On the Effects of Different Types of Electronic Dictionary Interfaces on L2 Learners' Reference Behaviour in Productive/Receptive Tasks

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Abstract
This paper[1] reports the effects of three different electronic interfaces on EFL learners' look-up behaviour. Subjects performed language tasks under three conditions: with a paper dictionary, a traditional electronic dictionary, and two non-traditional electronic dictionaries. Statistically significant differences in use were recorded.

1 Background

Electronic dictionaries[2] have been increasingly accessible to language learners recently and their pedagogical potential is too great to be ignored [NESI 1999]. There seems to be considerableadvantage in electronic dictionaries over paper (or hard-copy) dictionaries. A variety of search functions (thus faster look-up), links with multimedia files (e.g. sounds and pictures), virtually no space limitation (thus extra examples and databases), links with other software, and portability (in the case of hand-held dictionaries) are a few examples of those advantages. In relation to vocabulary learning, it is still an empirical question whether fast searching is really advantageous to the learning process (see, however, the positive findings in [Guillot/ Kenning 1994]). In spite of the doubt that language teachers express, however, there is evidence that many students prefer to have electronic format because it is much quicker and easier to look up words [Taylor and Chan 1994].

From lexicographical viewpoints, one of the differences between hard-copy dictionaries and electronic dictionaries is that the former has only a linear, non-hierarchical microstructure while the latter has a hierarchical, layered presentation. The paper dictionary has its own microstructure, but it must inevitably present all the information in a linear order on the same level (unless using different typesets or colours). Electronic dictionaries, on the other hand, can handle information in a more flexible way. For example, they can present word senses first, followed by examples or usage notes called up from amenu. While restricting information is possible via layered presentation, afull-text search can treat the entire dictionary as one whole text. Dictionary-publishing houses are trying to exploit these functions to the full and several different interfaces of electronic dictionaries nowavailable. There has been very little research, however, into the effects of those different interfaces on performing different language tasks.

I have made a series of studies on dictionary user interface [cf. Tono 1984, 1992] inhard-copy dictionaries, in which several interesting user habits have been identified. A gap exists in the quantity of research available for the evaluation of electronic dictionary interfaces. In an attempt to bridge the gap, the present study investigates whether different electronic dictionary interfaces would affect the performance in different language tasks.

2 Method

2.1 Overview

The present study investigated L2 learnersĄf dictionary use and three factors that might influence it – theinterfaces of electronic dictionaries, language tasks, and repeated exposure to the interface. Five Japanese MA students at Lancaster University participated in the study. They worked on three sets of language tasks: first, with a paper dictionary, second and third, with three different electronic dictionaries. Each set involved different language tasks such as word and phrase look-up, L1-L2/ L2-L1 translation, and paragraph reconstruction.

2.2 Research questions

The present study addressed the following research questions:

a) Is there a significant difference in look-up ease between paper and electronic dictionaries?
b) Is there a significant difference in look-up ease between different interfaces of electronic dictionaries?
c) Is there a significant difference in look-up ease between language task types? Is there any interaction effect between task types and electronic dictionary interfaces?
d) Is there a significant difference in look-up ease when the subjects are more exposed to one particular dictionary interface?

2.3 Variables

2.3.1 Independent variables

There were three independent variables:

1) Dictionary interfaces: 4 levels [Paper/ ED: traditional/ ED: parallel/ ED: layered].
2) Language tasks:
    a) Out of context: simple look-up [single words/ derivatives/ idioms & compounds]
    b) In context: translation & reading comprehension for paragraph reconstruction task
    c) Receptive vs. productive skills [L1-L2/ L2-L1]
3) Exposure to the dictionary: 2 levels [no exposure/ repeated exposure]

It is necessary to elaborate on the interfaces of electronic dictionaries.

