Linguistica Silesiana 22, 2001
ISSN 0208-4228

DANUTA GABRYŚ
University of Silesia, Katowice

MEASURING THE LEXICAL ORGANISATION OF TRILINGUAL LEARNERS' MENTAL LEXICON: EVIDENCE FROM THE ASSOCIATION CHAINS

Lexical competence of a speaker/multilingual learner which should be understood not only as "the sum of speaker's konwledge of the items the lexicon contains" (Meara 1996), but their mutual connctivity as well, can be described in terms of two major characteristics: size and structure (organization). The article reports the study focussing on the organization of a mental lexicon of trilingual learners with three different language competences: L1 – Polish (native), L2 – English (advanced) and L3 – German (intermediate). The group of 90 trilingual language students divided into three language groups (L1, L2, L3) was exposed to the task of creating association chains in three respective languages. The subjects were given a list of individual pairs of frequent words, selected at random, where in each pair one item constituted an input and the other, the output. The task consisted in filling in the gap in the association chain under the time limit (15 minutes for 20 association chains). The research was to give sample evidence of lexical competence in three different languages of the subjects in terms of their mental lexicon organization. The data collected aimed at showing examples of high versus low connectivity observed in the association chains, as well as showing similarities and differences in patterns of connections made in different languages. The variables considered were: the length of association chains, complete versus unfinished chains, types of associations: syntagmatic versus paradigmatic and concrete versus abstract words.

1. Introduction

1.1. How to measure lexical richness

Most of the studies on mental lexicon of foreign language speakers focus on measuring the lexical richness, which often seems to be treated as equal with the knowledge of words in possession by the given subjects and their number. What is understood by the knowledge of lexical items refers to the whole set of dictionary characteristics each word can be descibed by, such as: meaning, pronunciation, most frequent syntactic patterns the word enters (collocations), etc. But does this type of knowledge make the learners proficient users of words in actual performance? What seems to be missing is the mutual connectivity between these words as an indispensable part of the lexical competence. As Meara (1996:51) claims:

The crucial idea is that lexical competence is probably not just the sum of speakers' knowledge of the items their lexicon contains.

Meara (1996) proposes to view the lexicon from two different but interconnected dimensions: its size and its organisation (structure). The structure of the lexicon may be defined as as degree of connectivity between the lexical items. There are lexicons that probably exhibit a very high connectivity: those of native speakers and proficient speakers of a FL. The beginner's lexicon may either be a small sized dictionary (list) of entries, very loosely connected and if so, probably representing different patterns of connectivity from those of native speakers'. It can be hypothesised that the degree and type of connections exiting in the mental lexicon, change with the growth of its size and language proficiency. Not much research has been done in this respect.

1.2. Lexicon as a structure: principles and variables affecting connectivity

It has beeen proposed (Meara 1992) that lexical connectivity can be measured by means of association chains, a task in which a subject is asked to connect the input word with a given output item, as in the example:

sea... weed... flower... butterfly (Meara 1996: 49)

The abundance of patterns observed in L1 production is greater than in L2, the association link is created instantenously. However, in L2 or L3 the process of automatic association is inhibited because of the fewer possibilities a defective in completenss, lexicon offers.

The whole variety of factors can be assumed to influence the degree of connectivity observed. As De Groot (1993: 46) puts it: "In addition to other possible determinants of representational form (e.g. L2 learning kistory), the storage format may also dependent on wprd type (...), concrete words and cognates are relatively often stored in a compound fashion, while abstract words and non-cognates areare more likely to be stored in a coordinate form". She also adds: "A set of words (e.g. L2 words that are still in the early stage of being acquired) may be represented in a subordinate form. (...).Other words characteristics may also influence storage format (for instance, a word frequency) and whether or not a word's meaning isculturally distinct".

To sum up, the following variables may be singled out:

a) frequency of occurrence
b) linguistic characteristics (word category, eg. nouns acquired earlier in L1 and easier in a FL, concrete versus abstract quality)
c) connotations and background knowledge of a speaker (personal references)
d) learning mode.

Synectics i.e. "science" that observes the ability to associate different areas of perception, e.g. connecting colours with smells and sounds with colours, etc, assumes that the emotional component is more creative than the intellectual, that analogical thinking (the process of consciously looking for similarities among elements in the particular task and reality) is easier in our mother tongue than in other (foreign) languages. The "feeling of recognition" is based on "memories" of the reality as lived, whereas in the case of the languages learnt, this reality is grounded in a formal setting: a classroom instruction,

where a learning experience may become significant for the way lexical items of a certain language structure the lexicon (transfer of training).

