. A Dictionary of the English Language. W. Strahan, London (1755)
40. Cowie, A.P.: English Dictionaries for Foreign Learners: A History. Clarendon Press, Oxford (1999)
41. Kamińsky, M.P.: Defining with Simple Vocabulary in English Dictinaries. John Benjamins, Amsterdam/Philadelphia (2021)
42. Osselton, N.E.: Innovation and continuity in English learners' dictionaries: the single-clause when-definition. Int. J. Lexicogr. **20**(4), 393–399 (2007)
43. Hanks, P.: Definitions and explanations. In: Sinclair, J. (ed.) Looking Up: An Account of the Cobuild Project in Lexical Computing, pp. 116–136. Collins, London/Glasgow (1987)
44. Adamska-Sałaciak, A.: Dictionary definitions: problems and solutions. Stud. Linguist. Univ. Iagell. Crac. **129**(4), 323–339 (2012)
45. Moon, R.: Sinclair, lexicography, and the Cobuild project. In: Moon, R. (ed.) Words, Grammar, Text. Revisting the work of John Sinclair, pp. 1–22. John Benjamins, Amsterdam/Philadelphia (1997)
46. Rundell, M.: More than one way to skin a cat: why full-sentence definitions have not been universally adopted. In: Proceedings of 12th EURALEX International Congress, pp. 323–337. Edizioni Dell'Orso, Alessandria (2006)
47. Sinclair, J.: In praise of the dictionary. In: Williams, G., Vessier, S. (eds.) Proceedings of the 11th EURALEX Congress, pp. 1–12. Université de Bretagne-Sud, Lorient, France (2004)
48. Lew, R., Dziemianko, A.: A new type of folk-inspired definition in English monolingual learners' dictionaries and its usefulness for conveying syntactic information. Int. J. Lexicogr. **19**(3), 225–242 (2006)
49. Lew, R., Dziemianko, A.: Single-clause when-definitions: take three. In: Fjeld, R.V., Torjusen, J.M. (eds.) Proceedings of the 15th EURALEX International Congress, pp. 997–1002. Department of Linguistics and Scandinavian Studies, University of Oslo, Oslo (2012)
50. Ptasznik, B.: Which defining model contributes to more successful extraction of syntactic class information and translation accuracy? Lexikos **30**, 363–385 (2020)
51. Perego, E.: Accessible Communication: A Cross-Country Journey. Frank & Timme, Berlin (2020)
52. Mazur, B.: Revisiting plain language (2000). https://www.plainlanguage.gov/resources/articles/revisiting-plain-language/. Accessed 24 June 2022

53. European Commission: 24 clear writing tips (2021). https://ec.europa.eu/info/departments/translation/clear-writing-for-europe_en. Accessed 24 June 2022
54. Montolío, E., Tascón, M.: El derecho a entender: La comunicación clara, la mejor defensa de la ciudadanía. Los libros de la Catarata, Madrid (2020)
55. Lew, R.: Space restrictions in paper and electronic dictionaries and their implications for the design of production dictionaries (2011). https://repozytorium.amu.edu.pl/handle/10593/799. Accessed 1 July 2022
56. W3C/WAI: World Wide Web Consortium, Web Accessibility Initiative: Understanding Success Criterion 2.1.1: Keyboard (2022c). https://www.w3.org/WAI/WCAG21/Understanding/keyboard.html. Accessed 1 July 2022