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# DESIGNING RELATIONAL DATABASE STRUCTURES FOR STORING AND PROCESSING LANGUAGE QUESTIONNAIRE DATA:
## An example from a study in dictionary use

### 1. Introduction

Ever since the early work by Barnhart (1962), and especially in the wake of Tomaszczyk's (1979) groundbreaking study, questionnaires have remained the data collection instrument of choice in studies of dictionary use. Despite Hatherall's criticism (Hatherall 1984), the questionnaire continues to be an important, though often misused, tool in dictionary use research (Lew 2002). As questionnaire-based studies have expanded both in terms of sample size and breadth of factors investigated, the coding, storage, and processing of a large volume of questionnaire data has become a major problem. This was recognized in a recent large-scale (723 subjects) international project (Atkins and Varantola 1998), in which a team of experienced researchers devoted extensive time (12 years) and resources to put all data in electronic database form. Even so, the format used failed to allow certain types of potentially interesting queries. The authors did not apply any statistical significance testing.

In an ongoing study of dictionary use by 712 Polish learners of English, I have designed and employed a relational database to code and store questionnaire data in a way that allows the researcher to investigate potentially interesting variable interactions. Such data structures may then be queried by statistical packages for further computation and visualization. In what follows, I will outline the methodology of the study, followed by a selection of results to illustrate the types of questions that may be asked – and answered – with the help of a database so designed.

### 2. Summary of methodology

The ongoing study by the author which is described here employs two principal methods of data collection: learner survey and controlled experiment. A total of 712 Polish learners of English from 44 groups coming from 20 institutions act as subjects for the learner survey and controlled experiment. As yet another source of data, teachers of the subject learners complete a teacher survey. The underlying idea is that different types of information are collected through different means, allowing the researcher to examine potentially interesting interrelationships.

There is no space here to look in detail into the structure of the data-collection instruments used in the study. Instead, I will focus on the procedural and technical aspects of the study, and illustrate the potential of the approach by a brief look at selected results.

Before proceeding, however, a few fundamental details must be given of the experimental procedure employed in the study. Subjects were asked to perform a number of lexical tasks while

referring to dictionary entries that were specially designed for the tasks and included with the task sheets in the form of a booklet. The tasks varied with regard to the amount of context, bearing in mind the complex interaction of dictionary use and contextual guessing (Bensoussan and Laufer 1984; Fischer 1994; Hulstijn et al. 1996; McCreary and Dolezal 1999), and included synonym matching, sentence completion, sentence translation and text translation. To control for lexical preknowledge, English pseudo-words (appropriately structured nonce formations posing as English words) were used in the experiment, in a manner similar to Tono (1984). Subjects had access to one of six versions of the dictionary, randomly assigned.

### 3. Procedure

The flow chart in Figure 1 illustrates the general procedure of the study under discussion.

