Establishing evaluation criteria for e-dictionaries

Liezl H. Ball, (Department of Information Science, University of Pretoria, Pretoria, South Africa)
Theo J.D. Bothma, (Department of Information Science, University of Pretoria, Pretoria, South Africa)

Purpose

The purpose of this paper is to identify criteria according to which e-dictionaries can be evaluated. Information technology can be used to enhance e-dictionaries, but if not done carefully, information tools that completely overwhelm a user with irrelevant information can be developed. Criteria is necessary according to which e-dictionaries can be developed and evaluated to ensure tools that only provide relevant information on demand.

Design/methodology/approach

A literature review was conducted to identify trends in lexicography and modern information technology. Previous usability studies were considered to identify key usability issues. The information was synthesised to identify a set of criteria.

Findings

It was found the e-dictionaries should be evaluated according to their content, information architecture, navigation, access (searching and browsing), help, customisation and use of other innovative technologies.

Originality/value

A comprehensive set of criteria has been identified that can be used to evaluate e-dictionaries and to guide lexicographers in the development of e-dictionaries.

Keywords

e-dictionaries, electronic dictionaries, evaluation criteria, usability evaluation, lexicography

Paper type

Research paper

1. Introduction

1.1. Background

With the vast amount of information available, more tools that can help a person to access relevant information quickly are becoming increasingly important. An example of such an information tool that can meet information needs of users is an e-dictionary. Dictionaries contain selected and prepared data which are easily and quickly accessible through different access routes (Tarp, 2007: 173). The electronic medium is a different (and relatively new) medium through which dictionaries are made available. Developments in information technology allow for enhancements or additions to dictionaries that were not necessarily possible before and have led to many dreams and discussions about an ideal dictionary that can give access to only relevant information whilst withholding irrelevant information. The next section will consider some of the technologies that can be applied to e-dictionaries.

1.2. Information technology for e-dictionaries

Information technology presents many exciting possibilities to the field of lexicography. Through the use of technology much **more data** can be stored and included in a dictionary. For example, e-dictionaries do not need to rely on abbreviations of words (De Schryver, 2003: 157) or obscure symbols to identify items (Gouws, 2014a: 161). Furthermore, dictionaries can include or link to more information, such as more example sentences, interesting facts (De Schryver, 2003: 157) or multimedia (Lew, 2012: 344). Information technology also offers many advantages in terms of **access to information**. In the first place, the speed with which information can be retrieved with information technology is a considerable advantage (Verlinde & Peeters, 2012: 147). E-dictionaries can also offer various search features to users to allow for effective retrieval, for example, using wild card characters (Verlinde & Peeters, 2012: 147), Boolean operators (De Schryver, 2003: 175), the option to search for a phrase or locating multi-word expressions (De Schryver, 2003: 175), help with lemma identification (Lew, 2012: 345) or type-ahead search (Lew, 2012: 351). Lexicographers are also considering the idea of a **flexible dictionary that is customised** according to the user's needs and characteristics.

The database of a dictionary could contain a large amount of data that does not need to be shown to the user in one consultation. Instead, e-dictionaries should be customised to provide targeted information to the user (Verlinde & Peeters, 2012: 148). One could let the user choose or select what information (s)he would like to receive, for example, meaning, pronunciation, grammar, etymology. Alternatively, an e-dictionary can be customised according to a profile, perhaps even automatically (see for example, Bothma, 2011; De Schryver, 2003, Gouws, 2014b; Tarp, 2011). An e-dictionary can be customised according to various aspects, for example, the user situation, the type of user, the type of information. Each of these aspects will be explained next.

The **user situation** considers the activity with which the user is busy (or extra-lexicographical situation), for example, reading, writing or translating, and the best data for that situation can be selected by the lexicographer (Lew, 2012: 353). **Types of users** can be based on the language proficiency and the subject knowledge of the users (Bergenholtz & Gouws, 2007: 579; Bergenholtz & Kaufmann, 1997; Tarp, 2008). Thirty different types of users were identified by Bergenholtz and Gouws (2007: 579) by using the variables on subject knowledge and general and technical language proficiency. For example, a good journalist in a specific subject area could have moderate subject knowledge, and a high proficiency in the technical language used in the subject, as well as a high proficiency in general language. **Information** can also be characterised according to, for example, detail and complexity (Bergenholtz & Bothma, 2011: 60; Bothma, 2011: 76-79). People with different characteristics and in different situations may require different types of information, for example, a person who is an expert in a certain field might want more detail and understand a more complex definition, whereas a layperson might also want a lot of detail, but will not understand a complex definition with many technical terms.

