

# FROM SLA TO VSLA: A KNOWLEDGE-ORIENTED VIEW

WILFRIED WIEDEN  
*University of Salzburg*

## 1. *Introduction*

Current research into second language acquisition (SLA) is marked by a widening perspective not only as concerns the approach taken to the study of language acquisition, but also with respect to the object of study. Recently, attention has not only been paid to the formal linguistic aspects of SLA, but also, for example, to the pragmatic, discourse, or social interaction aspects (e.g. Kettemann and Wieden 1993). A problem closely associated with the widening perspective within the field is the growing heterogeneity of goals associated with language learning. It no longer seems so clear, what in actual fact it is, that the learner has to or is expected to acquire. This problem becomes one of even graver concern, when the focus of study is directed to a domain, which has so far received little attention within SLA, vocation-oriented second language acquisition (henceforth VSLA). Research into this particular field of SLA appears overdue in the face of considerable social and economic demands for the ability to access domain-specific knowledge multilingually.

The objective of this paper is basically twofold: It is first to outline (tentatively) the acquisitional task, in other words, to specify what it is that has to be acquired to achieve what may be called multilingual expert competence. Such competence by definition refers to the specific abilities required if domain-specific knowledge is to be accessed and proliferated with appropriate multilingual means. The focus will be on the lexical domain on language, however, different from most current studies on L2 lexical acquisition, under a knowledge-oriented approach, since the core problem in VSLA is assumed to be one of domain-specific knowledge and its representation rather than the problems of how the L2 lexicon is structured, how lexical items are stored by L2 learners and how they are retrieved from memory. The second objective is to outline (even more tentatively) characteristics of the acquisitional process, in other words, to draw attention to possible quanti-

tative and qualitative changes in knowledge and to the assumed determinants of these changes (developmental view). Much of the current research derives its motivation from an interdisciplinary software engineering project at the University of Salzburg, in which a computer-based resource system providing multilingual (and multimedia) access to domain-specific knowledge is being developed.

## 2. Stative view of multilingual expert competence

A distinction is made between knowledge, a collection of facts about the real world coded in the mind of an individual or groups of individuals, and the format or means of representation of that knowledge. This distinction is relevant since natural language can be both, a part (module) of our knowledge (where it contrasts with extra-linguistic knowledge), as well as a means of representation (where it contrasts e.g. with graphic means).

### 2.1. Aspects of knowledge

Depending on field of study and view, different types of knowledge may be distinguished. The proposed variant categories proposed are however, often difficult to compromise.

One distinction, that between declarative and procedural knowledge, relates to the functioning of memory and the mind. It seems to be well backed up not only by studies in cognition (e.g. Anderson 1983, 1985), but also by evidence in physiological psychology (Birbaumer and Schmidt 1991:539, 552ff.). This distinction makes plausible why knowing about the real world is something different from the ability to use known facts in interacting with the world (skills). However, assumed linguistic units of knowledge such as rules or constraints operating on these rules may be difficult to specify along this dimension, since they seem to qualify as either declarative knowledge (e.g. when they can be exclusively addressed in a verbalized, conscious search process) or procedural knowledge (e.g. when they can be activated automatically through association and in parallel with other types of knowledge).

A second relevant distinction, that between holistic and modular knowledge (cf. Schwarz 1992:23), relates to structural aspects of memory and the mind. The latter appears to be useful (as in the present context) where distinctions between different types of knowledge are suggested and different languages are adduced to represent that knowledge. Within the assumed knowledge sub-systems further distinctions relating to type of knowledge may be made. For example, linguistic and extra-linguistic knowledge may be distinguished. Extra-linguistic knowledge may be further divided into a sub-type for general purposes (generally shared knowledge) and a sub-type for specific purposes (domain-specific knowledge). Although the distinction may be made only or mainly along the lines of functional criteria, it seems to be commonly understood and approved. Distinctive characteristics of domain-specific knowledge derive from the assumption that it

- is available only to some members of a community;

- is adduced for the solution of problems arising only in specific fields of discourse;
- has an elaborate conceptual structure which, where declarative, is represented in specific language (terms);
- is ontogenetically later than generally shared knowledge.

Moreover, domain-specific knowledge may be specifically contingent upon cultural and linguistic communities (typically, for example, in the case of jurisprudence), but in some fields of discourse (for example, in technical fields of study) it may as well be highly independent of culture or language.

The basic structural unit of domain-specific knowledge is the concept. A particular conceptual unit is characteristically defined by attributes (its intension) as well as by its relations to other concepts, through which a specified number of real or mental phenomena is captured (its extension). Various concept typologies have been proposed in various field of discourse, with respect to the envisaged computational processing the following categories (reduced from more extensive proposals as made in Hennings (1991:40ff.), Reimer (1991:22f.)) may be distinguished:

- item concepts (the extension is in each case one object);
- class concepts (individual concepts in an IS\_ELEMENT\_OF relation to the class concept);
- concepts relating individual and class concepts (e.g. of an IS\_A relation between class concepts, a typical instance of a hierarchical relation);
- property concepts (prototypical characteristics);
- concepts of events (changes of state, or states of limited duration);
- rule concepts (e.g. IF\_THEN contingencies);
- domain-specific constraints operating on these rules;
- function concepts.