(a) The traditional interface:
Information is provided in a similar way to that ina paper dictionary. Idioms and phrasal verbs are listed after the list of translation equivalents and illustrative examples. This type of electronic dictionaries has been most popular, for it is easy to import the dictionary file into an electronic format. For this interface, the *Shogakukan's Progressive English- Japanese/Japanese-English Dictionary* built into the *Microsoft Bookshelf* (1996 Microsoft) were chosen.

(b) The parallel interface:
Information is provided in a parallel bilingual translation format. All the words and phrases, including phrasal verbs, compounds, idioms and collocations, are located separately in individual entries with their translation equivalents in a parallel format. For this interface, the shareware *Personal Dictionary for Windows (PDIC)* was chosen with a freely available dictionary called "*Eijiro*". This dictionary wascompiled by a group of volunteer translators who donate all the translated example words and phrases. It has currently more than 800,000 separate items in the dictionary. For L1-L2 translation, one should use the function to search strings in the translation equivalence section[3].

(c) The layered interface:
Information is organised by a tab menu. The microstructure is organised in such a way that different information appears on a different tab sheet. For example, the dictionary used for this study, the *Kenkyusha's College Lighthouse English-Japanese/ Japanese-English Dictionary* as part of *Dr. Eye* (1998 Inventec Electronics) has three tabs in one entry[4]. The first tab sheet has basic information such as the entry word, pronunciation, conjugation, anda list of translation equivalents with illustrative examples. The second tab has other extra information such as usage notes, collocation patterns, synonym/antonym, and derivative forms. The third tab sheet contains idioms and phrasal verbs.

In order to provide the base-line data, two paper dictionaries (*Kenkyusha's College Lighthouse English-Japanese Dictionary* and *Shogakukan's Progressive Japanese- English Dictionary*) were used for the control conditions.

2.3.2 Dependent variables

The dependent variable was defined as the mean length of time (sec) taken for accessing correct information. Correct information means a choice of acceptable translation equivalents for a looked-up word. In this study, look-up ease was equated with the speed at which the subjects found the information they needed.

2.4 Subjects

Five Japanese EFL students studying in the MA programme at Lancaster University agreed to participate in the study. Due to the restrictions of thehardware environment in which this study was conducted, the number of the subjects was very modest. However, the research was carefully designed so that sufficient number of observations could be made for each dictionary interface and different language tasks.

2.5 Materials

Three sets of dictionary look-up tasks were prepared in the present study. Language tasks for each session are the following[5] (E stands for English; J for Japanese):

(a) Session 1: with paper dictionaries

(i) Looking up single words out of context (10 words: E → J)
(ii) Looking up idioms and compounds out of context (10 phrases: E → J)
(iii) L2-L1 translation (10 sentences: E → J)
(iv) Looking up single words/ phrases (5 out of context; 5 in context: J → E)

(b) Session 2: with electronic dictionaries

(i) Looking up single words and derivatives (pre-selected)
(10 words per dictionary: E → J)
(ii) Looking up idioms and compounds (pre-selected)
(10 phrases per dictionary: E → J)
(iii) L2-L1 translation (2 sentences per dictionary: E → J)

(c) Session 3: with electronic dictionaries

(i) Looking up single words and phrases (pre-selected; 8 words per dictionary: J → E)
(ii) Looking up single words and phrases (pre-selected)
(9 words/phrases per dictionary: E → J)
(iii) Paragraph reconstruction (using their favourite dictionaries)
(iv) L1-L2 translation (3 sentences with their favourite dictionaries: J → E)

3 Procedures

The subjects were individually asked to visit the researcher's office and worked on the first set of tasks on paper. After the first session, each subject was asked to fill in the questionnaire. The following two sessions were done on the computer at one week intervals. At the beginning of the second session, the subjects were provided with detailed instructions on the use ofthree different electronic dictionaries. After 5-minute practice for each dictionary, they were asked to work on the tasks.

The subjects' look-up process was recorded using a Microsoft Camcorder, which enabled me to record the entire operations on the PC screen and save them as AVI files. The subjects were asked to use a mouse to point where they were looking and reading, which made sure that the recording could reproduce the subjects' eye movements. There was no fixed time limit for each task. The subjects were encouraged to work on the task as normally as possible.

