LEXICOGRAPHERS' DREAMS IN THE ELECTRONIC-DICTIONARY AGE*

Gilles-Maurice de Schryver: *Department of African Languages and Cultures, Ghent University (Rozier 44, 9000 Ghent, Belgium) and Department of African Languages, University of Pretoria (Pretoria 0002, South Africa) (gillesmaurice.deschryver@rug.ac.be)*

Abstract

The arrival of the modern computer set in motion a series of lexicographers' dreams without equal in the history of dictionary making. Achieving the wildest of those electronic-dictionary vistas has the potential to result in reference works beyond all recognition. This potential, alas, remains to be realised. The aim of this article is to analyse the major achievements and future prospects when it comes to 'human-oriented electronic dictionaries' (for short EDs). In the first two sections the scene is set by revisiting this article's title. In the third section various ED typologies are presented, including a new three-step access dictionary typology. The latter is used as a frame in section four, where forty pros and cons of paper *versus* electronic products are reviewed. This study clearly shows that ED dreams are indeed not without a solid basis. The next two sections then deal with the ED dreams proper, first in the form of a brief diachronic perspective singling out main dreams and main actors (section five), then in a much more detailed fashion sorting and scrutinising one hundred and twenty dreams found throughout the literature (section six). Section seven concludes with some observations on the way ahead.

1. Lexicographers' Dreams

'I would not be surprised if for most general uses dictionaries in book-form will be antiquated before the end of the century.' (Meijs 1990: 69–70)

Just like the adepts in any other field of scholarly activity, lexicographers have dreamt throughout the ages. Such dreams were and are, more often than not, sparked by technological revolutions. The invention of the transistor, and its subsequent use in what came to be known as the modern computer, eventually led to most lexicographers' dreams since the late-1960s. The use of the computer in linguistics, as compared to for example the natural sciences and engineering, was however a gradual process (Knowles 1990: 1646). When it comes to computer use in lexicography, Cerquiglini (cited in Pruvost 2000: 188) distinguishes three phases: (1) computer-assisted (paper) lexicography, (2) transfer of existing

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paper dictionaries to an electronic medium, and (3) electronic dictionaries in their own right, conceived afresh for the electronic environment. During each of these phases, dictionary makers and metalexicographers have conjured up their own version of 'the dictionary of the future' – and by extension, and in symbiosis with it, also 'the user of the future' and 'the lexicographer of the future'. Any trawl through recent publications amply confirms this, see for example the titles of works by Gove (1972), Kay (1983), Abate (1985), Bailey (1986), Crystal (1986), Dodd (1989), Zgusta (1991), Sobkowiak (1994), Atkins (1996), Grefenstette (1998), Leech & Nesi (1999), and Zaenen (2002), to name but a few.

Apart from being put down on paper, dreams are of course primarily dreamt, and sometimes (informally) voiced at conferences or symposia. In some rare instances dreams have been turned into truly revolutionary prototype dictionaries and were presented publicly, such as during a workshop on 'The Future of the Dictionary' held in Uriage-les-Bains (France) in 1994, where Atkins et al. demonstrated the potential for monolingual lexicography with *The Dictionary of the Future: A Hypertext Database*. The exercise was repeated two years later in a multilingual environment with *The Dictionary of the Future: A Multilingual Hypertext Dictionary* (Atkins 1996: 544).

Dreams such as those of Atkins are, together with their potential realisations, the topic of this article. Before analysing the dreams themselves, a brief history of the electronic-dictionary age will be presented (§2), as well as various dictionary typologies for this age (§3). Advantages of paper dictionaries over electronic ones, and vice versa, will be examined next (§4). The findings of these sections will then provide the building blocks and terminology for the subsequent detailed study of electronic-dictionary dreams (§5–6) and for predictions regarding the future of the dictionary (§7).

2. The Electronic-Dictionary Age

'If new methods of access (breaking the iron grip of the alphabet) and a hypertext approach to the data stored in the dictionary do not result in a product light years away from the printed dictionary, then we are evading the responsibilities of our profession.' (Atkins 1992: 521)

The early beginnings of the electronic-dictionary age can be traced back to the late-1960s, when Olney and Revard keypunched the entire *Webster's Seventh New Collegiate Dictionary* (Gove 1963) onto paper tape from paper text, for the purpose of computational exploration (Wilks et al. 1996: 81). The advent of computer typesetting techniques made such endeavours easier, as the magnetic tapes from which dictionaries themselves had been printed ensured the availability of machine-readable versions, and thus 'machine-readable dictionaries' (MRDs). These tapes, however, still needed substantial cleaning up before useful information could be extracted computationally from them; after all, such tapes were only a by-product of publishing paper dictionaries. The overall task was the modification and conversion of a flat character stream into a

structured format, typically a database accessible by machine (Boguraev & Briscoe 1989b: 13). During the late-1970s and throughout the 1980s, the most widely used MRD in natural language processing (NLP) was the *Longman Dictionary of Contemporary English* (Procter 1978), which was made available by the publisher for research and development purposes. Seminal reports on the first MRDs, lexical databases (LDBs) and the emerging field of computational lexicography, include Amsler (1980, 1984), Michiels et al. (1980), Michiels (1982), Calzolari (1984), Kay (1984) and the edited collection by Boguraev & Briscoe (1989a). A more recent overview was written by Wilks et al. (1996).

Before long dictionary publishers created genuine databases for storing and manipulating the data of their reference works, which means that NLP researchers could use these (instead of the earlier typesetting tapes) to populate the lexical components of their NLP systems. The development of these databases, coupled to hardware advances, logically led to the first human-readable electronic dictionaries available for the public at large. Indeed, from the late-1980s onwards, electronic dictionaries have been available online (whether or not by subscription), on CD-ROM and other disks, or in handheld devices.

Whether NLP lexicons were obtained through transduction of typesetting or LDB dictionary text, or whether they were purpose-built, the formalisms used to store the information make them usually unsuitable for human readers (Corréard & Mangeot-Lerebours 1999). Taken at face value, 'NLP lexicons used in large-scale working NLP systems' and 'human-readable electronic dictionaries' seem worlds apart. The data structures in typical text-based NLP applications (such as stemming, morphological analysis/generation, word disambiguation (part-of-speech tagging), shallow or robust parsing (chunking), syntactic parsing, summarisation, information extraction, question answering or machine translation), as well as the data structures in typical speech-based NLP applications (including text-to-speech generation, speech recognition, question answering or automatic interpretation), have indeed very little in common with the data structures found in a human-readable electronic dictionary. At this level it would thus be possible to differentiate between NLP lexicons on the one hand, and human-readable electronic dictionaries on the other. However, there is a clear trend towards ever more inclusion of NLP components in electronic dictionaries. Nesi has for instance proposed the following loose definition for 'electronic dictionary':

> 'The term *electronic dictionary* (or ED) can be used to refer to any reference material stored in electronic form that gives information about spelling, meaning, or use of words. Thus a spell-checker in a word-processing program, a device that scans and translates printed words, a glossary for on-line teaching materials, or an electronic version of a respected hard-copy dictionary are all EDs of a sort …' (Nesi 2000b: 839)

In its most simple form a spellchecker is just a list of (the most frequent) words, which can hardly be viewed as a dictionary, unless the thesaurus and grammar components are seen as an integral part of it. The point, however, is that a spell-checker is a basic NLP system – and less basic when it includes a morphological analyser (and grammar checker). Likewise, the second type of electronic

dictionary mentioned (a device that scans and translates printed words) can obviously be seen as a 'talking bilingual dictionary' – yet, packed with NLP software. Conversely, some NLP lexicons can also be, and are, consulted by humans. Examples for English are *WordNet* (Fellbaum 1998) – currently the most popular lexicon in NLP (Zaenen 2002: 234), although originally aimed at human users (Boguraev & Briscoe 1989b: 24) –, and *FrameNet* (Fillmore & Atkins 1998; Fillmore & Baker 2001). Nesi's description of an 'electronic dictionary' is however a good working definition, as it lists those 'object' electronic dictionaries that people also perceive to be electronic dictionaries. All these objects emanate from the same 'concept' electronic dictionary, that is to say, they are collections of structured electronic data that can be accessed with multiple tools, enhanced with a wide range of functionalities, and used in various environments. The focus in this article is, then, also on such object electronic dictionaries, which, for the reasons just hinted at, will also include some NLP extensions. Pure large-scale NLP lexicons designed specifically for computer applications will however not be treated. In this article, the term 'ED' will therefore stand for 'human-oriented electronic dictionary'.

From a user's perspective, the most innovative aspect of EDs is probably the retrieval system (Nesi 2000b: 839). Revolutionary though this retrieval system may be, without actually doing something about the contents too (through the addition of more and new types of information), and without truly implementing fully integrated hypermedia access structures, EDs aren't really very different from their paper counterparts (cf. e.g. Sharpe (1995: 48); Lehr (1996: 315); Rundell (1998: 328); Wiegand (1998a: 239)). From this one could conclude that most present EDs are stuck in Cerquiglini's second phase. However, it would be an exaggeration to claim that there is no ED (project) in which lexicographers have not tried to move to the third phase. Actually, with the ever-increasing power, speed and memory capacities of computers, the growing flexibility of databases and indexation systems, and the inclusion of NLP aspects, lexicographers' dreams have steadily multiplied and found their way to the creation of better EDs.

If scholarly discussions and the large-scale commercial production of EDs were still a rarity in the 1980s, they began to break through a decade later, with a boom from the mid-1990s onwards. This evolution is apparent when one reads through, for instance, the different EURALEX proceedings, or the volumes of the metalexicographic annual *Lexicographica*. As such, the topic of EDs, in addition to being discussed in journals dealing with computer science, language learning and language teaching, made its appearance in (meta)lexicographic publications.

3. Electronic-Dictionary Typologies

'More original typologies are undoubtedly imaginable, for instance one that would be based on the functions of dictionaries and/or on the different types of organization of addresses (that is, types of organization of access to information).' (Hausmann et al. 1989: xix)

It is well-known that any typology of reference works is to a very great degree fluid, and this is no different when it comes to EDs. A brief overview of some of the ED typologies that have been proposed in the 1990s will now be presented in chronological order, after which we will introduce our own suggestion. At the start of the 1990s, Martin (1992: 193–4) observed the following 'objects', as he calls them, in the lexicographical landscape: (1) dictionaries for human users, (2) computer-based dictionaries, (3) machine-readable dictionaries, (4) lexical/term banks, (5) machine dictionaries, (6) lexical databases, and (7) artificial intelligence lexicons. As one can notice, no attempt is made to differentiate between computational and non-computational 'objects'. It should not come as a surprise that the first dedicated ED typologies have also been developed where EDs first became popular, that is in the Far East. Ide's typology (1993a, b, cited in Sharpe 1995: 40–1) is based on differences in hard- and software and only focuses on electronic bilingual dictionaries (EBDs). Ide differentiates between: (1) specific EBDs, (2) electronic notebooks, (3) CD-ROM EBDs, and (4) ED software. A typology solely based on hard- and software does not seem to be very efficient, since it requires constant readjustments to cater for the never-ending innovations. Indeed, two years after Ide's four-way classification of EBDs, Sharpe (1995: 41) already had to add two further types of EBDs: (5) floppy-disk based portable EBDs, and (6) EBDs with hand-held optical character recognition (OCR) scanners.

One year later, a more convincing two-step technical-(meta)lexicographic ED typology by Lehr (1996: 315) appeared in print (shown in Figure 1). In a first step, EDs are classified on technical grounds, the main dichotomy being online vs. offline dictionaries, the offline dictionaries being further divided into pocket electronic dictionaries (PEDs) and PC dictionaries, and the latter then being subdivided into CD-ROM, floppy disk(s) and other dictionaries. In a second step, each of these EDs can then be evaluated on (meta)lexicographic grounds. Either an ED is based on a paper dictionary or it is a new development, and each of the latter types can further have a print appearance (i.e. onscreen the ED looks like a printed dictionary page) or have an innovative appearance (i.e. the ED does not mimic the display of paper dictionaries).

Among the recent typologies is Nesi's (2000b: 842). According to her, the 1990s saw the emergence of four types of EDs for language learning. Her data for these four types have been tabulated in Table 1. Even if the distinctions in Table 1 might have been fairly clear-cut a decade ago, Nesi (2000b: 841–3) rightly points out that they are presently blurred as, for example, highly innovative dictionaries are being developed for the Internet (some of which can only be accessed by subscription), online courseware is becoming commercially available and put on CD-ROMs, CD-ROM dictionaries are placed on the Internet, and PEDs are starting to receive more serious lexicographical attention.