The idea explained above is expressed in the **function theory of lexicography** as developed and furthered by lexicographers at or in collaboration with the Centre for Lexicography at the Aarhus University which proposes that dictionaries should be developed that only provide information relevant to a user in a specific situation and not burden the user with anything that is unnecessary (see for example, Bergenholtz, 2011; Bergenholtz & Bergenholtz, 2011; Bergenholtz, Bothma & Gouws, 2015: 3;

Bergenholtz & Gouws, 2007; Bergenholtz & Tarp, 2003; Nielsen, 2011; Tarp, 2007, 2008, 2011). Bothma and Tarp (2012: 90) explain:

> According to the function theory, the types of information needs relevant to lexicography should never be considered abstract needs, but specific and even concrete needs which are determined by the types of potential users of lexicography's practical works as well as the types of extra-lexicographical situations where lexicographically relevant information needs may occur, i.e. needs that may be satisfied by lexicographical tools.

Different basic types of situations that a user of a dictionary experiences have been identified in the function theory of lexicography, namely, cognitive, communicative, interpretative and operative situations (Bergenholtz & Bothma, 2011: 61). A dictionary can then provide information relevant for that situation (Bergenholtz, 2011: 31). For example, if a person is writing a text (communicative situation) and wishes to know how to use a particular idiom (s)he will be interested in the grammar and maybe some example sentences. The characteristics of users and information are also taken into account in the development of the function theory as explained above (also, Bergenholtz & Bothma, 2011: 60, Bothma & Tarp, 2012: 91).

When the situation and characteristics of the user are not taken into account, the user can be presented with irrelevant results that can lead to information overload (Bergenholtz & Bothma, 2011: 72), but modern information technology can contribute to lexicography by filtering and adapting information presented to the user according to a user profile or situation to present only the information that is relevant to the user and no more (Bergenholtz & Bothma, 2011: 69; Bothma, 2011: 84; Gouws, 2014a: 174). The next section will consider how current e-dictionaries have been using technology.

1.3. Application of technology to e-dictionaries

Unfortunately, though there is technology available to create better dictionaries, the dictionaries that are developed do not necessarily make use of the options available to improve dictionaries (see for example, Gouws, 2014a; Tarp, 2011). Furthermore, if not designed carefully, e-dictionaries can confuse and overwhelm users (Verlinde & Peeters, 2012: 148). This can happen, firstly, if dictionaries store a large amount of

information. As an example, if a person searched for the word *klou* in the *Woordeboek van die Afrikaanse Taal* (2017) more than 230 results are retrieved. All the results are listed in a panel, but the e-dictionary also displays the article for the lemma *klou* by default. It is very long and a user might have to scroll through and process a large amount of data to get to the information that (s)he is looking for.

With all the information that can potentially overwhelm a user, it would be better to somehow only give a person just what they need for a specific task and withhold any irrelevant information.

Secondly, users can be overwhelmed or confused when complex information technologies are used in e-dictionaries, such as advanced search options. The advanced search screen of the *Oxford English Dictionary* (2017) has many search options that give a user the opportunity to conduct a powerful search, but could be daunting.

1.4. Problem statement

Modern information technology can certainly assist in the field of lexicography to develop tools that provide only the information required to satisfy a specific information need and no unnecessary information. However, it is clear that an e-dictionary is not necessarily user-friendly and can overwhelm a user and discourage use. With the growing use of technology, there is an increasing awareness that products should be designed with the user in mind and that products should be usable (Preece, Rogers & Sharp, 2011: 2; Shneiderman & Plaisant, 2010: 15). Products that are designed with good usability in mind can do more than merely create a pleasing experience for the user but might also be critical to the success of the product (Nielsen, 2003, 2011).