4 Data Analysis

The recorded movie files were analysed carefully to obtain the list of words looked up. For each look-up word or phrase, the time taken for look-up and accuracy rate were calculated. The mean length of time taken for correct retrieval ofsingle words, derivatives, idioms and compounds was calculated for each subject using each of thethree different electronic dictionaries. In the case of translation tasks, time taken for each look-up and accuracy rate of look-up werecalculated. Univariate ANOVA and post-hoc tests were conducted on dependent measures: the mean length of time and the accuracy rate respectively. Some items deliberately appeared in more than two sessions for the purposes ofcomparison. For those items, GLM Repeated Measures were performed.

5 Results and Discussion

As space is limited, I will concentrate on the results of look-up for words and phrases in English out of context. The full results of the study, including the analysis of translation tasks, will be reported at the congress. Means and standard deviations for each dictionary type with task types (single words, idioms/compounds, derivatives) are shown in Table 1.

Dictionary type	Task type	Mean	Std. Deviation	N
paper	single word(E)	17.0264	7.6200	50
	idioms/compounds(E)	38.4100	26.7154	50
	Total	27.7182	22.3038	100
ed:traditional	single word(E)	6.8260	3.6208	25
	idioms/compounds(E)	32.5780	32.4699	25
	derivatives	18.4416	26.0152	25
	Total	19.2819	26.0397	75
ed:parallel	single word(E)	4.6636	3.4573	25
	idioms/compounds(E)	14.2124	12.6359	25
	derivatives	7.2060	4.5106	25
	Total	8.6940	8.8759	75
ed:layered	single word(E)	5.5644	1.7530	25
	idioms/compounds(E)	22.6996	15.6037	25
	derivatives	10.0708	4.8260	25
	Total	12.7783	11.8670	75

Figure 1: Descriptive Statistics of Look-up Time

Table 2 shows the results of the univariate ANOVA. Let me briefly summarise the findings by reviewing each hypothesis in the present study[6].

- H_0^1: *There is no significant difference in look-up ease between paper and electronic dictionaries*.

  The average time taken for look-up in paper dictionaries was significantly longer than the time taken in the case of electronic dictionaries (Tukey HSD: paper vs. traditional = 8.44**; paper vs. parallel = 19.02**; paper vs. layered = 14. 94**). As far as the macrostructure is concerned, the results substantiate the claim that electronic dictionaries provide quicker access to the target entry than paper medium.

- H_0^2: *There is no significant difference in look-up ease between different interfaces of electronic dictionaries*.

  As shown in Table 2, the main effect of three types of electronic dictionary interfaces was statistically significant. All post-hoc test comparisons (Tukey HSD, Scheffe, Bonferroni, LSD) found the difference between the traditional and the layered interfaces to be non-significant and the difference between the traditional and the parallel interfaces significant on every measure. The findings suggest that the parallel interface allows faster search than the other two interfaces.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
DICTYPE	14881.153	3	4960.384	17.161**	.000
TASKTYPE	19778.898	2	9889.449	34.214**	.000
DICTYPE * TASKTYPE	1939.254	5	387.851	1.342	.246
Error	90760.947	314	289.048		
Total	238305.640	325			
Corrected Total	133782.558	324			

Figure 2: Results of Univariate ANOVA Dependent Variable: Time; ** p <.01

H_0^3: *There is no significant difference in look-up ease between language task types. There is no interaction effect between task types and electronic dictionary interfaces.*

The main effect of the task type was also significant. Post-hoc comparisons found that idioms and compounds took significantly more time to look up than single words and compounds, which is not very surprising, considering the complexity of looking up multi-word units. The interaction of dictionary types and task types was non-significant. Figure 1 shows the estimated marginal means of time in relation to task types and dictionary types. The parallel interface seemed to be quicker in the case of complex search.