From this brief overview, it is clear that none of these proposed ED typologies is entirely satisfactory to cover today's variety. We would therefore like to suggest a typology based on one main, rigid criterion: the way in which dictionaries are *accessed*. More particularly, in designing this typology, we had one question in mind: "WHO accesses WHAT WHERE?" The resulting three-step typology is thought to be flexible enough to cater for future innovations.

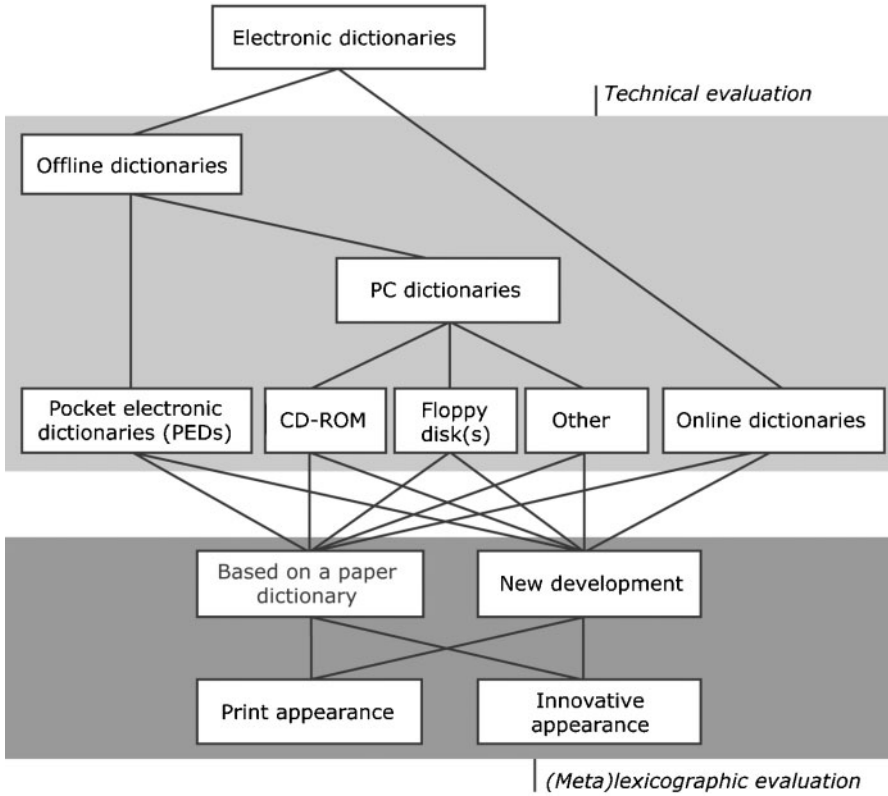

Figure 1. Two-step technical-(meta)lexicographic electronic-dictionary typology (Lehr 1996: 315, redrawn and translated here).

Table 1. Dictionary typology for the electronic age (Nesi 2000b: 842)

#	*Type?*	*Source?*	*Who?*	*Profit?*
1	Internet dictionary	(outdated) copyright-free material & users' contributions	[Netizens]	—
2	glossary for online courseware	[new material]	language-department staff members at universities	—
3	learners' dictionary on CD-ROM	reputable hardcopy reference books	major dictionary publishing houses	✓
4	PED	[no-named (hardcopy) source]	makers of electrical goods	✓

The first step in this three-step access typology answers the question "WHO accesses the dictionary?" Here one has two possibilities: either it is machines or it is humans. Machines can access NLP lexicons, humans can access human-readable dictionaries, while both machines and humans can access lexicons designed for NLP as well as human use.

For the second step, we need to answer "WHAT is accessed?" Reformulated, this means that we are seeking the dictionary medium. One can differentiate between a physical-object (i.e. non-electronic) medium and an electronic medium. Both these media can be further divided into handheld devices vs. robust machines. Central to the current discussion is the electronic-dictionary medium. From the overview presented in §2 it follows that 'human-oriented electronic dictionaries' (for short EDs) can simply be human-readable databases – possibly augmented with NLP software (such as morphological analysers), NLP lexicons in their own right (such as spellchecker lexicons),[1] or databases designed for NLP as well as human use (e.g. *WordNet* and *FrameNet*). The physical-object medium can cover the printed rendering of human-readable dictionaries and of lexicons designed for NLP and human use. Lastly, the electronic data of the latter and the NLP lexicons proper feed the large-scale working NLP systems (*not* the topic of this article). The two top layers in Figure 2 show the first two steps of the typology so far.

If the first two steps were rather straightforward, they were necessary to set the scene for the third step. The answer to the question "WHERE does one access the dictionary data?" can also be viewed as a search for the *type of storage* (or hardware in computer terms). For contrastive reasons we will begin with the types of storage for the physical-object medium. The classification is kept to a minimum, and we consider only some of the storage types diachronically. As far as handheld devices are concerned, we can name the clay tablet, waxed wooden tablet, papyrus, volumen, codex, etc. up to the printed page.[2] In this article, the latter (the printed page) is referred to as the so-called traditional 'paper dictionary'. In order to conserve the data of especially the early types of storage, the data can be photographed and stored on microfiches. A robust machine is required to read the resulting multiple micro-images reduced from the original.

Moving to the EDs, both the handheld devices and the robust-machines can be further subdivided along the lines of stand-alone vs. networked storage. Examples of handheld stand-alone dictionaries are PEDs, reading pens, or lexicons supporting text-messaging in cellular phones. At present, handheld networked dictionaries are scarcely out of the egg, yet some mobile electronic organisers currently marketed in technologically advanced countries do already provide access to some online dictionaries. Finally, today's most popular robust electronic machines are the desktop and laptop computer. In stand-alone versions, dictionaries are stored on various types of disks (CD-ROM, DVD, hard disk, etc.), while hard disks are primarily used as storage in the networked versions. For the latter, one must also make a distinction between dictionaries which are only accessible on a local area network, thus stored and only accessible on an intranet system (of corporations, libraries, universities, etc.), and those dictionaries available

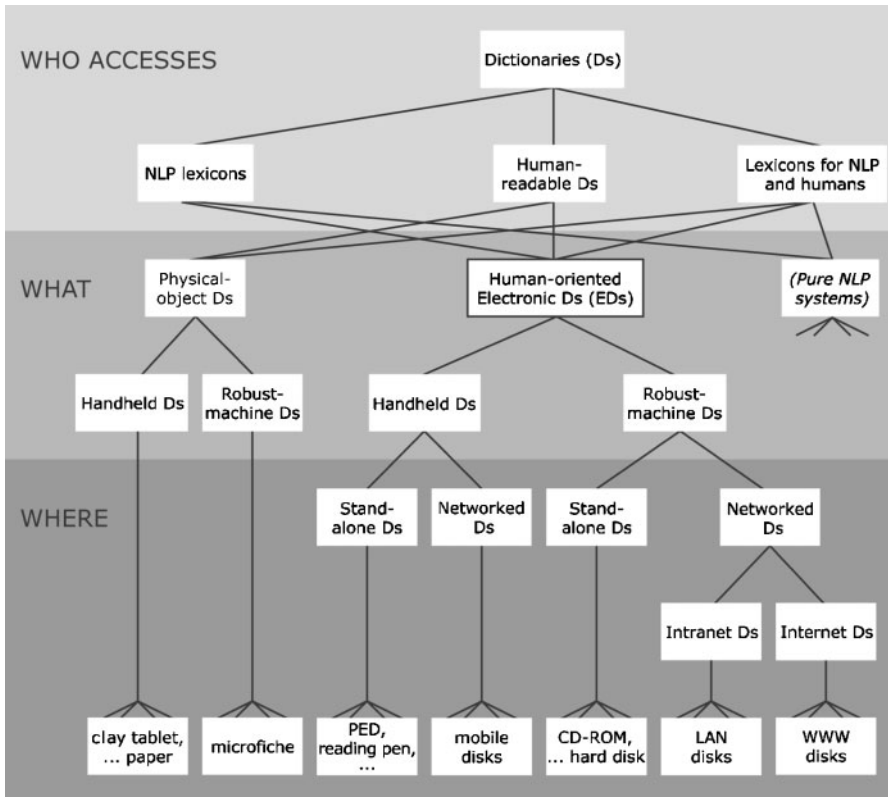

Figure 2. Three-step access dictionary typology (answering the question "WHO accesses WHAT WHERE?").

worldwide, thus stored on servers accessible on the Internet. (In addition, for each of the EDs one could add what Lehr (1996) termed a '(meta)lexicographic evaluation'.[3])

At the pace of today's technological innovation, widespread and generalised full access to the Internet (and thus also to Internet dictionaries) from handheld, wireless electronic devices seems possible (compare Leech & Nesi 1999: 305). When that day comes, dictionaries accessed in this way will, as a hybrid, be able to combine most of the strong points of both PEDs and Internet dictionaries. Likewise, many of today's intranet computers are also connected to the Internet, and more and more home-computer users log on to the Internet. In such environments the strong points of intranet or CD-ROM dictionaries can be combined with those of Internet dictionaries. In order to remain as close as possible to today's average reality however, we will not collapse the different types as yet, nor anticipate what is not already (widely) on the market. We will therefore focus on the ED types listed in Table 2, where the bottom level in that table answers the question "WHO accesses WHAT WHERE?"

Table 2. Today's average paper and electronic-dictionary reality

	Electronic dictionary (ED)			
	Dictionary on a stand-alone computer		*Dictionary on a networked computer*	
Traditional paper dictionary [PAPER]	*Handheld dictionary (e.g. PED)* [PED]	*Robust-machine dictionary (e.g. CD-ROM)* [CD]	*Intranet dictionary* [INTRA]	*Internet dictionary* [INTER]
one user uses a handheld book to access a D stored on paper	one user uses a palmtop to access a D stored on a small disk	one user uses a laptop/desktop to access a D stored on a large disk	a group of users use laptops/desktops to access a D stored on a local mainframe	users worldwide use laptops/desktops to access a D stored on an online server

4. Paper Dictionaries *versus* Electronic Dictionaries: Pros and Cons

'It is my view that the advantages of the electronic dictionary and the familiarity of today's young people with electronic devices will eventually relegate the printed notion of "dictionary" to a secondary sense.' (Sharpe 1995: 49)

In the scholarly literature on EDs, the most frequent collocate of ED is most probably *advantage*, where that advantage is perceived in comparison with paper dictionaries. We obviously fully adhere to this view, yet want to give both types a fair treatment. In this section we will therefore: (1) focus on the pros '✓' of both types, so the absence of a pro implies a con '—', (2) grade the pros in some instances using stars '*/**/***' (where more stars stand for a higher degree of positive feedback gleaned from the literature), and (3) attempt to look at 'comparable aspects', whilst leaving the (electronic) dreams for a later section.

Using the five dictionary types listed in Table 2, we will arrange our discussion in such a way that the pros gradually move from PAPER, via PED, CD, INTRA to INTER (see Table 2 for the codes and Figure 2 for the full typology). In the tables that will accompany this discussion, a selection of relevant references to the literature is included.

4.1. *The Unbeatable Paper Dictionary*

Some aspects of the traditional paper dictionaries that, as of today, remain unbeatable, are listed in Table 3. Despite Sharpe's view that the printed notion of 'dictionary' will eventually be relegated to a secondary sense, paper dictionaries remain by far the most familiar products (#1). They have a symbolic value in that the importance of a language is somehow palpable, and a book or set of books can be admired in a library (#2). Consulting paper dictionaries is also cosy: they are easy to browse, can truly be read recreationally, show the scope of treatment in a natural way, provide pleasure when physically handled, and do not stress the eyes as much as computer displays (#3–4). As an illustration, Hausmann is reserved when it comes to an 'all-electronic' future and stresses the importance of 'un espace papier qui préserve le feuilletage par voisinage, qui autorise aussi spontanément une appréciation physique du volume, de son «poids» et des proportions de l'information offerte par rapport à l'ensemble' (cited in Pruvost 2000: 191). Paper dictionaries also allow users to physically annotate or underline specific information in the dictionary (#5).[4] Finally, paper dictionaries are durable, have a solid independent existence (whereas the data carrier and interface of EDs become obsolete), and do not require a computer to be switched on (#6–8). As trivial as the latter may sound, this is still crucial in many parts of the world.