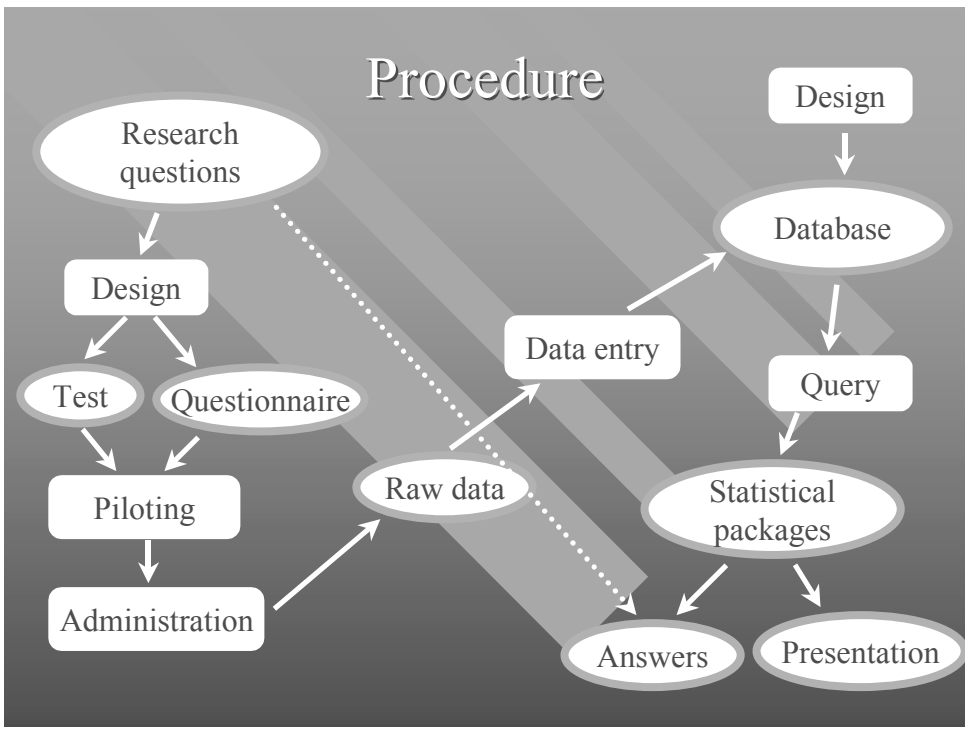


Figure 1: A flow chart showing the procedure of the study

Based on research questions, the instruments (test and questionnaire) were designed. The tools were then piloted to locate and eliminate design problems, and their corrected versions were administered to the subjects, yielding raw data. Meanwhile, a database was designed to store the data. Once the data had been entered in the database, they could be queried with statistical packages to help yield answers to original research questions and to assist in the presentation of results (tables, graphs).

### 4. Database structure

The database and the data-collection instruments were designed so as to represent as much of the original information as possible, i.e. with as little processing or interpreting of the

questionnaire/test responses as possible. In doing so, the database was made maximally flexible in terms of the range of possible queries.

The structure of the database is given in Figure 2 below.

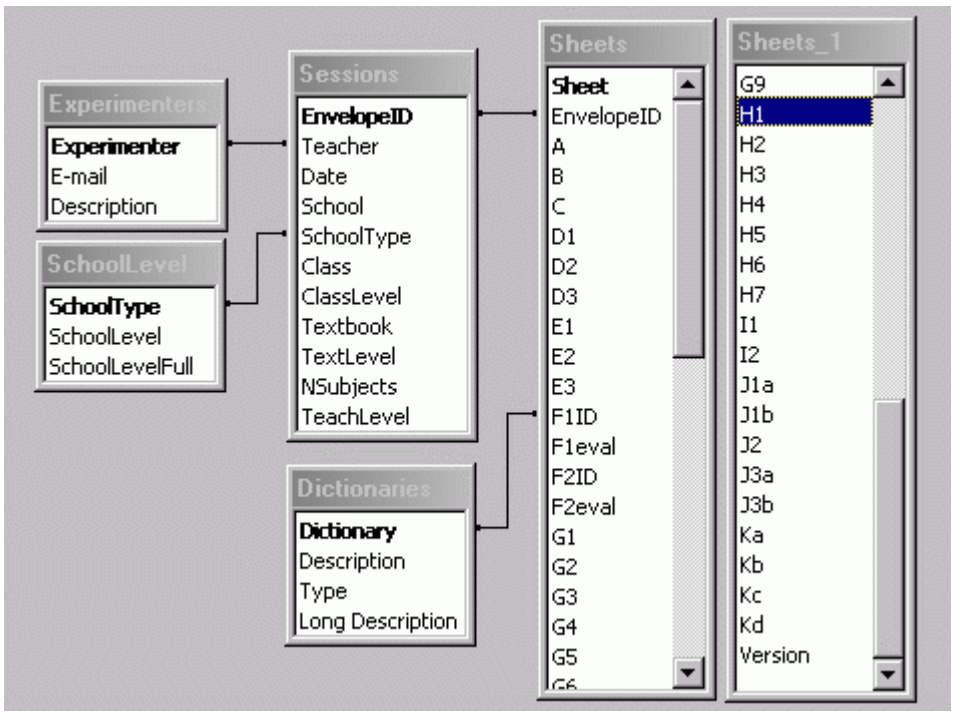


Figure 2: Structure of the database holding data from questionnaires and experiment

The Sessions table in Figure 2 holds details of each session during which the questionnaire and experiment were administered. The Sheets table stores individual responses as well as some design variables. Depending on the type of the item, records may hold text strings or numerical values. The Dictionary table stores data on dictionaries given by subjects as their first and second preference. The SchoolLevel and Experimenter tables are self-explanatory.