One activity that can help in creating usable products, is evaluation (Preece, Rogers & Sharp, 2011: 15). Various usability evaluation studies show that different aspects are considered in different usability evaluations, for example, the speed at which users perform a task, task success, satisfaction, aesthetics, navigation (e.g. Lavie, Oron-Gilad and Meyer, 2011; Molich et al., 2010; Ravendran, MacColl and Docherty, 2012). Nielsen (1995) has also suggested ten widely used heuristics (guidelines) according to which websites can be evaluated. Though such general usability criteria

exists, there does not seem to be usability evaluation criteria specific for e-dictionaries that also takes the requirements of the function theory from the field of lexicography into consideration.

This has led to the following research question:

What criteria can be used to evaluate e-dictionaries to ensure the development of user-friendly information tools that provide only relevant information on demand?

A comprehensive set of criteria can enable e-dictionaries to be tested thoroughly to obtain tools that are truly effective and efficient. At the same time, such a set of criteria can give lexicographers an idea of what kind of tools should be developed in order to really address user's information needs.

2. Methodology

In order to identify criteria for the evaluation of e-dictionaries, an extensive literature review was conducted. The literature was found primarily by consulting online databases and journals. Several books and websites on the subject were also consulted.

The literature review was conducted to get an understanding of the existing scholarship and current thinking regarding e-dictionaries from the field of **lexicography**. Existing **technologies** available to provide relevant information on demand to a user were also investigated and, in addition, which of these are successfully used in e-dictionaries and which can be used more effectively. **Usability** as concept was explored. Furthermore, various usability studies were examined to see what issues are typically evaluated in a usability evaluation. The literature review was then used to establish the criteria to be used in the evaluation which will be discussed in the next section.

3. Discussion of evaluation criteria

The following main categories of evaluation criteria for e-dictionaries were identified in the literature review and will be discussed:

- Content

- Information architecture

- Navigation

- Access (searching and browsing)

- Help

- Customisation

- Innovative technologies used to manage information in e-dictionaries

Though aesthetics (e.g. font colour, font size, general layout, use of white space) and general usability conventions (e.g. underlining a link, changing the colour of a link that was followed) are important, it will not be included in this discussion as it is not seen as paramount to the ability to provide relevant information on demand.

Usability evaluation methods can be categorised in two main categories, those methods that involve end-users and those that do not involve end-users, but rather people like expert evaluators or designers (Fernandez, Insfran & Abrahão, 2011: 790; Molich & Dumas, 2008: 264). The criteria identified in this study will be useful for expert (heuristic) evaluations.

3.1. Content

An important part of a product's usability is whether the product can be used for its intended use (Preece, Rogers & Sharp, 2011: 19; Rubin, Chisnell & Spool, 2008: 4). The content of a product is often evaluated in usability studies (Hasan, Morris & Probets, 2012: 718-719; Paterson *et al.*, 2011: 242; Calisir *et al.*, 2010: 425).

A user consulting a dictionary most likely wishes to obtain some information from the consultation. As a result, the information or content of the dictionary has to be evaluated when evaluating whether the dictionary can actually be used for the tasks for which it is consulted. It is suggested that the content in e-dictionaries is evaluated according to relevance, level of complexity, level of detail, currency, credibility, writing and editorial style and multimedia usage, as discussed below.

A dictionary should provide only the right (**relevant**) information for the specific information need of the user as explained by the function theory (e.g. Bergenholtz, 2011; Bergenholtz & Bothma, 2011; Bergenholtz, Bothma & Gouws, 2015; Tarp,

2011). For example, if a user wishes to know the meaning of an item, the dictionary should present the meaning. Any additional information, such as grammatical information or a detailed history of the item, albeit useful, is not necessary or relevant for the task at hand and has the danger of overwhelming the user.