4.2. *The Handheld Ease*

In this second subsection, we will look into aspects of paper dictionaries that still score high, yet where they are at the same time joined by PEDs. Together they represent the handheld dictionaries. Table 4 summarises their advantages. Both paper dictionaries and PEDs are portable and can be used anywhere straight

Table 3. The unbeatable paper dictionary

#	*Advantage*	*Paper*	*PED*	*CD*	*Intra*	*Inter*
1	familiar, reassuring (Abate 1985; Bailey 1986; Landau 2001)	✓	—	—	—	—
2	symbolic value as a physical object that can be owned and admired (Ford 1996; Considine 1998)	✓	—	—	—	—
3	easy to browse, can most readily be read recreationally, easy global reading, manhandling is part of the reading pleasure (Hausmann (in Pruvost 2000); Landau 2001)	✓	—	—	—	—
4	easy to read, best for the eyes (Corris et al. 2000; Landau 2001)	✓	—	—	—	—
5	easy to annotate, one can physically write on them (Considine 1998; Corris et al. 2000)	✓	—	—	—	—
6	durable, can be carried around the world without fear of serious damage or loss of functionality (Dodd 1989; Leech & Nesi 1999)	✓	—	—	—	—
7	has a solid independent existence (i.e. is not plugged into anything and nothing is plugged into it (Leech & Nesi 1999; Landau 2001; Jacquet-Pfau 2002)	✓	—	—	—	—
8	does not require a computer to be switched on (Perry 1997; Harley 2000; Nesi 2000a)	✓	—	—	—	—

Table 4. The handheld ease

#	*Advantage*	*Paper*	*PED*	*CD*	*Intra*	*Inter*
9	can be used straight after acquisition (i.e. without further purchases and without the need to have a laptop/desktop switched on) (Sharpe 1995; Nesi 1999)	✓	✓	—	—	—
10	can be used anywhere, not site-dependent (Perry 1997; Nesi 1999; Corris et al. 2000)	***	**	—	—	—
11	portable, small size, low weight (Taylor & Chan 1994; Sharpe 1995)	**	***	—	—	—
12	offline access (i.e. the D need not be connected to an intranet or the Internet) (Harley 2000; Nesi 2000a, b)	✓	✓	✓	—	—
13	low-profile product (i.e. not seen as a gadget or status symbol) (Poirier 1989; Taylor & Chan 1994)	***	—	**	**	*

after purchase (#9–11). However, PEDs are not as site-independent as paper dictionaries, and a multi-volume or large-sized dictionary is obviously less portable than a PED. (These differences account for the different star-ratings.) Another advantage for paper dictionaries and PEDs, an advantage the stand-alone dictionaries on disk share, is the fact that they can be accessed offline (#12). Finally, paper dictionaries have a low profile compared to electronic products, with PEDs often considered to be mere gadgets or status symbols (#13). Observe that a gadget that is perceived as a status symbol may increase the motivation to use it though, and where potential buyers are well-heeled, PEDs are indeed frequently used (Nesi 1999: 57). According to Landau (2001: 95–6), PEDs already have an effect on the bilingual market.

4.3. *The Local Disk Ease*

In the late-1980s, and some time after the gadget-like PEDs had already been circulating, the first dictionaries on CD-ROM saw the light.[5] With the advent of the CD-ROM the hardware space restrictions of the earlier electronic products were exploded, a trend presently continued with DVD technology on the one hand and ever larger hard-disk capacity on the other, enabling the easy transfer of CD-ROM data onto a computer's fixed disk. These disks' most important present-day advantages over the other dictionaries are listed in Table 5. Compared to paper, storing dictionaries on CD-ROM(s) takes very little physical space (#15). According to Chi, the Chinese have always held reference works in high esteem and have regarded them as 'teachers who cannot talk' (1998: 565). Today, thanks to the electronic medium, they too can finally talk. Various useful applications – true additions to the paper dimension – have already been implemented such as audible pronunciation, a range of sound files and record-and-compare facilities (#14, #16). The most amazing feature of local-disk based dictionaries is probably the rapidity at which (multimedia) data can be retrieved (#17). Also innovative are the new ways one can call upon to present data, for example computer graphics (#18). Some are excellent, such as Corris et al.'s 'moving coloured network representations of related words' (where synonyms attract and antonyms repulse one another, etc.) (2000: 172), yet others are utterly misleading, such as the 'waveform graph visualising pronunciation' (for a convincing critique, see Sobkowiak (1999: 59–62) who shows that even feeding the original recording back does not result in the same graph). To some, it is the variety of look-up routes possible in EDs (fuzzy searches, hyperlinks, etc.) which makes this medium truly exciting (#19). Still others argue that 'flexibility' (user customisation, interactivity, user-friendly interfaces, etc.) should be regarded as the most attractive aspect of EDs (#20–21). Finally, ED copy-and-paste facilities are also appreciated (#22). For each ED advantage discussed here, the networked implementations trail behind the local-disk ones.

4.4. *The Electronic Ease*

By now, the pros in our tables have moved away entirely from the paper dictionary towards the EDs. If one considers the EDs as a group, one notes that

Table 5. The local disk ease

#	*Advantage*	*Paper*	*PED*	*CD*	*Intra*	*Inter*
14	availability of audible pronunciation (thus no need to learn IPA) and sound files (Sobkowiak 1999; …)	—	**	***	*	*
15	D to be bought takes very little space and has an extremely low weight (Poirier 1989; Milic 1990; Zgusta 1991)	—	*	***	N.A.	N.A.
16	record-yourself facility (i.e. comparison of one's own pronunciation with the stored one(s)) (Battenburg 1998; Sobkowiak 1999)	—	*	***	*	*
17	speedy access to D data (Harley 2000; Geeraerts 2001)	—	*	***	**	*
18	alternative ways of presenting information (e.g. computer graphics) (Atkins 1996; Corris et al. 2000)	—	*	***	**	**
19	fuzzy search facility, multi-access, range of look-up routes, hyper reference (Kay 1983, 1984; Dodd 1989; Sobkowiak 1996)	—	*	***	**	**
20	(large-scale) user customisation; interactivity (Atkins 1996; Sobkowiak 1999)	—	*	***	**	**
21	highly user-friendly interface (Docherty 2000)	—	—	***	**	*
22	copy-and-paste facility (Nesi 1999; …)	—	—	***	**	**

there are some shared advantages compared to paper dictionaries. These have been tabulated in Table 6. Many an author, especially those working in the PED field, stress the importance of novelty leading to an increased motivation to actually consult the EDs (#23). One will note that this advantage is the antipode of advantage #1 listed in Table 3. Also, going electronic means less paper in the office (#24). The true core of the ED revolution however, lies in the fact that users are liberated from the alphabetical straitjacket, that hypertext, menus, etc. eliminate (artificial) linear text restrictions, that the data conjured up onscreen are not static, and that powerful search capabilities ensure a smooth overarching navigation (#25–27).

4.5. *The Online Ease*

From the moment that one considers networked dictionaries, it is clear that there are a number of aspects in which they, without question, have the advantage. These advantages have been enumerated in Table 7. Moving from the paper dictionary to dictionaries offered online in the public domain, thus on the Internet, one notices an ever-increasing storage capacity (#28). Some lexicographers have started to view the Internet in its entirety as a huge store of knowledge and thus as a huge encyclopaedia. From a sound metalexicographic point of view this is hard to accept, yet the Internet can definitely be used as the largest available collection of electronic data (accessible through e.g. web crawlers, see Grefenstette & Nioche 2000; Hanks 2001), with many hundreds of dedicated corpora also accessible (#29). The question remains, however, whether the average user is able to process the raw data and to turn these into lexicographically sound information. A similar problem arises with what is known as 'one-stop consultation', that is Internet sites where one searches up to several hundreds of dictionaries simultaneously. All the search data are shown in long lists, results from trustworthy sources and downright amateurish concoctions all mixed up (#34). Yet, the technology is there, and advanced users might benefit from it.[6] Further, dwindling space constraints open the way to new types of information such as video sequences or animation (#30–31). Another positive aspect of online dictionaries (and also stand-alone disk dictionaries, but not PEDs) is their large-scale linkability with other software (#32). This possibility is most successfully exploited in Computer-Assisted Language Learning (CALL) lingware. Also, if there is one undeniably positive feature of online dictionaries, it is that they have the potential of never being out of date, and can as such represent the ultimate dynamic repository of knowledge (#33).[7] Two decades ago, researchers like Arnold (1979: 110) and Kay (1983: 162–4) predicted that dictionaries would cease to be merely *products*, and would start to be offered as a user-oriented online *service*. According to Dodd, this has the advantage that, whereas printed dictionaries have a fixed price tag regardless of the usage, querying online dictionaries may be charged per consultation only (#35). Finally, Internet dictionaries are the only ones that have the potential of being used by anyone in the world for free, and some excellent dictionaries are indeed to be found on the Internet (cf. References) (#36). Landau rightly points out, however, that 'in most cases accessibility is limited to looking up particular

Table 6. The electronic ease

#	*Advantage*	*Paper*	*PED*	*CD*	*Intra*	*Inter*
23	charm of novelty (Taylor & Chan 1994; Corris et al. 2000)	—	✓	✓	✓	✓
24	paper-less office, ecologically sound (Dodd 1988; Ford 1996; Macklovitch 1996)	—	✓	✓	✓	✓
25	users are liberated from alphabetical order (Dodd 1988, 1989; Atkins 1996; Leech & Nesi 1999)	—	✓	✓	✓	✓
26	elimination of linear text restrictions; not everything needs to be written/visual and constant (Atkins 1996; Selva & Chanier 1998; Abel & Weber 2000)	—	✓	✓	✓	✓
27	optimisation of cross-referencing (e.g. avoidance of having to look up two items if the first should be a cross-reference) (Lemmens & Wekker 1990; Landau 2001)	—	✓	✓	✓	✓

Table 7. The online ease

#	*Advantage*	*Paper*	*PED*	*CD*	*Intra*	*Inter*
28	no space constraints other than the need to avoid swamping the user, huge quantities of data (Lemmens & Wekker 1990; Atkins 1996; Hanks 2001)	—	*	**	***	***
29	rapid access to large amounts of lexicographical evidence in corpora (Atkins 1996; Macklovitch 1996; Leech & Nesi 1999)	—	*	**	***	***
30	new types of information (Atkins 1996)	—	*	**	**	***
31	video sequences, animation (Nesi 2000b; Sato 2000)	—	*	**	**	***
32	links with (other) software (e.g. built-in teaching/learning, games, etc.) (Fox et al. 1980; Macklovitch 1996; Sobkowiak 1999)	—	—	✓	✓	✓
33	up-to-date; dynamic repository of knowledge (Kay 1983; Carr 1997; Harley 2000)	—	—	—	✓	✓
34	one-stop consultation (i.e. simultaneous searches of hundreds of native speaker and bilingual Ds) (Neff et al. 1988; Nesi 2000a, b)	—	—	—	—	✓
35	consultation cost based solely on the actual use (Dodd 1989)	—	—	—	—	✓
36	cheap if not free (Carr 1997; Harley 2000; Nesi 2000a, b)	—	—	—	—	✓

words. This kind of access is a selling tool rather than an information service, designed to entice the user to buy a book, CD, or electronic access to text on the Internet' (2001: 96).

4.6. *The Gains for Dictionary Compilers, Researchers and Publishers*

So far, we have been discussing the pros and cons of the different dictionary types from the point of view of the users (§4.1 through §4.5). This approach is defendable in that today's metalexicography places a high premium on the user-perspective (Knowles 1990: 1647). To round up this section, however, we will briefly list some gains for dictionary compilers, researchers and publishers. These are shown in Table 8. At present, Internet dictionaries are mushrooming. There are literally many thousands of them, unfortunately mostly the result of sloppy and hasty compilations or the in-progress output of so-called 'bottom-up collaborative editing'. The latter is a process whereby 'new types of references are evolving upward from readers directly onto the Net' (Carr 1997: 214). As exciting and 'democratic' (Simonsen 2000: 94) as this might appear at first, without mechanisms for quality control, such projects are of little scientific value (#37). A significant advantage for all concerned in the production of dictionaries is the fact that CD-ROMs are the easiest to protect against piracy and illegal copying (#38). They can also be produced at a fraction of a dollar (#39). From the moment one focuses on online dictionaries, there are no stock and diffusion costs anymore (#40). Much more importantly, the potential for feedback is enormous. Firstly, since all searches are automatically logged, dictionary compilers, researchers and publishers have free access to a variety of implicit types of feedback which each of them can put to good use in their field (#41). The potential of log files was already pointed out as early as 1984, following a presentation by Crystal at the first Fulbright Colloquium. In the discussion summary of the proceedings of that colloquium one reads that 'users of computerised dictionaries can have their procedures logged on the computer istself [sic]' (Crystal 1986: 80). One year later, Abate suggested using such feedback to enhance the structuring of data, access time, etc. in his projected dictionary's database of the future (1985: 283). Note that log files are not restricted to online dictionaries (where they are most convenient though). Tono (2000: 858), for instance, describes how he used a Microsoft Camcorder in research to record users' look-ups in various CD-ROM dictionaries. A second type of feedback that is facilitated with online dictionaries is the possibility for users to comment online or to suggest to-be-added items (that they for instance did not find in the dictionary) on the spot (#42). It is well known that a 'letter to the publisher' is much more easily written in an online electronic medium than when one has to actually pen down comments. Finally, through Internet dictionaries a customer base consisting of the users can easily be accessed and approached with various offers and advertisements (#43).