## 5. Querying the database

The database illustrated in Figure 2 above allows queries for various types of information depending on the particular research questions that are being asked. Because – as previously explained – the format of the stored data has been made to reflect as closely as possible the format of the original responses, the burden of processing and scoring lies with the queries, which can get fairly complex. As an illustration, consider an SQL query which derives learner level from a variety of variables (Figure 3), and a small fragment of a query which scores experimental task items by examining text strings (Figure 4).

```
SELECT DISTINCTROW [Sheets].[Sheet], [Sheets].[A], [Sheets].[B], [Sheets].[C],
[Sheets].[D1], [Sheets].[D2], [Sheets].[D3], [Sheets].[E1], [Sheets].[E2], [Sheets].[E3], [A]+[B] AS
QEdLevel, IIf(IsNull([C]),2,[C])-
2+IIf(IsNull([D1]),2.5,[D1])+IIf(IsNull([D2]),2,[D2])+IIf(IsNull([D3]),2,[D3]) AS QEnLevel,
[QEdLevel]+[QEnLevel] AS QLevel, [Sessions].[TeachLevel], [Sessions].[TextLevel],
[TeachLevel]+[TextLevel] AS TTLevel, [SchoolLevel].[SchoolLevel], [Sessions].[ClassLevel],
3*[SchoolLevel]+[ClassLevel] AS EdLevel, 2*[TTLevel]+[EdLevel]+[QLevel] AS AllLevel,
IIf([AllLevel]<28,1,(IIf([AllLevel]<32,2,(IIf([AllLevel]<38,3,(IIf([AllLevel]<46,4,5)))))))) AS [Level]
    FROM SchoolLevel INNER JOIN (Sessions INNER JOIN Sheets ON
[Sessions].[EnvelopeID]=[Sheets].[EnvelopeID]) ON
[SchoolLevel].[SchoolType]=[Sessions].[SchoolType];
```

Figure 3: SQL query to compute learner level

```
    [...]
    IIf([Sheets]![J3b]="przeźroczysty" Or [Sheets]![J3b]="przejrzysty" Or
[Sheets]![J3b]="good",1,0)+IIf([Sheets]![J3b]="ok",0.5,0) AS J3bS,
IIf([Sheets]![Ka]="zdumiewający" Or [Sheets]![Ka]="niewiarygodny" Or
[Sheets]![Ka]="good",1,0)+IIf([Sheets]![Ka]="ok",0.5,0) AS KaS, IIf([Sheets]![Kb]="ciężarny" Or
[Sheets]![Kb]="good",1,0)+IIf([Sheets]![Kb]="ok",0.5,0) AS KbS, IIf([Sheets]![Kc]="sąsiad,,
    [...]
```

Figure 4: Fragment of an SQL query to compute experimental task score

## 6. Sample research questions

As an illustration of how the apparatus outlined above can assist in providing answers to questions of interest to dictionary use researchers, let us take up a selection of such questions below. As the purpose here is mainly illustrative, no detailed discussion or interpretation of results will be offered.

### 6.1. Do users rate monolingual dictionaries more highly than bilingual dictionaries?

Subjects were asked to rate the dictionaries they used most often, and the Dictionaries table of the database holds information on dictionary type. Thus, average ratings of the two dictionary types (bilingual and monolingual) can be obtained. These are presented in Table 1 below.

| Dictionary type | Mean rating | N |
|---|---|---|
| bilingual | 3.96 | 572 |
| monolingual | 4.53 | 36 |

Table 1: User ratings of bilingual and monolingual dictionaries

The results suggest that users rate monolingual dictionaries significantly higher than they do bilingual dictionaries. There is of course no straighforward relationship here with the general quality or usefulness of the two types of dictionaries, as ratings are also no doubt affected by dictionary image and by the relative ease with which lookup failures are blamed on the user and

the dictionary, respectively. There is no space here to further discuss this interesting issue, nor is there space to report detailed ratings of specific products within the two types of dictionaries.