It can be predicted then, that the types of connectivity observed may be based on:

- semantic (conceptual) fields organised around a core concept that maybe language specific,
- phonetic coding,
- individual items versus chunks,
- grouping by contrast or similarity.

1.3. Association chains as evidence for lexicon structure: hypotheses

As already mentioned, in numerous studies on the structure of mental lexicon evidence has been gathered by means of a variety of methods, among them associations to individual lexical items (S → R pattern) and association chains, where the subjects are to connect the input stimulus word and the output word given in the task (e.g. stimulus: *table...* the final word: *hammer*).

The observation of the data collected may show in case of multilingual speakers a whole variety of responses with respect to the types of associations produced (eg. paradigmatic versus syntagmatic, semantic versus phonological, abstract versus concrete words), length of the chains and their completeness.

On the basis of the research reported in literature on the subject, the following hypotheses have been put forward in the present study for confirmation or rejection:

a. Access to the lexical items of a multilingual speaker will depend on his or her language proficiency, i.e. the more proficient the speaker, the shorter the association chains produced will be. In the case of high language command, the processing becomes more automatic on one hand and the speaker's lexicon is more extensive on the other, so consequently the chain produced requires less effort on the part of the speaker. The connections are made more directly.

b. There will be a positive correlation between the completeness of the association chains (complete versus no chains and complete versus incomplete ones) and speaker's language proficiency.

c. The types of associations made will be L1 (mother tongue), L2 (the first foreign language), L3 (the second foreign language) language specific:
   - they will be influenced by the context of exposure (the method of teaching/ learning), the theme (semantic field), frequency of use in certain contexts in a given language and idiosyncratic connotations of a given speaker;
   - they will be linguistically determined by word categories of the input and output items (eg. noun versus verb) and concrete versus abstract characteristics of a given lexical item in the chain.

2. The description of the study on the organisation of the mental lexicon

2.1. The characteristics of the subjects

The subjects participating in the study consisted of three groups of multilingual speakers, sixty in total. They were all pretty homogenous university students of English at the advanced level. One group studied German at the lower intermediate level. All of them learnt both foreign languages by means of formal instruction in a classroom setting

(school and university, private courses). In terms of their academic achievemnt, they can be evaluated very highly. One group of students performed two tests: L1 and L2 association chains, wheras the second group did only L3 tests (students specialising in German).

2.2. Data collection methods

The study made use of two research methods:
a. association chains
b. retrospection

The association chains the students were to produce, consisted of 20 pairs of words: stimulus the input word and the final output word. The combination of input-ouput items was random, however, all of them came from the inventory of frequently used words in all three languages involved in the study, i.e. Polish, English and German (see Appendix).

The words constituted the following pairs:

concrete (c) – *concrete* (c) → 7 pairs, *abstract* (a) – *abstract* (a) → 2 pairs,
abstract (a) → *concrete* (c) → 4 pairs, *concrete* (c) – *abstract* (a) → 7 pairs

The classification into *concrete* versus *abstract* was not strictly linguistic. Items labelled as *concrete* referred only to the nouns being either persons or objects, while any item describing quality (eg. colour, length, etc) was classified as *abstract* (an idiosyncratic understanding/conceptualisation by a speaker). De Groot (1993:46) makes a clear distinction (as already mentioned), between the abstract and concrete categories of words:

> "Concrete nouns may be the only class of words that share conceptual representations across languages"

while:

> "Abstract words by contrast, have no external referents; their meanings have to be acquired through the dictionaries or inferring their sense from context 9..) So abstrqact words are often represented language dependently (i.e. in a coordinate fashion), whereas concrete words are represented in a compound fashion."

And consequently:

> "The bilingual lexicon has mixed representations"

The students were exposed to twenty pairs of items and instructed to complete them as chains, following the example given. They were not allowed to go back to the chains unfinished at the first attempt. The time limit to perform the task was 10 minutes for each test. Some of the association chains had to be rejected since the subjects either clearly misunderstood the instructions, perceived the tests to be impossible to perform (even in L1) or neglected the task. The final data collected comes from 20 tests for each language, in total 60 tests, i.e. 1200 chains. The task of associating was followed by **the retrospective comments** made by the subjects, which were supposed to be impressionistic in nature.The students were asked to comment on the degree of difficulty of each task performed. The

group which did two tests (L1 and L2) was to compare the difficulties encountered in L1 and L2 test. However, the comments made were random and not very substantial.