5. Electronic-Dictionary Dreams: A brief diachronic perspective

'[A] few lines may be spent on a fling of imagination if necessarily a nebulous one.' (Zgusta 1991: 3158)

Table 8. The gains for dictionary compilers, researchers and publishers

#	*Advantage*	*Paper*	*PED*	*CD*	*Intra*	*Inter*
37	controllable proliferation (Docherty 2000; Nesi 2000a)	✓	✓	✓	✓	—
38	protection against piracy and illegal copying (Geeraerts 2001)	—	***	***	**	*
39	negligible cost of a single D (Ford 1996; Sobkowiak 1999)	—	—	✓	N.A.	N.A.
40	no stock and diffusion costs (Poirier 1989)	—	—	—	✓	✓
41	free implicit feedback: all searches are automatically logged (so one can find out exactly what and how people look up) (Crystal 1986; Sobkowiak 1999; Harley 2000)	—	—	—	✓	✓
42	direct feedback: users are encouraged to comment instantly on articles and suggest new items (Harley 2000)	—	—	—	✓	✓
43	availability of a large, easily accessible customer base, advertising opportunities (Harley 2000)	—	—	—	—	✓

With the pros and cons of the various dictionary types discussed in the previous section – where one cannot but note the preponderance of ticks and high star-ratings in the ED field – it should not come as a surprise that nearly everyone involved in present-day dictionary making is enthusiastic about the potential of the electronic medium. ED dreams are indeed not without a solid basis. Given this knowledge, we can now look into some of those dreams in more detail without laughing them away as mere science fiction. In this section a brief diachronic perspective will be offered, the next one (§6) will be much more detailed.

As early as 1971, Aitken prophesied that 'both archive and dictionary will become available for general consultation at remote terminals so that dialogue communication with both, perhaps using a screen outlet, will become possible' (1971: 16). Today's text corpora and EDs available on the Internet seem to have walked straight out of Aitken's dream. The 1970s and 1980s seem to have been a breeding ground for many prophecies lexicographic, see for example Kay (1983, 1984) on the 'dictionary server', or Arnold (1979), McArthur (1986) and Grosbart (1987) for similar dreams. At the first Fulbright Colloquium in 1984, Bailey briefly summarised some utopian dictionary schemes up to that moment (1986: 134), while Crystal presented his 'ideal users in their ideal lexicographical world' (1986: 79). Crystal's projection is remarkable, for it not only stresses 'technological wizardry', but pays at least as much attention to 'a new user behaviour'. It is indeed undeniable that lexicographic products function best where there is a highly developed dictionary culture. As for Crystal's projected technology, we are still eagerly awaiting voice-activated EDs. Then, near the end of the 1980s, Dodd explored his remarkable version of the dictionary of the future, suggesting that with profiles stored on the computer for each individual user 'it becomes possible to think in terms of a personal dictionary' (1989: 92).

In 1996 the dream of a 'personal dictionary' is pushed even further with Atkins' futuristic concept of the 'virtual dictionary'. Here a de-terminologised use of virtual is exploited, as shown by Meyer et al. (1998). According to the latter scholars, and within a framework influenced by a prototype approach to lexical description, 'Atkins' *virtual dictionary* activates the features COMPUTING and DYNAMIC' (1998: 648). DYNAMIC – which 'refers to the notion of "created for a specific purpose and for a limited period of time" ' (1998: 647) – is the 'strongest' of the two semantic features. This leads Meyer et al. to the following brief description of Atkins' dream: 'Atkins' (1996) *virtual dictionary* is created for a specific user and his/her specific needs at the time of dictionary consultation' (1998: 647).[8] The idea behind the virtual dictionary is straightforward. The starting point is a set of databases (in the case of bilingual dictionaries, two) created through the application of a *Frame Semantics* approach to corpus analysis.[9] It is crucial that all the monolingual databases be compiled within the same theoretical framework, here Frame Semantics, so that most of the linguistic facts are inter-compatible. From these databases, dictionaries are created using four different processes, viz. simple extraction, partial translation, comparison and alignment, and each of these processes involves the introduction of hypertext links.[10] Atkins summarises her own proposal as follows: 'the monolingual databases are *real*; links (including metalanguage and instructions)

between database items are *real*; the dictionaries themselves are *virtual*' (1996: 531). On top of this framework, Atkins sketches some options for customising the various dictionaries to suit individual needs.

A brief overview of ED dreams is not complete without also mentioning Grefenstette who – together with people like Atkins, Kay, Hanks, etc. – belongs to the few who not only dreamt but also contributed to the development of new lexicographic tools and strategies for the ED age. One of Grefenstette's beliefs is that future lexicons will be 'three and four and five dimensional in which information is stored about how each word is used with each other word, and how that pair of words is used with a third word, and that triple with a fourth word' (1998: 39). Visions like those of Grefenstette and Atkins not only imply massive data structures, but also indicate that the dictionaries of the future needn't really be there anymore, meaning that they might only exist at the time of access.

6. Creating Order in Dreamland

'Electronic dictionaries would be most effective if they were designed from scratch with computer capabilities and computer search mechanisms in mind.' (Nesi 2000a: 140)

We will now try to classify ED dreams in a more rigid way, attempting to take stock of what has been dreamt and achieved so far. From the characterisation of the concept 'human-oriented ED' in §2 (cf. also Figure 2) it follows that the dreams will include extensions to NLP components. Furthermore, besides commercial, experimental EDs will be considered as well, since dreams are often realised in such environments first. For the discussion below, we will group the various dreams around similar features (grouping data and functionalities), provide selected references to the literature throughout, and indicate: (1) the degree of realisation of each dream at the time it was mentioned in the selected literature, and (2) the degree of current realisation for each of those dreams. (1) and (2) will be treated in columns labelled THEN and NOW respectively, and three symbols will be used to grade this degree: '—' not realised, '±' more or less realised, '✓' realised. (For the column THEN, the date of the first cited reference is considered.) The focus will be on EDs, not on 'the user of the future' nor 'the lexicographer of the future'.

6.1. *Dreams Revolving around Space & Speed*

With the ever-developing capabilities of computers being the impetus for most lexicographers' dreams, it is logical that quite a few projections have to do with the seemingly endless data storage capacities and the soaring rapidity with which data can be retrieved, processed and presented. Dreams primarily revolving around these aspects, and calls for their sensible use, are looked at in this first subsection, summarised in Table 9. Although storage capacities have risen throughout the 1990s, and even though entire encyclopaedias have been placed on one or more CD-ROMs, methods to avoid swamping the user are still very much underdeveloped (#1). In addition, Hanks rightly points out that the 'absence of space constraints call for more, not less intellectual discipline in the

Table 9. Dreams revolving around space and speed

#	*Dream*	*Then*	*Now*
1	no space constraints other than the need to avoid swamping the user, huge quantities of data (Abate 1985; …)	—	±
2	let 'the computer' help in treating a D's bulk (e.g. with valences of verbs, collocates of nouns, etc.) (Zgusta 1991; Leech & Nesi 1999)	—	±
3	offer entire (monolingual) learners' dictionaries as PEDs; wireless communication between PEDs and large data resources on the Internet (i.e. where the problem of information capacity can be ignored) (Perry 1997; Leech & Nesi 1999)	—	—
4	no need to exclude possible inclusions or extra example sentences on the basis of space (Dodd 1989; Harley 2000; Tono 2000)	—	±
5	liberate the makers of historical Ds from the need to truncate their quotations (Considine 1998)	—	—
6	inclusion of a full thesaurus as an integral part (Atkins 1996; Leech & Nesi 1999; Varantola 2002)	—	±
7	disappearance of the long-standing dispute regarding the inclusion or exclusion of encyclopaedic information (Dodd 1989)	—	±
8	offer monolingual functions (definitions, etymologies, usage notes) in bilingual and multilingual Ds (Atkins 1996)	—	—
9	give SL a full treatment, just as in a monolingual D (Atkins 1996)	—	—
10	create a sum of D types, combine (and integrate) various reference information sources (Lemmens & Wekker 1990; Leech & Nesi 1999)	—	±
11	one-stop consultation (i.e. simultaneous searches of hundreds of native speaker and bilingual Ds) (Neff et al. 1988; Nesi 2000a, b)	—	✓
12	up-to-date; dynamic repository of knowledge (Kay 1983; …)	—	±

selection and arrangement of information' (2001: 9), while Corréard (2002b) convincingly argues that some space-saving strategies remain useful in EDs. For a different (and somewhat dated) view on the 'space problem', see for example Clear who is convinced that 'limitations of space are still an issue' (1996: 265). Even so, EDs have started to take care of what Zgusta called 'the dictionary's bulk' (#2). On the whole, extra space has only begun to result in more data on most levels (#3–7). As far as bilingual and multilingual dictionaries are concerned, we are still awaiting the first EDs answering Atkins' calls to include monolingual functions and to give the source language its due treatment (#8–9). Also, the creation (and integration) of a sum of dictionary types from which users could select and combine elements is still mostly on the drawing-boards (#10). On the other hand, and moving to speed considerations too, the possibility to search hundreds of dictionaries simultaneously has become a reality online, yet again mostly without methods to avoid swamping (#11). Finally, even though online dictionaries have the potential of being 'never out of date' (as e.g. claimed by the *Longman Web Dictionary* 2000), in reality most EDs aren't very different from their paper counterparts as far as up-to-dateness is concerned (#12).

6.2. *Dreams Revolving around Multimedia*

The issues dealt with in Table 9 concentrated on giving more space to text. Yet, just as in a paper dictionary, space (and thus memory) can also be allocated to line drawings, illustrations, photos, images, maps, charts, various kinds of graphs, etc. With this we have moved to multimedia, which in addition include animation and video, and also all things audio. In this subsection we will first look into 'computer graphics' (here the cover term for all multimedia except text and audio), and subsequently 'audio'. The former is done in Table 10. Challenging words to define with text, such as procedures, relations and uncommon objects, may be clarified graphically throughout in an ED (#13). One of the gadgets predicted by Zgusta a decade ago, namely to one day be able to give non-static representations of actions and processes in an ED, has indeed come true (#14). The *Oxford Advanced Learner's CD-ROM Dictionary* (2000) for instance, utilises high-quality video sequences to illustrate over eighty hard-to-define verbs such as 'flick', 'shrug' and 'sneer'. Since the early-1990s CD-ROM dictionaries have contained all kinds of moving material and video sequences, yet, whereas these were mostly unrelated to the look-up process back then, they are becoming more functional these days (#15). In the mid-1990s Sharpe predicted that a particularly interesting use of motion (especially for learners) would be to show logographic characters being written by means of animation (#16). CALL lingware doing just that has been developed in experimental environments since then (e.g. Wang 1999). The use of various interactive and/or automatically generated (and moving) coloured network representations has also exploded recently, especially in research dictionary set-ups, and gradually also on the commercial market (#17). Finally, and with this we link on to the audio applications, some dictionaries display a (misleading, cf. §4.3) waveform graph visualising pronunciation (#18).