### 6.2. What information do learners at various levels most frequently seek?

In Figure 5 below, declared frequencies with which learners sought particular types of information in their dictionaries are plotted against their overall English language competence level.

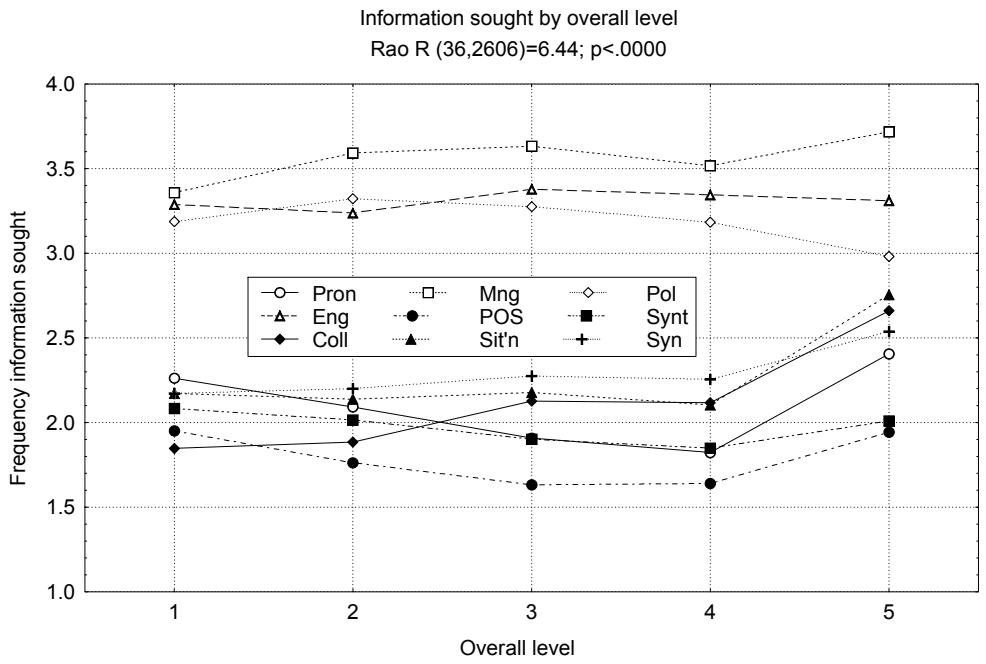


Figure 5: Information sought by overall level
(Pron = pronunciation; Eng = English equivalent; Coll = collocation; Mng = meaning; POS = part of speech; Sit'n = style/register; Pol = Polish equivalent; Synt = syntactic patterns; Syn = synonyms)

The graph indicates that for all levels but the the highest, a clear preference is given to searches for meaning or equivalents (semasiological and onomasiological), to the exclusion of the less prototypical categories of dictionary information. However, for the most advanced learners the interest in some of the "peripheral" types of information almost catches up with the more traditional semantic information types.

There are also interesting differences amongst the different non-semantic types of dictionary information investigated here. Collocational information, for example, gains in popularity fairly steadily with growing level, while pronunciation exhibits a general downward trend, only to surge at the most advanced level.

### 6.3. Is the monolingual dictionary really more helpful to the more advanced students? If both translations and definitions are given, does it matter if definitions are in English or in Polish?

These two questions are conveniently addressed in tandem. To investigate the use of different types of dictionaries, subjects were presented (randomly) with one of six dictionary versions:

1. bilingual with Polish equivalents
2. monolingual with definitions in English
3. hybrid with Polish equivalents followed by definitions in English
4. bilingual with Polish equivalents followed by definitions in Polish
5. hybrid with definitions in English followed by Polish equivalents
6. bilingual with definitions in Polish followed by Polish equivalents

For better clarity, Table 2 below breaks down the six versions of the dictionary by controlled variables. Dashes in four of the cells indicate values that are indeterminate by design..

| version | equivalent | definition | definition first | definition English |
|---|---|---|---|---|
| **1** | 1 | 0 | – | – |
| **2** | 0 | 1 | – | – |
| **3** | 1 | 1 | 0 | 0 |
| **4** | 1 | 1 | 0 | 1 |
| **5** | 1 | 1 | 1 | 0 |
| **6** | 1 | 1 | 1 | 1 |