3. The results of the study

3.1. The quantitative results

3.1.1. The length of the association chains

Table 1 presents the numerical results of the study with reference to the length of the chains produced. The tasks performed are described in terms of:

- no chains (no association made at all),
- one word chains (the shortest possible lexical access)
- four and more words association chains.

The results are presented for each type of input-output pattern. Percentages of the whole (400 chains for each language) for different length chains were calculated.

Table 1. The length of the association chains (the number of chains for each pair type)

Item type*	L1 test**			L2 test**			L3 test**		
	0	1	>4	0	1	>4	0	1	>4
1. a → c	*0*	*0*	*2*	*0*	*3*	*1*	*3*	*0*	*3*
2. c → a	*1*	*0*	*1*	*0*	*1*	*1*	*3*	*1*	*4*
3. c → a	*1*	*0*	*1*	*0*	*1*	*2*	*1*	*1*	*3*
4. c → a	*1*	*0*	*2*	*2*	*1*	*0*	*6*	*0*	*1*
5. c → c	*3*	*0*	*4*	*1*	*3*	*4*	*9*	*0*	*2*
6. c → c	*2*	*0*	*3*	*1*	*0*	*7*	*1*	*0*	*3*
7. c → c	*1*	*2*	*2*	*2*	*4*	*3*	*8*	*1*	*3*
8. c → a	*1*	*1*	*4*	*3*	*2*	*0*	*4*	*1*	*1*
9. c → a	*3*	*0*	*1*	*0*	*1*	*0*	*4*	*2*	*2*
10. a → a	*3*	*0*	*0*	*0*	*0*	*4*	*5*	*1*	*2*
11. c → c	*0*	*0*	*2*	*0*	*1*	*3*	*3*	*5*	*1*
12. c → a	*1*	*0*	*2*	*0*	*2*	*1*	*4*	*3*	*3*
13. c → a	*1*	*1*	*2*	*0*	*0*	*4*	*1*	*3*	*1*
14. c → c	*0*	*3*	*1*	*1*	*2*	*0*	*2*	*7*	*1*
15. a → c	*2*	*3*	*2*	*2*	*2*	*2*	*3*	*3*	*0*
16. a → a	*5*	*3*	*0*	*3*	*0*	*2*	*5*	*1*	*0*
17. c → c	*1*	*1*	*4*	*1*	*0*	*1*	*0*	*2*	*3*
18. c → c	*1*	*3*	*0*	*2*	*2*	*3*	*4*	*3*	*1*
19. a → c	*3*	*4*	*1*	*0*	*3*	*0*	*3*	*3*	*0*
20. a → c	*5*	*1*	*2*	*9*	*0*	*2*	*9*	*0*	*3*
Total	35	22	36	27	28	40	78	37	37
(%)	(9%)	(6%)	(9%)	(7%)	(7%)	(10%)	(0%)	(9%)	(9%)

* *concrete* (c): a noun, an object or a person
abstract (a): a quality (descriptive, interpretation prone)

** 0: no association chain produced
1: one word complete chain
>4: a chain of four or more words

Comment: Most of the chains recoverd in all three tests were on average 2-3 words long, the values for L1 and L2 are the same; 76%, whereas for L3, the value is lower: 62% of 2-3 word chains. So, as can be observed, there were no substantial differences between the performancce in all three languages. However, if we look at the other lengths, i.e. no (zero) chains, one word and over four words chains, these differences can be detected:

3.1.1.1. No chains. It is in the case of L3 test, that 20% of the 400 chains were zero chains, while L2 test brought the lowest 7% of zero associations only. It could be easily explained by the already stated in the hypothesis language proficiency of the learners in the particular languages (English – advanced, German: lower intermediate) being responsible for these results.. However, L1 tests produced more zero responses (9%) than L2, which obviously cannot be explained by the above mentioned variable (language proficiency). Perhaps it was the nature of the task, more natural as a foreign language task (a learning task) at a more advanced level (L2 versus L3 results), but unnatural in L1.Another reason might be that the L1 lexicon is more complex (extensive) and loaded with connotations (e.g. emotional) which might impede the speed of access.

3.1.1.2. One word chains. Again, although the differences are not statistically significant, it it L3 that resulted in 9%, compared with 7% for L2 and 6% for L1, of one word associations. Does it mean that the smallest lexicon allows for the more direct and automatic connections between the lexical items? And that perhaps such a lexicon is more "directly" structured than L1, in which the lexical store, as already observed, must be most extensive. In L1 the associations become richer. The processing itself is not only cognitive but affective as well (e.g. personal experiences, childhood memories).