Table 10. Dreams revolving around computer graphics

#	*Dream*	*Then*	*Now*
13	enhanced illustration throughout: procedures, relations and uncommon objects may be clarified graphically (Abate 1985)	—	✓
14	non-static representations of actions and processes in order to illustrate certain verbs and nouns (Zgusta 1991; Leech & Nesi 1999)	—	✓
15	see particular things, animals, or people in motion, video sequences (Ide 1993a, b; Cignoni et al. 1996; Nesi 1999)	±	✓
16	animation, for a language with logographic characters: show the character being written by means of animation (Sharpe 1995)	—	±
17	visualisation of semantic and associative fields by means of interactive coloured computer graphics (Dodd 1988; Abel & Weber 2000; Corris et al. 2000)	—	✓
18	waveform display of a 'record-and-compare' facility (Sobkowiak 1999)	✓	✓

Audio was the first novelty to be added (to the so-called traditional paper dictionaries) about which publishers could boast. The trend preceded EDs, in that pronunciation recordings were already included in the 1970s in the back of paper dictionaries. These were however a commercial failure (Crystal 1986: 81) and it is only with PEDs that sound became truly popular. Probably the finest overview of audio matters in EDs is found in Sobkowiak (1999). Table 11 lists his and other scholars' audio dreams. One of the early 'wild dreams', namely to make the entire knowledge native speakers possess about the lexis of their language audibly available, remains, of course, a dream (#19). When it comes to the pronunciation of lemma signs and the sound connected with some of them, however, we have seen how the implementation gradually spread from PEDs to CD-ROMs and now to online EDs (#20–21). An early experimental ED even showed the potential of audio for blind and visually-impaired persons, whereby users could hear up to entire definitions through a voice synthesiser (#22). Yet, in general, audio is sadly limited to the 'word' level, and we are still far away from recordings illustrating sandhi, sentence stress, intonation, or simply entire example sentences (#23–24). The latter has not even been realised through synthetic speech, and this although speech synthesis exists – for English – that is hardly distinguishable from human speech (#25). At least one large ED, the *Van Dale Groot woordenboek der Nederlandse taal* (also known as the *Elektronische Grote Van Dale* (2000, EGVD)), has opted for (diphone-based) speech synthesis – alas again only for the multimedia representation of lemma-sign pronunciation (#26). The diphone data are cleverly used though for fuzzy searches (cf. below), but it is sad to note that the *entire* dictionary does not yet speak. Reversing the direction, some EDs (especially on CD-ROM) enable users to input their own speech and to compare it with a stored, 'original' recording (and with a stored, 'original' waveform display, cf. Table 10, #18) (#27). A next step could be true automatic speech recognition (ASR) lingware that would analyse a user's input and grade it (#28). Further, Landau wishes PEDs to be able to one day return an audible translation for words input in one's own language (#29). The ultimate ED is probably the one that can be accessed viva voce, much like Harrison Ford accesses a photo at the start of Ridley Scott's *Blade Runner* (1982) – but that movie, lest we forget, was a science fiction epic (#30).

6.3. *Dreams Revolving around Corpora & Extra Software*

Far from being science fiction, electronic corpora have been used in lexicography for at least three decades, and no serious compiler would undertake a large dictionary project nowadays without having one (and preferably several) at hand. Since the early-1990s, various scholars have expressed the wish to offer users of EDs the same wealth of information lexicographers find in corpora, in other words, to include a corpus cum query tools as integral parts of an ED. As most electronic corpora are 'text corpora', nearly all corpus dreams also concern this type. Some of these dreams are looked at in Table 12. Already in 1994, Varantola suggested that users should be allowed to access corpus citations *directly* from the appropriate dictionary sense (#31). Remarkably, just one year

Table 11. Dreams revolving around audio

#	*Dream*	*Then*	*Now*
19	Associative Lexicon: represent in visual and audible form the knowledge native speakers possess about the lexis of their language (Makkai 1980)	—	—
20	audible pronunciation of lemma signs (viva voce, in real sound, thus no need to learn IPA; including dialectal variants, male vs. female voice) (Lemmens & Wekker 1990; …)	✓	✓
21	hear the sound connected with certain words (Cignoni et al. 1996; Sobkowiak 1998; Tono 2000)	✓	✓
22	for blind and visually-impaired persons: hear definitions by means of a voice synthesiser (Law & Sandness 1985)	±	±
23	audio-recorded sandhi, sentence stress, and intonation (Sobkowiak 1998)	—	—
24	access to recorded usage examples (Perry 1997)	—	—
25	hear example sentences via synthetic speech (Hovy et al. 1999)	—	—
26	diphone-based generated speech for lemma signs (Geeraerts 2000)	✓	✓
27	record-yourself facility (i.e. comparison of one's own pronunciation with the stored one(s)) (Battenburg 1998; Sobkowiak 1999)	✓	✓
28	automatic speech recognition (ASR) lingware that could do an intelligent phonetic analysis of a user's input 'foreign' speech, in order to evaluate and grade it (Battenburg 1998; Sobkowiak 1998, 1999)	—	—
29	PEDs should say the word in the language we want to hear it in, and even respond to our saying the word in our own language (Landau 2001)	—	—
30	direct access to a database through a voice-activated terminal (Crystal 1986)	—	—

later *Collins COBUILD on CD-ROM* (1995) included the Word Bank, a searchable 5-million-word corpus of 'raw' language data (#32). One would have expected a boom of corpora integrated in EDs from then onwards, yet nothing is further from the truth.[11] The Word Bank – termed 'the most useful feature' by Seedhouse (1997: 62) – was not included on the *Collins COBUILD edict* (1998) yet fortunately reappeared on the *Collins COBUILD III on CD-ROM* (2001). Apart from the Word Bank, one would have a hard time finding anything like a serious corpus attached to current EDs. There is no rationale for this, especially considering repeated calls to do better than the Word Bank (#33–34).[12] While the 1995 Word Bank did not contain a concordancer, the 2001 version does, and works even across all the other resources included in the package (#35). As a result of the generally underdeveloped corpus-query software in EDs, the realisation of the multifarious corpus dreams is very disappointing indeed. Users cannot really access corpora to check out collocational options, neologisms, systematic polysemy, variation in multi-word units (MWUs), creative exploitation of MWUs, etc. (#36–37). Fully integrated systems including EDs, context-sensitive, extralinguistic and culture-specific information, links to tailored corpus collections and encyclopaedic knowledge bases, etc. etc. are even further away from current reality (#38–39). Moving to bilingual dictionaries, it has been suggested that users should be enabled to check upon the raw material the compilers used or even that they should be allowed to make their own judgement on equivalences by scanning parallel concordance lines (#40–41). More successful has been the development of the translation-memory cum terminology-management system known as the 'Translator's Workbench' (#42). Finally, in the field of historical dictionaries, it has been suggested that an ever-growing database be created, including links to various connected and unconnected data sources (#43). Even a cursory glance at the last two columns of Table 12, suggests that we *might* be dealing with science fiction in the end.

Corpora needn't be text-based, as one can well imagine the creation of large-scale and easily accessible computer-graphics corpora or audio corpora (McEnery & Wilson 1997). Truly multimedia corpora would then consist of a combination of all these media, thus text, computer graphics and audio, where all these types would be integrated and fully cross-referenced with one another. Due to the enormous storage capacities required for such truly multimedia corpora, the only feasible place to access them will probably be the Internet. Recently Sato presented his personal, yet still experimental, audio-visual database containing 500 movies, where he and others agree that the video scripts should be searchable, and Sobkowiak suggested access to speech corpora as an integral option of the dictionary look-up procedure (see Table 13, #44–46). If corpora are still rarely enclosed with EDs, extra software has had more success, as can be seen from the second half of Table 13. Whereas the link between word processors and built-in dictionaries (and thesauri) has become commonplace, most recent CD-ROM dictionaries also provide links to various word processors (and often also to web browsers and Internet e-mail). The copy-and-paste facility is frequently used (#47). EDs also start to include more and more features of CALL lingware, pushing 'real, human teachers' and 'real, social interaction' ever further aside (#48–50).[13]

Table 12. Dreams revolving around text corpora

#	*Dream*	*Then*	*Now*
31	enable users to access corpus citations from the appropriate D sense (Varantola 1994; Atkins 1996; Grefenstette 1998)	—	—
32	Word Bank (i.e. 'raw' language data) (*Collins COBUILD on CD-ROM* 1995)	✓	✓
33	'virtual corpus' (i.e. a personal, ad hoc, text corpus created interactively), enable the selection from specialised corpora (e.g. spoken/written, dialects) and texts categorised according to genre and register (Ahmad et al. 1994; Rogers & Ahmad 1998; Nesi 1999, 2000a)	—	—
34	concordance lines made available in PEDs (Nesi 2000a)	—	—
35	generate concordances of selected words in their particular context using the full text of the D, example sentences in particular (Sobkowiak 1999; *Collins COBUILD III on CD-ROM* 2001)	—	✓
36	allow the user to browse through genuine attested corpus examples when that user is seeking collocational options (Atkins 1996; Nesi 1999)	—	±
37	skilled users must have rapid access to large amounts of lexicographical evidence in corpora in order to cater for gaps in coverage (e.g. neologisms, systematic polysemy, variation in MWUs, creative exploitation of MWUs) (Atkins 1996)	—	±

38	access to static lexicographic data (in databases) + dynamic lexicographic data (through corpora) + non-lexicographic data (by means of intranet/Internet searches) (Simonsen 2000)	±	±
39	hypertext articles with links to context-sensitive, extralinguistic and culture-specific information, and links to tailored corpus collections and encyclopaedic knowledge bases; user-controlled search chains (Kalliokuusi & Varantola 1998; Varantola 2002)	—	—
40	give the user direct access to the parallel concordances that the lexicographer has used (Dickens & Salkie 1996)	—	—
41	skilled users should be enabled to make their own judgement on equivalences by scanning corpus examples (Atkins 1996; Varantola 2002)	—	—
42	'Translator's Workbench' = EDs + user-made glossary or 'translation memory' (i.e. the consultation of one's own earlier translations) + bi-text terminology bank with bilingual concordancer (Lemmens & Wekker 1990; Clas & Safar 1992; Macklovitch 1996)	—	✓
43	create a dynamically growing historical language database and link the ED to a bibliographical database, to some of the actual source texts and to other (synchronic) Ds (Cederholm 1996; Ruus 2002)	—	±

Table 13. Dreams revolving around multimedia corpora & Dreams revolving around extra software

#	*Dream*	*Then*	*Now*
44	access to that part of a video sequence where a word or phrase is actually being used (Hovy et al. 1999; Nesi 1999)	—	±
45	retrieve data from several Internet Ds + the Internet + digitised movies (with their transcriptions) (Sato 2000)	±	±
46	access to speech corpora with aligned orthographic transcriptions as an integral option of the D look-up procedure (Sobkowiak 1999)	—	—
47	copy-and-paste facility (Nesi 1999; …)	✓	✓
48	links with (other) software (e.g. built-in teaching/learning, word games, etc.) (Fox et al. 1980; Macklovitch 1996; Sobkowiak 1999)	±	✓
49	multimedia educational games (e.g. dictation and sound-to-word or sound-to-picture matching exercises) (*New Oxford Picture Dictionary on CD-ROM* 1997)	✓	✓
50	depending on the user's current needs and preferences, exercises or grammatical units could be proposed and individually linked by the system (Gamper & Knapp 2000, 2001)	✓	✓

6.4. *Dreams Revolving around Accessibility*

6.4.1. *Communicating with the database*. No matter how outstanding the contents of a dictionary, if the contents one needs at a particular point in time cannot be accessed in a quick and straightforward way, the dictionary de facto fails to be a good dictionary. It is not surprising, then, that dreams concerning accessibility are abundant and their realisation generally satisfactory. This abundance forces us to break down the various accessibility dreams into different aspects. Table 14 lists the first series, namely those aspects dealing with the types of communication between users and the EDs. Keying in, copy-and-pasting, and mouse clicking are today's most frequent actions used to uncover the data in an ED. Yet, these are not the only ways. We can first recall Crystal's dream to directly communicate with a database through a voice-activated terminal (cf. Table 11, #30) – so far, still a dream. In the early-1990s Sharpe speculated about alternative ways to communicate with the information in Japanese dictionaries for English-speaking learners, and suggested such (then wild, high-tech) devices as a pen-shaped OCR scanner as input to the keyboard or a light-pen input that could be 'matched' by software (#51). By now, the so-called reading pen using both OCR and advanced text-to-speech technology is already fairly established, and some PEDs include handwriting recognition (#52). Also popular today are pop-up EDs, already predicted at the beginning of the 1980s by Kay, with which one only needs to position the mouse pointer over (and in some versions also single-click) words onscreen, after which the relevant dictionary article or articles pop up in a window (#53). While the user still needs to select the appropriate sense or translation from such pop-up articles, research is underway to develop context-sensitive systems that can do that for the user. Some scholars have also been hypothesising about information-handling devices able to deal with natural language (queries), and true dialogues between users and databases (#54). Whereas such an option was still very much on the drawing-boards in the mid-1980s, some EDs have begun dealing with basic natural-language questions, such as the 'Ask Britannica' function in the *Britannica CD Multimedia Edition 1999* (1999). Where it has been suggested that future EBDs should also come together with monolingual dictionaries, the user will, as part of the outer search path, have to decide which kind of dictionary to consult (or in terms of Atkins' virtual dictionary (cf. §5), communicate to the ED which of the four processes – simple extraction, partial translation, comparison or alignment – to activate) (#55). It is also interesting to note how, diachronically, database-dreams evolved from a development tool to ensure consistency, via consultation-reading and then exploration-research, to communication with a multiple queriable database (#56–58). Finally, paper dictionaries also start to come with their corresponding electronic equivalent, so the former is enriched by the latter (#59).