A dictionary should provide the right **level of complexity and detail** for the specific target audience (Bergenholtz & Bothma, 2011: 60; Bothma, 2011: 76-79). A lay person, semi-expert or expert will require information at different levels of complexity and might prefer less or more detail to be given. More data does not necessarily have to be included in the e-dictionary, but can be links to external sources (Bothma, 2011: 80; Heid, Prinsloo & Bothma, 2012: 274-276). There is a vast amount of information sources available on the Internet, for example, open data and corpus data. Heid, Prinsloo and Bothma (2012:273) warn that if external data are used in a dictionary the data should be very carefully selected. It is important to ensure the quality of a dictionary, because a dictionary is typically seen as a trusted source of information (Tarp, 2012: 264). In this light, it is suggested that any data from external sources or links to external sources are clearly indicated so that a user knows exactly when information is from the dictionary and when it is from elsewhere (Heid, Prinsloo & Bothma, 2012: 285; Tarp, 2012: 264).

Currency or timeliness refers to how up to date a source of information is and is very important when evaluating websites in general (Metzger, 2007: 2079). A user should be able to establish easily when a particular page or item has been updated. Links to external sites should also be current and active. Broken links can be a sign that the site has not recently been maintained.

The authorship of a dictionary is important to establish **credibility**, which will help a user to establish whether the information on the site might be regarded as credible and can be used with confidence (Metzger, 2007: 2079). The user should know who published the dictionary and therefore be provided with such information (Almind, 2005: 41). Furthermore, the contact details of the editors or publishers of the dictionary can be provided should the user wish to ask any questions or provide feedback on the dictionary (Almind, 2005: 41).

The way in which the content is written should also be evaluated. Nielsen (1998, 2009a) emphasises that microcontent, such as headings and page titles, should be

very well written and clear. Though headings and page titles in a dictionary are probably standard on most pages (probably the lemma of the article) there are some instances where care should be taken that items are clear. Particularly if there are different sections, functions or dictionaries, it should be clear to a user which option is relevant to him/her. A possible advantage that the electronic medium brings is the use of space. In an e-dictionary, labels for synonyms, antonyms, collocations and other parts of an article can be written out instead of using symbols or abbreviations to indicate the parts (Almind, 2005: 41; De Schryver, 2003: 182). Writing clear and concise labels can also assist with navigation (Cardello, 2013).

Multimedia can be used to enhance the content (Lew, 2012: 344), for example, the inclusion of audio files. In some cases multimedia can even potentially be used more effectively than written words, for example, to illustrate a process or item. However, multimedia can cause information overload and its use should be evaluated (De Schryver, 2003: 163).

3.2. Information architecture

The information architecture of an information product refers to how the information or content of a site is structured and organised in order to make the information usable and findable (Cardello, 2014; Information Architecture Institute, 2013).

The information architecture of a product is often evaluated in usability studies (e.g. Weir, Anderson and Jack, 2006, Hasan, Morris and Probets, 2012, Paterson *et al.* 2011). In this study the overall organisational structure and the organisation on page level is considered.

Designers of information products can make use of **different structures** to organise information. Structures should help users predict where they will find information (Usability.gov, n.d. a). Typical organisational structures are hierarchical, sequential and matrix (web) Usability.gov, n.d. b). Nielsen (2009b) notes that one of the biggest information architecture mistakes of websites is when there is no structure. Specific to the organisation of information in a dictionary, is the concept of functions. Dictionaries can be organised according to functions to help people find information more easily. Information can also be organised to appear to the user as completely different dictionaries. Different dictionaries can be created from the same database

(Bergenholtz, 2011: 42). It should be evaluated whether the structures or functions and any other method used to organise the information in the dictionary are logical, clear and can actually be used effectively by a user.