Table 2: Six dictionary versions broken down by four design variables

In Figure 6 below, test scores on all tasks are plotted as a function of dictionary version and level. With any dictionary, higher-level learners achieve highers scores. When individual dictionary versions are examined, one version – the monolingual dictionary – performs significantly worse than each of the other five versions. There are no significant differences between any of the other versions. A look back at Table 2 reveals that the monolingual dictionary (version 2) differs from the other versions in its absence of Polish equivalent, which is thus found to be the best predictor of success on the test tasks.

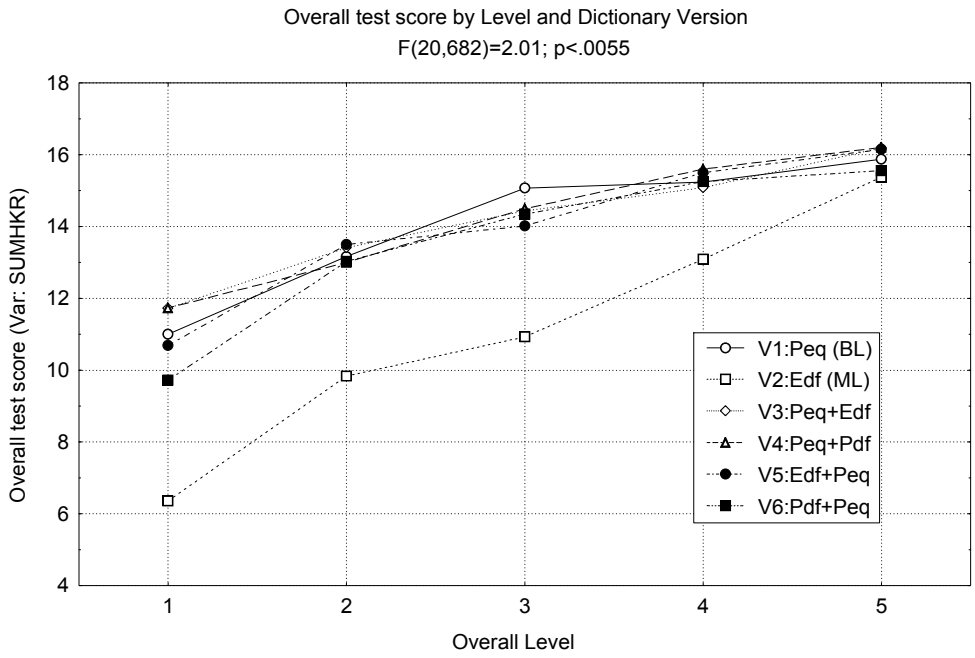


Figure 6: Overall test score by Level and Dictionary Version

To address the first research question of this section, the monolingual dictionary appears to be less useful (on the tasks given) to the learner than any other type. However, there is also a significant interaction effect whereby the disadvantage of the monolingual dictionary diminishes with increasing level. The monolingual dictionary, then, does appear to be *relatively more suitable* for the more advanced learners, but only in a discouraging sense of presenting less of a disadvantage vis-à-vis the dictionary types that offer the support of Polish equivalents.

In terms of the second research question of this section, a contrast analysis of versions 3 and 5 on the one hand against versions 4 and 6 on the other reveals no significant difference, suggesting that the language of the definition does not matter as long as the translation equivalent is present.

Obviously, other types of tasks than those used in the study might produce different results, but it is nevertheless very interesting to compare the high ratings given to monolingual dictionaries with their rather disappointing performance on the tasks in this study.

## 7. Conclusion

As I have tried to demonstate, various types of potentially interesting research questions can be addressed when data collected through a number of methods (questionnaire and experiment) are represented in relational database format.

The drawback is that table structures and queries can get fairly complex, but that is a price to pay for the increased sensitivity of the approach. A price, it appears, that is well worth paying.

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Keywords: database, questionnaire, dictionary use, lexicography, dictionaries, dictionary preference, information in dictionaries, dictionary entry structure, dictionary definition, dictionary equivalent