6.4.2. *Searching the entire database*. We will now look into those access aspects for which the outer search path (leading to a lemma sign) does not necessarily precede the inner search path (leading to data within articles). In a way, both types of search paths have an equal access status in this case, and are even

Table 14. Dreams revolving around accessibility, part 1: Communicating with the database

#	*Dream*	*Then*	*Now*
51	for a language with logographic characters: pen-shaped OCR scanner as input to the keyboard, or light-pen input that can be 'matched' by software (Sharpe 1993, 1995)	—	±
52	reading pen which translates and pronounces words scanned in directly from the printed page (*Seiko Instruments Quicktionary* 1998)	✓	✓
53	pop-up access (i.e. the user only needs to point the mouse at (and sometimes single-click) the to-be-looked-up word(s)) (Kay 1983; *Babylon* 1997; *MoBiMouse* 1998; *Macmillan English Dictionary for Advanced Learners* 2002; *Oxford Genie* 2002; …)	—	✓
54	information-handling devices able to deal with natural language (queries); enter into real-language dialogue with the database (Abate 1985; Zgusta 1991; Rogers 1996)	—	±
55	users should be in a position to switch, within one system, D types (mono-, bi- and multilingual) at will (Dodd 1988; Atkins 1996; Gamper & Knapp 2001)	—	—
56	transform the lexical database development environment into a lexical database consultation environment (Amsler 1984)	—	±
57	the consultation-reading of a database should give way to exploration-research of that database and thus the possibility to complete D articles (Gorcy 1990)	—	±
58	many a D of the future may well be a multiple queriable database (Docherty & Heid 1998)	—	±
59	printed D enriched by the corresponding e-database (Zgusta 2000)	—	±

indistinct to some users. Table 15 shows this second 'accessibility series'. One of the early dreams, namely to facilitate bringing anything together that users wish to compare, remains to be realised (#60). Just over a decade ago, Knowles could still claim that '[a]ny public domain material being offered at the present time is likely, unfortunately, to amount to no more than machine-readable dictionary text with low-level access facilities' (1990: 1656). Yet he foresaw the day when it would become possible to search all database fields, as a kind of Ali Baba's open sesame to both the left-hand fields (macrostructure) and the right-hand fields (microstructure) (#61). This, together with the option of filtered searches and the use of Boolean operators, has indeed become fairly standard today (#62). Nevertheless, some of Dodd's predicted search routes are still unrealised and Sobkowiak notes that the generation of quite a number of desirable (and straightforward) extractions from a database remain very rare or simply impossible with today's ED search tools (#63–64). Still others go one step further and suggest that fuzzy or complex searches should enable the retrieval of words containing the same phonological, syntactic or semantic features (#65).

From the moment one can search entire databases applying filters and Boolean operators, the step to onomasiological approaches to data retrieval is not that big anymore. At the start of the 1990s, databases with ever-growing storage capacities led to dreams in which databases would one day combine alphabetically and thematically ordered dictionaries in one. By the end of that same decade, thematically structured search paths have indeed been developed in addition to the better-known alphabetical search path, especially for electronic encyclopaedias. Nonetheless, the approach to onomasiological EDs has started to shift from a mere focus on database size to clever search mechanisms by which traditional alphabetically organised dictionaries are searched from within an article to the lemma sign (#66). Here an inventive use of specific search words, labels, Boolean operators, article fields to be searched, etc., can for instance lead from a combination of keywords in a definition to the item(s) one is looking for.[14] Some prototype dictionaries being developed do the reverse in that they are basically onomasiological EDs, with an alphabetical index. A unique implementation in this regard is *WordNet* which can be seen as a sophisticated variant of the old thesaurus concept (Zaenen 2002: 234). Lexical items are arranged into sets of synonyms, called 'synsets', and the senses across synsets are related to each other through one or more lexical relations, viz. hyponymy/hyperonymy, meronymy/holonymy, troponymy, antonymy, pertainymy, etc. (Wilks et al. 1996: 126–7). Alphabetised lists of all the word forms are known as index files, and '[e]ach index file entry for a word form contains a list of the synset addresses for all the senses of the word' (Tengi 1998: 114).

6.4.3. *Accessing the macrostructure*. We will now try to dissociate the outer from the inner search path, and will first study some access methods that are *primarily* used for macrostructural retrieval. This is done in Table 16. A first feature facilitating the swift access to lemma signs is the fact that users don't need to know the sequence of the alphabet's letters anymore (#67). Stronger, tools have been developed that (try to) re-route wrongly written items to the

Table 15. Dreams revolving around accessibility, part 2: Searching the entire database

#	*Dream*	*Then*	*Now*
60	create the ultimate D that can be used by the entire language community, through a lemma-sign list of limitless extent and the potential to bring together related items (e.g. senses, spellings, etymologies, etc.) drawn from anywhere in the D (Abate 1985)	—	—
61	paradigmatic search: access directly and purposively right-hand fields (in addition to 'in-and-out' consultation of left-hand side) (Knowles 1990; …)	—	✓
62	'filtered searches' (i.e. selection of data types to be included in a search); full text searches with the aid of Boolean operators (Poirier 1989; …)	—	✓
63	a multitude of new routes to the data (…, has an etymology of D, dates from year/century E, is used in style of F, …) in combination with fuzzy matching, various operators, and morphological and grammatical analysers (Dodd 1989)	—	±
64	various enumerations like: heterographic homophones, (L1-sensitive) paronyms and confusibles, words within or outside a particular frequency, familiarity or polysemy band, words whose associated visual representations (in a multimedia D) meet certain conditions, etc.; all such criteria with multiple Boolean searches (Sobkowiak 1999)	—	±
65	access meanings directly, fuzzy or complex searches for groups of words containing the same phonological, syntactic or semantic features (Abate 1985; Webster & Ning 1996; Nesi 2000a)	—	—
66	within the framework of a large lexical database system: successful coexistence of semasiological and onomasiological approaches, thematically structured search path (Kay 1983; *Microsoft Encarta 99 Encyclopedia – World English Edition* 1998; Geeraerts 2000)	—	±

Table 16. Dreams revolving around accessibility, part 3: Accessing the macrostructure

#	*Dream*	*Then*	*Now*
67	liberate users from alphabetical order (Dodd 1988, 1989; Atkins 1996; Leech & Nesi 1999)	±	✓
68	for a language with logographic characters: provide (incorrect/dummy) lemma signs for those characters whose stroke numbers are commonly miscounted and re-route the user to the correct one (visual look-up) (Sharpe 1995)	—	±
69	help with poor spelling: through fuzzy spelling options (spelling corrections) and browsing links from sight-words (i.e. words users recognise the shape of) (Corris et al. 2000)	±	±
70	phonetic-access D (PAD) (i.e. access 'through sound', with wildcards for certain segments), phonetically-aware fuzzy search algorithms (both strictly linguistic and algebraic fuzzy searches) and phonetic similarity searches (Kay 1983; Sobkowiak 1994, 1996, 1998, 1999; *Macmillan English Dictionary for Advanced Learners* 2002)	—	±
71	macrostructural retrieval through suggestive searches (spelling corrections, near-homophones (by means of diphone data), inflectional forms) (Geeraerts 2000)	✓	✓
72	edutainment: search functions featuring wildcards, reverse indexes and anagrams; rhyming D (by means of diphone data) (Geeraerts 2000)	✓	✓
73	new means to access data: start keying an item and select from a list, a phonetic tool to find the correct spelling, searches with wild cards, an automatic conjugation tool (Duval 1992)	±	±
74	speedy retrieval through the possibility to click on a word and/or focus-in typing (i.e. to type the first letter(s) of a word) (Selva & Chanier 1998; Landau 2001)	±	±
75	speedy retrieval by means of a morphological analyser (Dodd 1988; …)	—	±
76	inclusion of *all* inflected forms as lemma signs in the D (Corris et al. 2000)	—	—
77	guide users to a particular sense through the display of intermediate homonym windows and collocation windows (Selva & Chanier 1998)	±	±
78	problems with for example homonymy vs. polysemy status cease to be elevant (Dodd 1989)	—	±

correct ones, where those tools are presently better for alphabetic scripts than for languages using logographic characters (#68). Especially in communities without a long dictionary culture, these aspects, in combination with browsing links from sight-words, ease the dictionary-consultation process (#69). With this, we have moved to what is known as 'fuzzy searches', a concept Sobkowiak has taken one step further in his pre-beta phonetic-access dictionary (PAD) (#70). In PAD one basically enters the database contents 'through sound' where one can even use wildcards for certain segments. Linguistic as well as mathematical/statistical procedures are used to suggest one or a set of likely items for the fuzzy search. A variation on PAD is used in the EGVD, where diphone data underlie every single lemma sign (#71–72). The EGVD in addition utilises lists of inflectional forms to 'suggest' certain search items. To speed up the look-up process even more, an increasing number of EDs use 'focus-in typing', aka 'incremental search', whereby a list of candidates is shown (and narrowed down) as one is typing. From the moment one sees the item one is looking for, one can simply select it. Actually, focus-in typing was already implemented in an experimental *le Grand Robert* CD-ROM at the end of the 1980s, together with the option to use wildcards, as well as phonetic and conjugation tools (#73–74). Lately, various EDs have also begun to include morphological analysers, and are thus rather successful in dealing with inflections, derivations, etc. (#75–76). Linking both the outer and the inner search paths, at least one experimental ED project guides users to a particular sense through the display of intermediate homonym and collocation windows (#77). Finally, Dodd claims that 'the perennial problem of what should constitute a headword, in particular with regard to the thorny problems of polysemy and homonymy, ceases to be relevant' (1989: 91) (#78).

6.4.4. *Accessing the microstructure*. In this subsection we will look into access structures that are *primarily* aimed at retrieving microstructural data. Table 17 summarises the dreams. It is one thing to be able to store ever more data, but another thing entirely to present just the data users want in response to a particular look-up. This fact led to the simple conclusion and later implementation that not everything needs to be written/visual and constant in an electronic environment. Indeed, the linear text (and media) restrictions of the paper dimension finally start to be exploded in EDs through the use of hypertext (and hypermedia) functionality (#79–80). It is well-known that in the traditional paper dictionary, MWUs and phraseological units such as idioms and proverbs are often entered within several articles, even though they are, from a metalexicographic point of view, serious candidates to receive lemma-sign status. One of the practical reasons why the latter is not feasible, however, is that MWUs and phraseologisms are frequently manipulated and thus rarely occur in their canonical form (Moon 1998). In recent EDs such as the EGVD, the retrieval of idioms and proverbs is made somewhat more efficient through a phraseological dialogue box (#81). Despite the potential for evermore data, rich collocational information is still missing from general-purpose EDs, although these can be found in dedicated collocation EDs (#82–83). On a more scientific and non-commercial level, some researchers like Fontenelle (1997a, b,

Table 17. Dreams revolving around accessibility, part 4: Accessing the microstructure

#	*Dream*	*Then*	*Now*
79	hypertext functionality eliminating linear text restrictions; not everything needs to be written/visual and constant (Abate 1985; Atkins 1996; …)	—	±
80	plan of an article + full treatment per clickable sense (Selva & Chanier 1998)	±	±
81	compound nouns, phrases and idioms should be made directly accessible, retrieval of idioms and proverbs through a phraseological dialogue box (Abate 1985; Lemmens & Wekker 1990; Geeraerts 2000)	—	±
82	check whether two particular words collocate; list words with particular collocates (Lemmens & Wekker 1990; *Collins Cobuild English Collocations on CD-ROM* 1995)	—	✓
83	information about the use of every single word (cluster) with each other word, of every single resulting word cluster again with each other word, etc. (Grefenstette 1998)	—	—
84	automatic disambiguation of meaning (Zgusta 1991; …)	—	±
85	attempt to provide the user with the correct equivalent for a word as used in the passage at hand (contextivity) (Michiels 2000; Whitelock & Edmonds 2000)	±	±
86	what if the computer was able to analyse any word in context, extract all the patterns that the word was found in, cluster them in a coherent way, and display these further examples succinctly for the user? (Grefenstette 1998)	—	±

2000b) developed electronic products which exploit the collocational material of bilingual dictionaries to make these collocations accessible in the form of semantic networks with added lexical-semantic relations. In the ED environment increased attention can also be given to context, and rather successful attempts have indeed been made in prototype dictionaries in which users are provided with correct equivalents for items as used in the passages at hand (#84–85). Finally, a particularly interesting microstructural dream was offered in 1998 by Grefenstette, namely to let the computer analyse any word in context after which all found patterns would be presented to the user (#86). As wild as this might have seemed just a few years ago, Kilgarriff's current work on 'Word Sketches' starts to move in the direction of this dream (see Kilgarriff & Tugwell 2001, and for a similar project Lin 2000; compare also with Grefenstette et al. 1996).