Another possible explanation might be that in L3 the highest numbers of one word chains are observed for the *concrete – concrete* pairs of lexical items (examples: 11 and 14), which probably are remembered and stored in a long term memory first and with a greater ease than the abstract ones. In the case of absence of one word chains, the pairs of words are in most cases mixed (examples: 1, 4 and 20). However, this explanation does not always account for the results in L2 test and never in L1 test.

3.1.1.3. Four and more word chains. As far as longer association chains are concerned, their distribution in all three tests seems to be almost identical: L1: 9%, L2: 10% and L3: 9%. No pattern in terms of pair combinations can be observed, i.e. no one of the input – output pairs seem to produce longer chains than the others.

3.1.2. The completeness of the association chains

The data collected in table 2 shows the finished versus unfinished chains with respect to different association pairs. The average completeness for each test and each lexical pair has been calculated.

Table 2. The completeness of the association chains (values given in %)

Item type	L1 test	L2 test	L3 test	Average for each item
1. a → c	*100*	*100*	*75*	90%
2. c → a	*50*	*90*	*80*	73%
3. c → a	*75*	*90*	*98*	87%
4. c → a	*60*	*70*	*50*	60%
5. c → c	*75*	*95*	*50*	73%
6. c → c	*60*	*98*	*75*	74%
7. c → c	*75*	*98*	*50*	74%
8. c → a	*75*	*95*	*80*	83%
9. c → a	*50*	*98*	*80*	76%
10. a → a	*65*	*98*	*80*	81%
11. c → c	*100*	*100*	*95*	98%
12. c → a	*80*	*100*	*80*	86%
13. c → a	*60*	*100*	*98*	86%
14. c → c	*95*	*98*	*80*	91%
15. a → c	*95*	*98*	*95*	96%
16. a → a	*60*	*98*	*70*	76%
17. c → c	*95*	*98*	*98*	97%
18. c → c	*80*	*98*	*80*	86%
19. a → c	*75*	*100*	*98*	91%
20. a → c	*50*	*50*	*50*	50%
Average completeness for each test:	73.75%	93.6%	78.1%	

Comment: The highest completeness of the association chains was detected in the case of English (L2) test: 93.6%, while the Polish (L1) test manifested a much lower number of the completed pairs: 73.75%. Even the German (L3) task was performed in a more satisfactory way in terms of the finished chains: 78.1%. So obviously, it is not the language proficiency of the subjects that is reponsible for the results. However, it might be the nature of the task again (a classroom type of task) combined with language proficiency since it was L2 test that brought a significantly higher score for the completeness of the chains (table 2).

3.2. The qualitative analysis

In terms of content of the association chains there is of course a certain overlap in kinds of associations produced, but on the other hand certain dominating types and patterns can be discerned in each of the individual language tests.

A. L1 association chains are in the main built as certain scripts, where a script can be understood as: "*a unit of meaning consisting of sequences of events and actions that are related to particular situations*" (Richards, 1985:251). The association chains represent sequences that focus on a particular situation, usually from everyday life of a subject. Knowledge of realia contributes to the association lines. Examples:

gwizd – *policja – drogowa – balonik* – ***whisky***
[whistle – police – traffic – "baloon" – whisky]
lew – *mysz – pułapka* – ***zaniepokojony***
[lion – mouse – trap – afraid]
gwizd – *pociąg – Wars* – ***whisky***
[whistle – train – "Wars" – whisky]

Certain scripts are based on the subjects' knowledge of the world deriving from such media as films:

gwizd – *pociąg – dziki zachód – saloon* – ***whisky***
[whistle – train – wild west – saloon – whisky]

or perhaps their personal experience:

gwizd – *oznaka radości – alkohol* – ***whisky***
[whistle – sign of joy – alcohol – whisky]

Apart from the scripts, the subjects made references to their knowledge of (Poilsh) literature and film:

pająk – *robak – Pan Tadeusz* – ***ksiądz***
[spider – insect – "Pan Tadeusz – priest]
złość – *film "The Beauty and the Beast"* – ***piękny***
[anger – "The Beauty and the Beast" – beautiful]

There were also examples of associations made to Polish history:

pająk – *krzyżak – Grunwald – wojna* – ***ksiądz***
[spider – spider with a cross/Prussian knight – war – priest]