Research shows that people seldom read online, rather, they scan for information (Nielsen, 2013) and therefore the **content on a page** in a website should have a scannable layout (Nielsen, 2015). It is doubtful that a user looks up an article to read the entire article, although consulting a dictionary for entertainment can happen (Bergenholtz, 2011: 31). There could be many fields for each article, for example, meaning, grammar, style. Each article should be organised to allow a person to find information easily and quickly. Almind (2005: 117) emphasises that the order in which items in an article are displayed should be logical and legible. In addition to a clear and logical ordering of items on a page, it should be considered whether the user should be allowed to manipulate the items that (s)he wishes to see on a page (Almind, 2005 :117), as "[m]onstrous articles are just as hampering as illegible ones" (Almind, 2005 :117). Bergenholtz (2011: 37-51) explains how a dictionary with only one function can help by only selecting data from the fields in the dictionary database that are relevant to the user. For example, if the dictionary is made to help a user understand a text, there will be no unnecessary information about the background or etymology of the word or phrase. The way in which the data of each article is organised should be evaluated. When looking at the information architecture it should be considered whether the fields are arranged logically and clearly marked so that people can find the relevant information when scanning an article and whether it is possible for the user to manipulate the information, either by selecting various functions or filtering fields directly. There are various filtering techniques that can be used to filter data on a page, e.g. check boxes.

3.3. Navigation

Navigation refers to finding information through using the navigational components of a product, such as menu items (Cardello, 2014) and should show a user where to go next and where (s)he is currently (Farrell, 2015). Navigation is considered to be one of the most important aspects to get right in website design (Nielsen, 2006) and is often evaluated in usability studies (e.g. Hasan, Morris & Probets, 2012; Huang & Cappel, 2012; Paterson *et al.*, 2011; Ssemugabi & De Villiers, 2007).

The navigation should always be clear and easy to identify (Nielsen, 2009b). Users should know where they are in a website (orientation) in order that they do not feel lost (Farrell, 2015). Feedback, such as path or hierarchy information and visual cues can help a user to understand where in the information space they are (Farrell, 2015; Nielsen, 2007). This could be important if a dictionary is divided into different sections or if the e-dictionary is in actual fact a portal to several dictionaries. The user should know at all times in which dictionary or section (s)he is searching and how to move to a different place.

A factor related to navigation that can be evaluated is the time it takes to use the product. This can range from evaluating the number of steps (clicks) a user has to do to perform a task (Neilson & Wilson, 2011: 55) to measuring the time it takes to download items or the time it takes for the system to respond to the user (Calisir *et al.*, 2010: 424). It should be easy for a user to navigate to the information in a dictionary. The time it takes the user to search for information is a very important criterion when evaluating the use and quality of a dictionary (Bergenholtz, 2011: 35; Bergenholtz, Bothma & Gouws, 2015: 14). The search algorithm, access structure of the data and the navigation can have an influence on how quickly the user can access the relevant information. In an evaluation of an e-dictionary, the time it takes for a user to access information or the number of steps it takes the user to reach information should be considered. This will evaluate the efficiency with which an e-dictionary can be used. In order to help achieve a short access time, the navigation should be as easy and clear as possible.

Links allow quick movement through an information space. Links should be well designed so that they contribute to the usability of the e-dictionary (Pernice, 2014). Different types of links can be used in an e-dictionary. Internal links (links to pages on the same site) can be used to lead users to other words/items that they want to look up or other interesting information that is presented. External links (links to pages on a different site) can be used to lead to more information outside the dictionary (Heid, Prinsloo & Bothma, 2012: 275). If an article is very long, links that lead to somewhere on the same page can also be used so that a user can find specific information quickly. It should always be made clear what type of link is being used so that users know if they are staying on a site or referred to another site (Heid, Prinsloo & Bothma, 2012: 285; Tarp, 2012: 264). Links should be clearly labelled so

that users can correctly anticipate what type of information to expect on the other side (Pernice, 2014; Sherwin; 2015). If links are badly labelled it could lead to users making bad navigational decisions or get confused (Heid, 2011: 301; Nielsen, 2009b). One can also consider if words in an article link to their own entries, or if a user needs to search for an item in order to open that article.

3.4. Access

A system needs to give users access to the information it stores. There are various techniques that can be employed to give users access, such as searching, browsing and filtering. A product's access facilities (e.g. searching and browsing) are often evaluated in usability studies (e.g. Hasan, Morris & Probets, 2012; Huang & Cappel, 2012; Neilson & Wilson, 2011; Calisir *et al.*, 2010). In a dictionary, quick access is very important and the following can be considered when evaluating access, a basic search option, advanced search features, browsing options, filtering, viewing and manipulation of results or processing speed.