6.4.5. *Accessing the mediostructure*. The mediostructure, also known as the system of cross-referencing, is used to connect different components of a dictionary. Given the availability of hyperlinking in EDs, navigating through multimedia dictionary data by means of following up cross-references, or in simple terms 'accessing the mediostructure', cannot always be easily disentangled from the outer and inner access structures. Clicking, typing and mouse pointing, no matter where one starts nor where one goes, remain clicking, typing and mouse pointing. Nonetheless, some *typical* mediostructural features are listed in Table 18. Anything, in any multimedia, that can conceivably be hyperlinked and is useful to be linked, will in future also be connected. This includes both dictionary-internal cross-references (e.g. central-section data with front and back matter material, articles with related articles, article-internal sections with one another, etc.), and dictionary-external cross-references (such as links with corpora, other reference works, the Internet, etc.). For instance, whereas a grammar and a dictionary used to be quite distinct products (with paper dictionaries at best including a mini-grammar in the front or back matter), in EDs grammatical pop-up windows or hyperlinks from within dictionary sections to *relevant* grammar cards have now seriously begun to close the gap between the two (#87–88). Nonetheless, we are still some way from Burchfield's claim that 'at any rate in electronic form, the larger dictionaries will absorb the entire contents of the larger grammars' (1990: ix). What one does see, however, is that entire grammars (plus also language-usage guides, thesauri and in rare cases corpora) are placed *alongside* one or more EDs on a single CD-ROM. Where the integration of these different resources is meticulous, the mediostructure is of a high quality (#89). The process known as '(definition) chaining' (sometimes simply called 'hyperlinking') must also be counted among the popular features of EDs (#90). Ideally, this process means that 'information on any word in any component can be obtained by highlighting the word and calling up a new window' (Nesi 2000a: 139), where a truly user-friendly implementation will present such parallel windows in a non-overlapping way (Dodd 1988: 14), and will only focus on the sense relevant to the cross-reference (instead of listing all senses of an article and expecting the user to wade through them) (#91). At the very least, a backtrack

Table 18. Dreams revolving around accessibility, part 5: Accessing the mediostructure

#	*Dream*	*Then*	*Now*
87	grammatical pop-up windows (with inflectional paradigms + explanatory text) (Sobkowiak 1998; Geeraerts 2000)	±	✓
88	hyperlink grammar notes and the unavoidable abbreviations to specific grammar cards explained in the learners' mother tongue (Dodd 1988; Abel & Weber 2000)	—	±
89	meticulous D-external links (*Collins COBUILD on CD-ROM* 1995; *Collins COBUILD III on CD-ROM* 2001)	±	✓
90	definition chaining (aka hyperlinked cross-referencing, searches by chaining or hyperlinking, internal cross-referencing) (Duval 1992; Nesi 1999, 2000a; Geeraerts 2000)	±	✓
91	cross-references only showing the proper sense in a parallel (non-overlapping) window (Selva & Chanier 1998)	±	±

option should keep a history of the hyperlinked items and enable the user to go back to any of them.

6.5. *Dreams Revolving around User-friendliness & Customisation*

Both the *Merriam-Webster's Collegiate Dictionary* and the *Oxford English Dictionary* (OED) agree that the adjective 'user-friendly' entered the English language in 1977. In addition, Sobkowiak observes that the noun 'user-friendliness' is 'a computer term which has made a world-wide career also outside the realm of computers' (1999: 42). Metalexicographers, for instance, have often and for quite some time now analysed *paper* dictionaries in terms of the user-perspective (cf. §4.6), for which user-(un)friendliness is one of the core criteria. Nonetheless, today both the adjective and the noun remain as relevant to the *electronic* environment as they have been since their inception, if not more so. The concept itself, however, is of course not that new. Already in the 1960s Barnhart, for one, pointed out the importance of responding to the users' true needs (1967: 161).

Today, there is hardly any ED that does not try to be user-friendly. Some general aspects contributing to the user-friendliness of EDs are listed in Table 19. A highly user-friendly interface between dictionary users and an ED obviously makes use of a graphical user interface (GUI) (#92). A GUI is a display format that enables users to point to pictorial symbols (icons) or to lists of menu choices onscreen with a mouse.[15] Fail-safe procedures, clear menus, pull-down and pop-up windows, dialogue boxes, etc. are therefore tantamount to user-friendliness; as well as multimedia, hypertexts, hypermedia, hierarchical/layered representations, definition chaining, high speeds, instant/balloon help, etc. (#93). The latter, instant/balloon help, is now often, in addition, offered in the form of an extensive built-in tutorial or tour on how to use the ED (#94). Abbreviations, codes and symbols may also be written in full (especially for the less-motivated users), and this information together with all metalanguage may be offered in the user's mother tongue (#95). Along the same line, the familiar 'telegraphese' style of definitions and explanations may now be abandoned (#96).

Going hand in hand with a user-friendly dictionary, is a flexible dictionary. According to Sobkowiak '[f]lexibility in computer terms is usually referred to as customisation. This means that the user can streamline the software to his/her permanent and transient needs and preferences' (1999: 257). We will now look into some customisation dreams from two angles, namely first to those that are rather straightforward, and second to those that can be termed smart customisations. Table 20 shows the first series. A first straightforward, and from another point of view even 'inessential', type of flexibility with regard to EDs is the possibility/potential to fully customise the display onscreen as well as the layout of the printed page (#97). Already more interesting are the stratified interface levels suggested by Corris et al. who, working with Aboriginal languages, see this aspect as a way to make EDs accessible not only to advanced but also to inexperienced dictionary users (#98). No matter whether one is dealing with mono-, bi- or multilingual EDs, Atkins suggests offering users the possibility to choose the content language (the object(s) of the

Table 19. Dreams revolving around user-friendliness

#	*Dream*	*Then*	*Now*
92	complex Ds with powerful and multi-purpose 'navigation' facilities, highly user-friendly interfaces (Amsler 1984; Poirier 1989; Docherty 2000)	—	±
93	fail-safe procedures; clear menus, pull-down and pop-up windows, dialogue boxes; multimedia, hypertexts, hypermedia, hierarchical/layered representations, definition chaining; high speeds; instant/balloon help, etc. (Knowles 1990; …)	±	±
94	demonstration tours (i.e. the D software shows how to use the ED) (Ford 1996; Nesi 2000b)	✓	✓
95	restricted metalanguage (abbreviations, codes and symbols) – hard to understand for the less-motivated users – may be written in full and in the user's mother tongue (Atkins 1996; Harley 2000)	—	±
96	the familiar 'telegraphese' style of definitions and explanations may be abandoned (Atkins 1996)	—	±

Table 20. Dreams revolving around straightforward customisation

#	*Dream*	*Then*	*Now*
97	customising the display/presentation of the D (i.e. typography, page make-up, colours, etc.) in the computational environment and for printing (Dodd 1989; Atkins 1996)	—	±
98	different levels of interface for different users (Corris et al. 2000)	—	—
99	offer the possibility to choose the content and presentation languages (Atkins 1996)	—	—
100	offer both look-up mode (the user is in search of a specific piece of information) and browsing mode (relaxed reading) (Lemmens & Wekker 1990; Atkins 1996)	—	±
101	modular ED, that is let the user activate those blocks in which he/she is interested (e.g. encyclopaedicity) (Arnold 1979; Lemmens & Wekker 1990; Zgusta 1991)	—	✓
102	zooming into different levels of granularity, dynamic interactive lookup (i.e. customisability of the level of detail in the display, anything from abridged to full articles), layered representation (i.e. users can locally probe or 'peel off' an article with increasing depth of detail) (Fox et al. 1980; Kay 1983; Duval 1992; Geeraerts 2000)	—	±
103	there should be layers of varying complexity in the interpretation of the lexicon provided in Ds (Bailey 1986; Nesi 1996; Perry 1997)	—	—
104	each D type of the set of virtual Ds may offer various levels of information (from brief and simple to long and complex) (Atkins 1996)	—	—
105	provide various D styles (i.e. different ways and manners to present the same information), the user must have a say in what information the D offers and how it presents it (Dodd 1988, 1989; Zgusta 1991; Atkins 1996)	—	±

lexicographical analysis and description) and the presentation language (the language in which all metalexicographic information is couched) (#99). Further, she (with others) also suggests having two main types of dictionary consultation between which users should be able to move freely: look-up vs. browsing mode (#100). An early vision, namely to create an environment in which users would activate those slots in which they are interested, has now been realised (#101). Good examples of this are EDs in the Collins COBUILD series and the OED in electronic form. In the experimental *le Grand Robert* CD-ROM (end 1980s) or in the recent EGVD users can even 'peel off' an article with increasing depth of detail (although the number of layers is still rather low) (#102). Surprisingly, the call since the mid-1980s to stratify all types of information offered in an ED has, to date, remained unanswered (#103–104). Within the framework of Atkins' virtual ED, this means that for most types of information (definition, syntax, examples, etc.), the amount, complexity and presentation of data returned in response to a query depends on the content language, presentation language, dictionary type, consultation mode, and the user's declared objective, level and interest in dictionary contents (#105).

If one takes the straightforward customisations a step further, one enters the field of the smart customisations, of which some are shown in Table 21. Smart customisations are characterised by a more systematic application of flexibility and interactivity, and have also begun to show (in prototype products) some built-in 'intelligence'. An example of a fully fledged interactive, yet still experimental, tool is Turrini et al.'s children's multimedia Activity Book, a true ED laboratory with which children may interactively produce a dictionary mostly written by themselves (#106). Pushing smart-customisation dreams even further, several scholars since the mid-1980s have hypothesized about question-, context- and user-sensitive interactive EDs (#107–108). Kalliokuusi & Varantola suggest that this may be achieved one day through an interactive and instructive buffer interface with interactive/buffer questions ('do-it-yourself index'), and the availability of several hypertext-structured databases with clearly defined user levels. In the field of CALL lingware, Whitelock & Edmonds developed a tool that provides interlinear Japanese glosses for Japanese learners reading English text onscreen. Since each of the glosses is assigned a (1 out of 12) difficulty level, with a display set according to the user's *current* proficiency level, incidental vocabulary acquisition may be facilitated (#109). Whereas the difficulty level must still be set by the users themselves in Whitelock & Edmonds' approach, in truly smart EDs, software modules should take care of this. In order to do so, one will firstly need to 'know' a lot about the general preferences of every particular user (#110–111). Secondly, one will need to have a model of each individual user (#112).