The above quoted examples are all based on scripts, concepts or visual images which conjure up the associations. However, some of the subjects when associating would automatically focus on form. The best examples come from the associations using rhymes:

spragniony – *miłoœæ* – ***słodka – gładka***
[thirsty – love – sweet – smooth]
ciasto – miasto
[cake – city]
michy – cichy
[pot's – calm]

Apart from individual lexical items constituting association chains, fixed phrases (collocations) or sayings were also observed:

krowa – ***czarna w kropki bordo*** (a popular saying in the past)
[cow – black with red spots]
ręka – ***rękę myje*** (a proverb)
[hand – washes another hand], i.e. "scratch my back and I'll scratch yours"

A. L2 association chains are also grounded in some scripts originating in everyday life experiences universally shared:

you – *me – love* – ***dream***
doctor – *patient – death – funeral* – ***black***
bed – *and breakfast – eggs – milk* – ***cheese***

What is interesting in the above quoted example is the use of the set phrase *bed and breakfast* recovered as a chunk. Other patterns discovered made use of the subjects' knowledge of literature and film:

spider – *fly – literature – Puritan* – ***priest***
foot – *hand – Edward Scissorhand* – ***scissors***

Also some personal memories of the past contributed to the associations:

memory – *past -childhood* – ***stove***

or present day experiences of a language student:

loud – *repetition – practice – language* – ***command***

A substantial number of chains used some sort of a linguistic device:

whistle – *whinning – whisper* – ***whisky*** (alliteration)
hand – *handbag – handle – hassle* – ***city*** (alliteration)
doctor – *white* – ***black*** (antonyms)
memory *bad – good* – ***stove*** (antonyms)
outside – *out – side- in* – ***inside*** (word formation?)

In all the chains received in L2 test the dominance of nouns as a word category can be observed.

C. L3 association chains represent a good number of scripts as those observed in L1 and L2 tests, however, they differ in terms of their linguistic composition. A lot of them make use of fixed phrases, usually grammatical collocations describing certain actions characteristic of a schematic situation:

long – *work – washing clothes* – ***bath***
bed – *getting up – breakfast – bread* – ***cheese***
foot – *go for a walk – hairdresser* – ***scissors***
thirsty – *to drink coca with ice – ice* – ***stove***

Compared with L1 and L2 tests that focus on nouns only, the importance of verbs can be easily noticed here (ahigher status of verbs in German?).

What is particularly interesting in the German association chains is the extend to which they refer to experiences and knowledge of the world (often having some connection with German culture, history, etc.):

hand – *roundabout – traffic -New York* – ***city***
memory – *war – concentration camp* – ***stove***
loud – *to scream – power – Hitler* – ***command***

or sciences which were created by German speaking psychoanalysts:

you – *personality – Yung* – ***dream***
outside – *personality – power – control* – ***inside***

Summing up, it could be said that in terms of **similarities**, the associations in all three languages observed, refer to:

- scripts (shared general knowledge)
- media knowledge (e.g. films)
- personal experiences

In terms of differences, they focus on:

- background information specific for a language (not crossing the language borders, e.g. Polish literature, Polish history observed only in L1 tests)
- form, e.g. language devbices (e.g. alliteration for L2 and rhyming for L1).

4. The association chains from the learners' perspective (the comments of the subjects)

Having performed the association tests, the subjects were asked to comment on the task, and in particular on the degree of difficulty encountered. The opinions expressed were no unanimous. In the group that did L1 and L2 tasks, there was no clear majority for those who would consider the L1 test easier or more difficult than L2. Some of the learners claimed that:

The L1 test was easier. It is becaue of the abundance of vocabulary and that we have done similar tests earlier in Polish classes at school.

or

It was easier to write in Polish (L1). maybe because Polish words convey extra emotional background, eg. childhood memories.

Whereas others would say:

L1 more difficult. L2 more natural as a learning task, playing with the language.

and

It was definitely easier to write in English, never more than two words.

Still others would agree that:

I can't quite decide which test was easier (L1 or L2), I can only distinguish between the particular examples.

Both tests were pretty difficult.

Of the same difficulty, some words came very quickly, some hadn't come at all.

Some associations did not come easily in both tests.

Commenting on the types of associations, the subjects admitted that:

Sometimes they were real, sometimes funny ans senseless.

It was easier to find assocciation to the words that derive from everyday life, which are used frequently.

Some of the learners distinguishged between the word categories that were more easily accessible for them than others:

Mainly nouns came to my mind and only a few verbs, at the beginning some words seem to have no connection (L3 task). Evaluating the tests, generally, the subjects admitted that they were interesting to perform and educational, might be *useful in learning the language*, as somebody added.