Users often search to find the information they are looking for (Nielsen, 2009b). Searching involves a definite search strategy (Bothma, 2011: 81; Bergenholtz, Bothma & Gouws, 2015: 7; Wang, 2011: 34), which is a plan for or an overall approach to the searching process. A system typically allows for searching through a basic search input box (Wilson, 2011: 148).This **basic search field** should be easy to find on a site and be accessible from all pages on a site (Nielsen, 2001) and be the centre of attention (Almind, 2005: 39). Evaluating the basic search is particularly important for an e-dictionary as the user consults an e-dictionary with the purpose to find information quickly.

Effective searching can reduce costs that a user can incur, such as time and energy spent. Therefore, not only should the dictionary provide easy access to a main search facility, it should also include **advanced search features** to enable people to create more sophisticated queries. These can be features such as Boolean operators (AND, OR, NOT) (Bergenholtz, Bothma & Gouws, 2015: 23; Bothma, 2011: 81; Lew, 2013: 24; Wilson, 2011: 148), proximity operators (Chowdhury, 2010: 218) or range operators (Chowdhury, 2010: 119). If a person is searching a database with distinct fields it is possible to limit the search to only search in certain

fields (Bothma, 2011: 81; Chowdhury, 2010: 219). For example, a person can specify that the search should be limited to the author field. Truncation allows a person to search for all the variations of a certain word (Bergenholtz, Bothma & Gouws, 2015: 23; Bothma, 2011: 81; Chowdhury, 2010: 220; Witten & Bainbridge, 2003: 104).

Only relying on search features to access information can inhibit a user from finding information, especially if the user does not know the scope of the information. Consequently, it is important to add **browsing** options for the user to access information. Browsing makes use of people's great ability to recognise something rather than remember or recall it (Hearst, 2009; Wilson, Schraefel & White, 2009: 1407). Browsing can therefore be less demanding than searching as a person does not have to plan and formulate a query, but merely recognise what is relevant (Hearst, 2009; Marchionini, 1995: 103) and it does not require much training (Bawden, 2011: 6). Besides making words in an article linkable, the dictionary can offer other browsing options, such as an alphabetical list through which a user can scroll, categories of items the user can browse through to get to something interesting, related words (synonyms and antonyms), or an option to view words near a certain word. Browsing can also help if a specific article is very long and there is a panel to the side of the page that allows a user to browse to a specific section of that article.

Filtering is a technique to reduce the amount of information a user retrieves. Filters can range from simple hyperlinks to checkboxes and sliders and is used to constrain a data set (Wilson, 2011: 150, 157). Filters can be effective as search parameters can be changed quickly and the effect on the result set is immediate (Ahlberg & Shneiderman, 1994). According to Lew (2013: 25) filters can be used in e-dictionaries to restrict the search to set of well-defined lemmas.

The **results** retrieved after a search query can be overwhelming (Bergenholtz & Bothma, 2011: 55). Apart from other techniques suggested so far to reduce information overload, the results should be displayed logically. Only providing alphabetical lists has been challenged and Almind (2005: 39) suggests that other options should be explored, for example, by relevance. Almind (2005: 39) suggests

only showing a limited number of results per page. The user should also be able to redefine a search.

The speed with which the system processes the data could also be evaluated.

3.5. Help

Help documentation should be available for when a user gets stuck (Nielsen, 1995; Shneiderman & Plaisant; 2010: 478). A usability evaluation study will often confirm whether there is appropriate and understandable help available and whether the user can find it (Calisir *et al.*, 2010: 426; Hasan, Morris & Probets, 2012: 720; Ssemugabi & De Villiers, 2007: 134).

Almind (2005: 41) emphasises that help texts are important in e-dictionaries for the non-professional user. The help should explain how the dictionary can be used, especially how the search features on the site work. Almind further explains that headings in the dictionary can be linked back to the help. When evaluating an e-dictionary it is important to evaluate how easily accessible the help is and how thorough the help is.