6.6. Dreams Especially Relevant to Dictionary Compilers, Researchers and Publishers

In Table 22 a number of dreams especially relevant to dictionary compilers, researchers and publishers are listed. There is no better way to find out about a user's requirements than through feedback generated by that very user. Numerous techniques exist (cf. the overview in Wiegand 1998b, Chapter 4), one with

Table 21. Dreams revolving around smart customisation

#	*Dream*	*Then*	*Now*
106	children's multimedia Activity Book: a creative tool with which children interactively produce their tailored D (Turrini et al. 2000)	±	±
107	varying levels of detail tailored to the nature of the question (Bailey 1986)	—	—
108	adjust the information level according to the different target groups and their needs, compile interactive lexical databases that would be both context- and user-sensitive (Kalliokuusi & Varantola 1998, 2000)	—	—
109	graded vocabulary: divide D articles into a number of difficulty levels and meet the *changing* needs of the user (Whitelock & Edmonds 2000)	±	±
110	'D server' = a multi-interface, multi-user, flexible resource, able to extract from an online database the information currently required and to customise this information according to the user's needs and tastes (Kay 1983, 1984)	—	±
111	users should access an ED through identification, upon which each user's preferences, styles of definition and profile of choices are retrieved; the database is continuously moulded in response to each user's personal activities (Dodd 1988, 1989)	—	±
112	towards adaptive hypermedia EDs: a model of each individual user (goals, preferences, knowledge, etc.) is maintained with which the system dynamically adapts its behaviour and data presentation (Selva & Chanier 1998; Sobkowiak 1999; Gamper & Knapp 2000, 2001)	±	±

Table 22. Dreams especially relevant to dictionary compilers, researchers and publishers

#	*Dream*	*Then*	*Now*
113	free implicit feedback as well as direct feedback (Abate 1985; Crystal 1986; Dodd 1989)	—	±
114	selecting subsets of lexical material from one comprehensive database should enable the production of a series of Ds or offshoots (Weiner 1987; …)	—	±
115	database contents should serve Ds for humans and lexicons built for other systems (Boguraev & Briscoe 1989b; Atkins 1996; Froon & De Jong 2002)	—	✓
116	the use, in concert, of databases for English and other languages, each internally structured so as to allow for comparison of similar semantic structures (Abate 1985)	—	—
117	devise an analysis technique common to all languages involved so that true multilingual Ds can be compiled (Atkins 1996)	—	—
118	since any bidirectional, bifunctional paper D (8 Ds in one) is highly redundant for any particular use(r), the ED should be tailorable to one particular type of use(r) (Atkins 1996)	—	—

more flaws than the other (Hatherall 1984), yet the electronic environment makes possible the truly exciting, namely the potential to retrieve feedback without the user being aware of this, in addition to direct feedback (#113). Several scholars have made suggestions to design the 'development database' in such a way that a series of different dictionaries (paper and electronic) could be extracted from it, and that it could serve both humans and machines (#114–115). At *Van Dale Lexicografie* this has actually been achieved, as their product-independent lexical database with formal word features is 'beneficial for the production of printed dictionaries, for the development of NLP-products targeting the end-user market, and for the level of support for NLP research teams' (Froon & De Jong 2002: 5). For bi- and multilingual lexicography it has been pointed out that only a strong and common theoretical framework underlying all the databases will result in true bi- and multilingual EDs (#116–117). Finally, mainly financial considerations resulted in a situation whereby as many different target user groups as possible are simultaneously catered for in paper dictionaries, making such products highly redundant for any one use(r). Dictionary compilers, researchers and publishers should be delighted to note that this need not be the case anymore in EDs where users could be enabled to select exactly *that* type of dictionary required for the consultation at hand (#118).

7. The Dictionary of the Third Millennium

'[T]he direction in which electronic lexicography is moving is exactly this: towards more content, more flexibility and customisation, more user-friendliness, better access and more connectivity with other sources of knowledge, lexicographic and beyond.' (Sobkowiak 1999: 275)

Given the 'flings of imagination' reviewed above, one could be tempted to suggest that the Dictionary of the Third Millennium, while undoubtedly electronic, will simply be a jamboree of all those dreams. Such a suggestion is obviously naïve. Firstly, without a sound underlying theory any 'dictionary of the future [will] simply blip its little electronic way off into the sunset dazzling its readers with the speed [with] which it dishes up the same old facts on a technicolor screen' (Atkins 1996: 515–6). Secondly, the price tag of realising *all* those dreams would ensure that no one could afford to buy the product – no matter how wonderful the reference work would be. On the theoretical front, new approaches to the lexicon have indeed been developed over the past fifteen years. From a primarily NLP perspective, for instance, Zaenen (2002: 232–5) mentions Pustejovsky's *Generative Lexicon*, Fillmore's *Frame Semantics*, Miller's *WordNet* or Mel'čuk's *Meaning-Text lexical functions*. In each of these semantic formalisms 'the lexicon is viewed as a repository of thousands of concepts and words linked to one another in a huge web' (Fontenelle 2000a: 230). Various dictionary projects are also based on these new approaches. When it comes to cost, it is clear that the choice for the development of this or that dream is dependent on the application and intended target user group. For instance, an

increasingly popular type of ED used when browsing the web is the pop-up ED. On the Internet users typically need instant and concise information, and being able to simply point at a word (possibly in combination with a mouse-click) makes sure the dictionary look-up does not distract too much from the main activity. Moreover, a bilingual implementation, say Hebrew to English, 'enables users to read and understand texts that they cannot even type in' (Prószéky & Kis 2002: 288). Enhancing the context-sensitivity might very well be the main dream pursued in the years ahead for this type of ED.

If there is one single feature likely to be applicable to all EDs of the future, it is that they will stop functioning as stand-alone products. The tendency to integrate ever-more reference sources, as well as CALL lingware and NLP extensions, with EDs and vice versa is already apparent. According to Varantola the future ED will be 'an integrated tool or a number of tools in a professional user's toolbox where it coexists with other language technology products' (2002: 35). She especially stresses the integration with corpora, corpus query and compilation software, and translation-memory systems. Probably the most exciting development, however, are the projects that aim at creating adaptive hypermedia systems (Brusilovsky 1996), hence EDs in which the potential is explored to link an automatically derived dynamic user profile to the proffered multimedia lexicographic output (cf. Table 21, #112). A strong expression of this vista of the future dictionary is as follows:

> 'I will be shamelessly selfish and ask for the impossible. I will advocate for a dictionary that will always adapt to my needs and always be ready to provide me with exactly the answer that I need and will also agree with. I also expect the dictionary to be able to give satisfactory answers to those questions that I forget to ask.' (Varantola 2002: 31)

This is a bold vision, of course, yet a handful of research projects are indeed actively working towards adaptive hypermedia EDs. These EDs are not based on hardcopies but are truly conceived from scratch for the electronic medium. Examples of some such projects are ALEXIA/DAFLES, ELDIT, Fuzzy SF and Benedict. *ALEXIA* (Selva & Chanier 1998; Selva 1999) was an experimental monolingual French ED for learners consisting of several modules, one being a user model. That model indicated the way in which learners utilised the ED, and based on that the aim was to orient, evaluate and advise the learner. The project was discontinued but lives on as the online semi-multilingual *DAFLES* (Selva et al. 2002; Selva & Verlinde 2002). Besides the already innovative presentation of the contents in DAFLES, the intention is to add a personal dictionary and to integrate a user model. The online *ELDIT* (Abel & Weber 2000; Gamper & Knapp 2000, 2001) is a prototype German and Italian ED for learners and is part of a web-based hypermedia language learning system. A tracking feature observes the user's navigation and a model of each user is drawn up with this information. This model is supplemented with data derived from each user's manual customisation. In *Fuzzy SF* (De Schryver & Prinsloo 2001), or Fuzzy Simultaneous Feedback, log-file based Artificial Intelligence components enable the implicit retrieval of personalised user feedback with which the package customises each user's own and unique dictionary. To that

end, all the data in both the databases and the multimedia (sub)corpora are graded using Fuzzy Sets, so that the electronic reference work only answers queries on the user's (current) level. This concept is currently being implemented in a first ED for Sepedi, a Bantu language spoken in South Africa. Lastly, *Benedict* (Herpiö 2002) is a development project for a new 'intelligent' dictionary for the Finnish/English corporate world. It aims to adapt to different users and to the material they work with. To that end an interactive user-specified interface will tailor the information supply. Syntactically and semantically-based search tools as well as links to corpus data will be integrated with multi-layered entry structures.

While envisaging such 'smart' EDs of the future, it is however wise to take heed of Zaenen's (2002: 239) caution that since dictionaries are seen as a kind of Bible, a change of their format might jeopardise this status. Combined to the inevitably huge investments needed for the development of the most revolutionary dreams, the expected changes to dictionaries as we know them today might indeed be more gradual than expected, yet change they will.

Notes

* An earlier version of this article was presented at the 6th International Conference of Afrilex. The author would like to thank the two anonymous IJL reviewers for their constructive comments.

[1.] Some researchers refer to spellchecker lexicons as 'machine dictionaries' (cf. e.g. Jacquet-Pfau 2002: 90).

[2.] Volumen is Latin for "book" and refers here to the first (papyri) rolls; codex is Latin for "collection" and refers here to the first bundled rectangular products (i.e. written (papyri) pages stitched together).

[3.] Note also that this suggested access typology does not say anything about the actual contents of the dictionaries.

[4.] Annotation in EDs, for instance by means of the 'note index' in the *Oxford Advanced Learner's Dictionary on CD-ROM* (1997) or the 'annotations window' in the *Cambridge International Dictionary of English on CD-ROM* (2000), remains rather cumbersome.

[5.] The best-known of the early CD-ROMs is probably the *Oxford English Dictionary on Compact Disk*, first released in 1987 on two disks (A–N and O–Z), later on one. It merely contained the 1928 edition of the OED, and offered only limited search options, albeit in any or several of the eight different indexes, with one type of wild card and three Boolean operators (Milic 1990). In 1992, the Second Edition of the OED (1989) was released on CD-ROM. The first learners' dictionary on CD-ROM was the *Longman Interactive English Dictionary* (1993).

[6.] The technology has recently been implemented in the *Oxford Reference Online: The Core Collection* (March 2002), bringing together one hundred Oxford dictionaries and reference works into a single cross-searchable web database.

[7.] In general, any ED is obviously easier (and cheaper) to update than printing paper dictionaries.

[8.] Atkins' 'virtual dictionary' should not be confused with Makkai's use of 'virtual dictionary'; for the latter it stands for the ability of (learned) individuals to '*engage in* «acts of linguistic originality»' (1992: 260), that is to make up forms through playful manipulation.

[9.] For a detailed exposition on the potential of Frame Semantics in lexicography, see the *FrameNet Project* at <http://www.icsi.berkeley.edu/~framenet/>.

[10.] For instance, if one has two databases, these four processes can result in ten different dictionary types. Say one database contains language X, the other language Y. 'Simple extraction' will result in a monolingual X for speakers of X, and a monolingual Y for speakers of Y, 'partial extraction' will result in a monolingual X for speakers of Y and a monolingual Y for speakers of X, 'comparison' will result in a contrast X and Y dictionary for speakers of X, and a contrast Y and X dictionary for speakers of Y, finally 'alignment' results in equivalence dictionaries very close in function to the bilingual dictionaries we know today, that is X-Y for speakers of X, X-Y for speakers of Y, Y-X for speakers of X, and Y-X for speakers of Y.

[11.] This is especially surprising since '[s]ome computational linguists propose that the dictionary can be eliminated entirely: that procedures can be developed for getting answers directly from corpora' (Hanks 2001: 8). See in this respect for example Clear (1996: 265–8) or Zaenen (2002: 237).

[12.] One of the main reasons for publishers' reluctance to attach corpora to EDs might be the problems involved in getting copyright clearance. Leech & Nesi also mention the 'pedagogical difficulty of integration between a dictionary and a corpus, where the corpus (consisting of authentic, unpreselected text or discourse data) inevitably contains many items which are not represented in the dictionary, and vice versa' (1999: 301). A result of these obstacles is that the Internet is increasingly queried as a stand-in corpus.

[13.] An excellent overview of possibilities in this field can be found in Sobkowiak (1999: 251–7).

[14.] A variant of going 'from within an article to the lemma sign' uses n-gram analysis (Nesi 2000a: 142), which (in this context) is an algorithm whereby typed-in article definitions are matched with stored ones by looking at the statistical similarity of letter-combination occurrences.

[15.] In 1983 Lisa, developed by Apple, was the first computer with a GUI. Lisa's GUI was the forerunner of Apple's Macintosh (1984). In 1985 Microsoft followed the lead and introduced the Windows GUI. Prior to the GUI, publishers simply had their sequential tapes transformed into random access files. According to Neff & Cantor, early commercial EDs 'embodying this technology include[d] versions of Merriam dictionaries sold by Proximity, Inc., the Collins bilingual dictionaries prepared by Linguatech, Inc., and various dictionaries in the Bookshelf product sold by Microsoft, Inc. Most of these products present[ed] the dictionary as an on-line version of a printed dictionary' (1990: 298–9).

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yourDictionary.com <http://www.yourdictionary.com/> [Portal with thousands of online dictionaries in several hundred different languages.]

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