Recapitulating, the subjects attributed the difficulties encountered in executing the task:

- to the size of their lexicon (s) than to the connectivity (structure)
- type of a task (learning, unnatural)
- individual word characteristics not language (either L1, L2 or L3)
- lack of connotations (affective) in case of L2 or L3 (especially)
- word categories.

5. The answers to the hypotheses

a) The first hypothesis: *The positive correlation between access to the lexical items stored and language proficiency of the learners.*
The data gathered did not confirm the above. The high command of language on its own did not determine the lexical length of access (i.e. the length of the chains produced), only in combination with other variables.

b) The second hypothesis: T*he positive correlation between the completeness of the chains and language proficiency.*
It seems that language proficiency was the main variable in the scores for completeness (i.e. the number of the complete chains in the L2 test was significantly higher than in L3) for the languages learnt (L2 and L3) and not for the one acquired (L1).

c) The third hypothesis: *The associations made are language specific.*
Language specificity described here linguistic characteristics (word categories and concrete versus abstract words), the context and frequency of exposure and use as well as affective domain. Each of these factors influenced the lexical processing of the subjects, which was reflected in the content of the associations produced.

It would be difficult to distinguish between L1, L2 and L3 structure of the lexicons of the subjects. Obviously, apart from some patterns, these lexicons are highly idiosyncratic and individual differences can clearly be observed. It can be stated that that the three types of the organisation of words in memory can be found, i.e. coordinate, compound and superordinate in each of the three languages in question. So one observable quality is obvious, namely that a multilingual lexicon has mixed representations that are accessed interdependently.

Bibliography

Craik F., Tulving E. (1975). Depth of processing and the retention of words in episodic memory. *Journal of Experimentsl Psychology* 104, 268-294.

De Groot A. (1993). Word-type effects in bilingual processing tasks. In: R. Schreuder, B. Weltens (ed.), *The bilingual lexicon*. Amsterdam/Philadelphia: John Benjamins Publishing Company.

Dietrich R. (1990). Nouns and verbs in the learner's lexicon. In: H. Dechert (ed.), *Current trends in European second language acquisition research*. Clevedon: Multilingual Matters.

Ellis R.D. (1995). *Questioning consciousness*. Amsterdam/Philadelphia: John Benjamins Publishing Company.

Ellis R. (1999). *Learning a second language through interaction*. Amsterdam/Philadelphia: John Benjamins Publishing Company.

Gabryś D. (2000). Content and form evidence for multilingual vocabulary storage systems. Paper delivered at ISAPL'2000 Congress, Universite Caen, Caen, France (unpublished).

Meara P. (1992). Network structures and vocabulary acquisition in foreign language. In: P. Arnaud, H. Bejoint (eds.), *Vocabulary and applied linguisitcs*. London: Macmillan.

Meara P. (1996). The dimensions of lexical competence. In: G. Brown, K. Malkjaer, J. Williams (eds.), *Performance and competence in second language acquisition*. Cambridge; Cambridge University Press.

Schreuder R., Flores d'Arcais G.B. (1992). Psycholinguistic issues in the lexical representation of meaning. In: W. Marslen-Wilson (ed.), *Lexical representation and process*. Cambridge, Mass: The MIT Press.

APPENDIX: Association chains

Instructions:

1. Complete the association chains, follow the example given below.
2. Put down the associations that come frist to your mind
3. Do not go back to the association chains you were not able to complete, mark them as *unfinished* (*incomplete*).

Time limit: 10 minutes (!)

Example:

Stimulus word: *sea* ..... Final word: *butterfly*

association chain: *sea* ... *blue* ... *sky* ... *fly* ... *butterfly* (from Meara, 1996)

1. *dark* ..... *square*
2. *lion* ..... *memory*
3. *butter* ..... *red*
4. *tobacco* ..... *high*
5. *whistle* ..... *whisky*
6. *hand* ..... *city*
7. *outside* ..... *inside*
8. *you* ..... *dream*
9. *cheese* ..... *afraid*
10. *thirsty* ..... *smooth*
11. *table* ..... *hammer*
12. *light* ..... *quiet*
13. *doctor* ..... *black*
14. *foot* ..... *scissors*
15. *long* ..... *bath*
16. *anger* ..... *beautiful*
17. *bed* ..... *cheese*
18. *spider* ..... *priest*
19. *loud* ..... *command*
20. *memory* ..... *stove*