3.6. Customisation

It has been argued that the ideal dictionary is one that can be customised exactly according to the user's needs (e.g. Bergenholtz & Bothma, 2011: 69; Gouws, 2014a: 174; Tarp, 2009: 61; Verlinde & Peeters, 2012: 148). The phenomenon where a system adapts its behaviour according to the needs and characteristics of the user is often referred to as adaptive hypermedia or an adaptive hypermedia system (Brusilovsky, 1996: 87). Brusilovsky (1996: 96-100) suggests that the elements in a hypermedia system that can be adapted are the content (content-level adaptation), also referred to as adaptive presentation, and links (link-level adaptation), also referred to as adaptive navigation. Knutov *et al.* (2009: 25-30) further differentiate between adaptive presentation, adaptive content and adaptive navigation. Customisability has been evaluated in usability evaluations (e.g. Calisir *et al.*, 2010: 426). The dictionary could be customised according to user situation (Bergenholtz & Bothma, 2011: 63), characteristics (Bergenholtz & Gouws, 2007: 579; Tarp, 2008) or type of information (Bergenholtz & Bothma, 2011: 60; Bothma, 2011: 76-79). An e-

dictionary should be evaluated to see if technology such as adaptive hypermedia is, and if so, how effectively. One could consider, for example, whether the level of detail or complexity of the information displayed can be adapted according to the user's characteristics, such as language proficiency and subject knowledge; can a user specify how (s)he wishes to have the data in the e-dictionary presented; or are links shown/hidden according to the user's characteristics, such as language proficiency and subject knowledge?

If adaptive technologies are used user profiles are necessary (Godoy & Amandi, 2006: 329) and the data need to be marked in some way (for example with metadata) (Bothma, 2011: 90-91). It will be important to evaluate how a user profile is created, if the profile is indeed correct and whether it can be applied effectively. An important aspect of user profiling is that a user should be able to change his/her user profile (Bothma, 2011: 86). This is important if a profile was created that was incorrect, or simply that the user wants to change deliberately, for example, if a user used the system on behalf of someone else. While evaluating the way in which an e-dictionary can adapt according to a user, the way in which the data is marked up, in other words the use of metadata, must be evaluated.

3.7. Innovative technologies used to manage information in e-dictionaries

The use of any other innovative technologies should be evaluated. For example, the use of recommendations, annotations or decision trees in e-dictionaries have already been suggested (Bothma, 2011). Recommendations are an effective way to cope with information, especially large quantities of information (Nichols & Twidale, 2011: 209). Recommendation can for example be used in an e-dictionary to recommend a preferred word in a group setting (Bothma, 2011: 95). There are many different ways in which users can annotate information (add to existing information) on the web, for example, textual descriptions or evaluations to items in the form of comments or reviews (Kazi, 2012: 74). Bothma (2011: 98) explains that annotations can be used to allow the public to share information about an item which can help to keep the e-dictionary current or it can be used to make private notes about the use of a word (Bothma, 2011: 98). Decision trees are a way to guide a user through a vast information space and can be employed in e-dictionaries to help a person to make

the correct lexical selection, based on the parameters of the language (Bothma, Prinsloo & Heid, 2013). These decision trees can range in complexity, from very simple with one or two variables, to very complex (Prinsloo, *et al.*, 2011: 216).

4. Findings

The criteria identified and discussed in section 3, is summarised in table format in this section. The primary purpose of this criteria is to guide expert evaluators in a heuristic evaluation of an e-dictionary.

Content[1]	
Level of detail and complexity	• To what extent does the e-dictionary make use of external sources to provide extra information?
Currency	• Can a user easily establish when a page was last updated? • Are the external links on the page current and active?
Credibility	• Can the authorship of the dictionary be established? • Are the contact details of the publisher or editors available should a user have questions or want to provide feedback?
Writing and editorial style	• Are the labels (for synonyms, antonyms, etc.) clear and not abbreviated? • Are the headings and page titles clear?
Multimedia usage	• What multimedia is used and is it used effectively?
Information architecture	
Organisational structure	• Are the structure and/or functions clear?
Organisation of content on a page level	• Are items on a page marked clearly? (Is it easy to scan a page?) • Are the items on a page ordered logically? • Can the information to be shown on a page be specified?