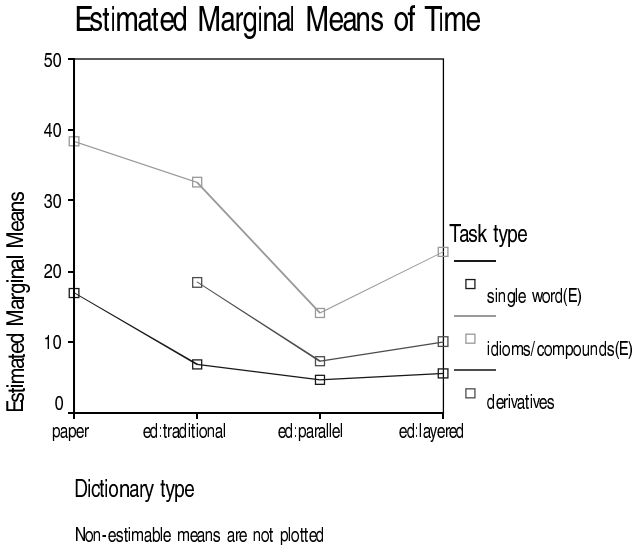

Figure 3: Estimated marginal means of time

While the final results of the study will be reported at the Congress, the findings based on the meaning search of predetermined words and phrases indicate that the subjects found information more quickly in the parallel interface than the traditional or layered interfaces. The parallel interface is especially effective in the case of derivatives, idioms and compounds, which require the user's prior knowledge of microstructure of the entry. If the microstructure wasdifferent

from what the users expected, they becameconfused and ended up making avery slow search. Since the parallel interface does not have a complicated internal organisation within the entry, search speed is significantly increased.

Although empirical research of electronic dictionary use is still in its infancy, it is also a very promising research area. The interface of electronic dictionaries can be much more easily revised andimproved than that ofpaper dictionaries, and thiswill facilitate research into various radical interfaces which otherwise cannot be realised in paper dictionaries. Electronic dictionaries seem already to be on the way to becoming a preferred alternative to the 'fat' dictionary in print [Nesi 1999: 65]. Further research could dramatically improve the potential of electronic dictionaries for language learners.

Notes

[1]I wish to thank Hilary Nesi for reading the draft and making a number of helpful suggestions.

[2]In this paper, I will deal with CD-ROM dictionaries only, although I am aware that hand-held electronic dictionaries are becomingincreasingly popular among young language learners.

[3]There is a Japanese-English dictionary available for PDIC, which I could not obtain in time for this research. Thus I asked the subjects to use the search function.

[4]In *Dr. Eye*, only the English-Japanese dictionary section has the tab sheet interface. The Japanese-English dictionary has a traditional single-page interface.

[5]Details of the tasks can be obtained from my web page (http://www.lancs.ac.uk/postgrad/tono).

[6]The results of Hypothesis 4 cannot be discussed here for lack of space. The full results will be reported at the congress.

References

[Guillot / Kenning 1994] Marie-Noelle Guillot and Marie-Madeleine Kenning: "Electronic monolingual dictionaries as language learning aids: a case study", *Computers in Education*, 23 (1/2): 63-73

[Nesi 1999] Hilary Nesi: "A user's guide to electronic dictionaries for language learners", *International Journal of Lexicography*, 12 (1) 55 - 66

[Taylor / Chan 1994] Andrew Taylor and Adelaide Chan: "Pocket electronic dictionaries and their use", in: Willy Martin, Willem Meijs, Margreet Moerland, Elsemiek ten Pas, Piet van Sterkenburg, and Piek Vossen (Eds.) *Proceedings of the 6th Euralex International Congress*, (Amsterdam: Euralex) 1994 598 - 605

[Tono 1984] Yukio Tono *On The Dictionary User's Reference Skills.* Unpublished B.Ed Thesis. Tokyo: Tokyo Gakugei University. 1984.

[Tono 1992] Yukio Tono "The effect of menus on EFL learners' look-up processes", in *LEXIKOS* 2 (AFRILEX-reeks series): 230-53.