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[1] The extent to which the content is **relevant** to a user's real need cannot be evaluated in a heuristic evaluation and is therefore excluded from this table. It is recommended that heuristic evaluation is supplemented with usability testing where real users are involved to determine whether the content is relevant.

Navigation	
Ease of navigation	• Are the navigation options clear? • How long is the path to relevant information?
User orientation	• Is feedback given to indicate the position in the e-dictionary?
Links	• Is the difference between internal and external links clearly indicated? • Is it clear what information is behind a link? • Does the dictionary provide the option for users to click on an item to go to that article instead of searching for that item?
Access	
Basic search	• Is the search field easy to identify? • Is the search field available from all pages?
Advanced search	• What advanced search features are provided?
Browsing	• What browsing options are available?
Filtering	• How is filtering used in the e-dictionary?
Viewing and manipulation of results	• How are search results displayed? • To what extent can search results be manipulated?
Help	
Help and documentation available	• Is the help easily accessible? • How clear and thorough is the help?
Customisation	
Customisation options in the e-dictionary	• To what extent does the e-dictionary adapt to the needs and characteristics of the user? • Can user profiles be created and if so, how effectively is this done? • To what extent is data marked up to adapt according to the user profile?
Innovative technologies	
Innovative technologies used to manage information in e-dictionaries	• To what extent are innovative technologies used to manage information in the e-dictionary, for example, recommendations, annotations, or

	decision trees?

The criteria discussed above were used in the evaluation of five e-dictionaries, namely, the *Algemeen Nederlands Woordenboek, Interactive Language Toolbox, Ordbogen over faste vendinger, Oxford English Dictionary Online* and *Afrikaanse idiome-woordeboek* (Ball, 2016). Through these evaluations the validity of the criteria could be confirmed. The findings of these evaluations will be reported on in detail in a separate publication. The purpose of this article was to explain the criteria and to act as a point of reference, the validity of the criteria will be evident in the next publication. The application of the criteria will also be clearly demonstrated.

Brief remarks about the evaluations will be given here. All five e-dictionaries complied with a greater or lesser extent to the criteria. However, none complied fully with all criteria.

Issues of compliance included:

- The entity responsible for the e-dictionary was mostly easy to identify, which increases credibility (content).

- Most pages (articles) were clearly organised (information architecture).

- The user position was mostly clearly indicated (navigation).

- All e-dictionaries have a basic search field that is easy to identify (access).

Issues of non-compliance included:

- Not all e-dictionaries make efficient use of external sources (content).

- Very little multimedia was included (content).

- Unnecessary use of abbreviations and symbols were noted in some cases (content).

- Boolean operators or field searching were rarely included (access).

Librarians can use the established criteria when purchasing e-dictionaries to evaluate the quality of the product that they are interested in. To be able to do such

evaluations librarians should understand the basics of usability testing, specifically the role of expert evaluations, the fundamentals of information architecture and the possibilities of advanced searching that technology provides.

Publishers can also use the criteria to make sure that the e-dictionaries that they develop are advanced tools that can address users' needs. From the short synopsis of the evaluation outcomes, it is evident that publishers will also need to understand issues such as usability evaluation, information architecture and advances search options through technology in order to use the criteria most effectively. They should do their own evaluations and thereby provide better quality products to users of e-dictionaries. The criteria can be useful at the design stage when a product is being planned, as well as later to evaluate the success of a completed product.

Additional evaluations of existing e-dictionaries are recommended for future research.

5. Conclusion

Though there are many examples of e-dictionaries available, many of them do not make extensive use of the possibilities that technologies offer to create enhanced dictionaries. If technology is embraced in e-dictionaries, tools that give relevant information on demand to users can be developed. However, technologies should only be incorporated in e-dictionaries with insight and careful judgement, and once implemented be evaluated, to ensure that e-dictionaries do not overwhelm or confuse the user. As more technology is added to systems, usability becomes increasingly important. The usability evaluation criteria that was discussed in this article has adapted general web usability evaluation criteria to be specifically relevant to e-dictionaries and will make it possible to evaluate e-dictionaries, and assist lexicographers with the development of e-dictionaries by pointing to the ideal e-dictionary.

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