For the linguistic knowledge module a comparable basic distinction between language for general purposes (LGP) and language for specific purposes (LSP) can be postulated. An LSP differs from the respective LGP (in a monolingual situation) as, for example,

- it does not constitute an autonomous semiotic system;
- its use is restricted to specific fields of discourse, text types, and groups of speakers or recipients;
- its lexical units (terms) are less arbitrary; they are often created by metaphoric extension from LGP (e.g. *keyboard, mouse, laptop, screen*), and they seem to be primarily defined by their referent properties rather than by other lexical devices;
- it uses selected linguistic structures with specific frequencies (e.g. Hoffmann 1985);
- it is ontogenetically posterior to the respective LGP system.

Knowledge of more than one language system poses additional problems. It

has long been a matter of debate in which way different LGP systems interact and develop in the mind of a bilingual (cf. Ervin and Osgood 1954; quoted in Osgood and Sebeok (1965:139); Albert and Obler 1978; Singleton 1993), but these findings do not seem immediately transferable into the LSP situation. Multilingual LSP knowledge appears to be structured along two different dimensions, the language dimension (here: English/German), and the variety dimension (LGP/LSP). Selected evidence of two different types was collected to see whether this assumption does receive empirical (linguistic) support.

In a sample test based on one English and one German LSP text to an expert audience with a topic on literary criticism, and two letters to the editor on a related topic, were analyzed by means of a database management system (dBase IV) relative to a number of variables. Results confirmed the expected systematic variation across the language and the LGP/LSP dimension. For example, the number of clause elements/sentence in the English texts is lower than in German texts, and in turn in the LGP texts it is lower than in the LSP texts. On the other hand, the number of modifiers/sentence in the English texts is higher than in the German texts, but in the LGP texts it is lower than in the LSP texts. Note also the symmetries in the degree of difference:

clause elem./sent.	LGP German:	2.0	LSP German:	2.3
	LGP English:	1.6	LSP English:	1.9
modifiers/sent.	LGP German:	1.5	LSP German:	2.6
	LGP English:	1.7	LSP English:	2.8

Table 1: Average number of clause elements/sentence (first set) and modifiers/sentence computer across 4 texts selected relative to the criteria German/English and LGP/LSP; number of words in the text: LGP German: 244; LGP English: 260; LSP German: 612; LSP English: 624.

Analysis of terms for LSP German and LSP English the computational sciences, on the other hand, revealed clearly specific sources of influence. For example, English LSP *computer* is a derivative of English LGP *to compute*. In the respective German LSP the terms *Rechner* and *Computer* compete, the former being a derivative from German LGP *rechnen*, the latter a loan from English LSP. Accordingly, sources of linguistic influence may assume (for the given situation) the following two-dimensional pattern:

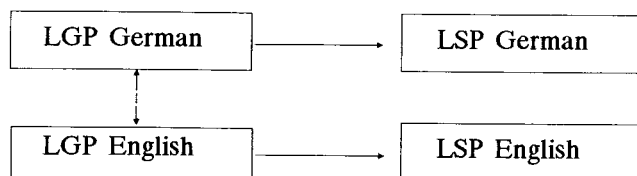


Fig. 1: Graphic display of the possible sources of influence on a second language for specific purposes; LGP: language for general purposes; LSP: language for specific purposes.

Thus the conceptual system constituting multilingual LSP knowledge must be hypothesized to be respectively complex. The list of possible categories for LSP concepts is partially analogous to that of domain-specific knowledge (e.g. inventory of terms, classes of terms, linguistic rules for term formation, ...), however, relational concepts appear to be typically more frequent and elaborate in the multilingual situation; examples of such relational concepts include formal relations among terms within LSP 1, between LSP 1 and LSP 2; between LGP lexical items and LSP terms within a language and across languages.

There seems to be a third type of knowledge which is functionally distinct from LSP and domain-specific knowledge, i.e. knowledge about the real-world social, cultural or economic conditions which may operate as constraints on the use of LSP and domain-specific knowledge. For example, the German item *Rechner* (as a standard term according to DIN 44300, March 1972) has a distribution across text types that differs from that of *Computer* (which predominates in more informal situations). Multilingual expert competence by necessity includes such pragmatic knowledge. It is assumed that during use of that knowledge specific relations among these sub-systems must be available/activated. Some of these relations, as, for example, term-concept relations, are however more suitably addressed under the representational aspect of knowledge.

## 2.2. Aspects of knowledge representation

The approach taken in this section is a knowledge-oriented (onomasiological) one. As relevant studies suggest (e.g. Reimer 1991; Altenkrüger and Büttner 1992) knowledge may be represented in a variety of different formats. A basic distinction is that between analogue formats (e.g. photographs, or an oscillographic display) and symbolic formats (specifically suited for the representation of concepts). Typical representatives of the latter are natural and artificial languages, networks (for the display of associative links between concepts), and frames (for the display of prototypical characteristics of a concept). To facilitate multilingual access to expert knowledge the use of different formats is suggested.

Outside automated applications the most comprehensive and approved means of representing expert knowledge is natural language, even though it is frequently unable to represent units of that knowledge without ambiguity. For example, there is not necessarily a one-to-one relationship between representational and represented units. Representational units may assume variant (surface) forms to represent LSP (term) units: orthographic variation obtains, for example, in the case of *harddisk/hard-disk/hard disk/HD* in the representation of the term *harddisk*. In turn, representation of concepts is often not symmetric across languages. For example, the concepts A DATA FILE and A STRUCTURED STORE OF DATA (including means of maintenance) is represented in English by one (homonymic) term, *database*, in German by two terms, respectively *Datenbasis* and *Datenbank*. Alternatively, different languages may represent one and the same concept by different sets (numbers) of terms (cf. the example of *computer* above).

Considering that concepts in turn represent real world phenomena, the following representational chain emerges, in which the unshaded boxes are representational units, the shaded ones represented units:

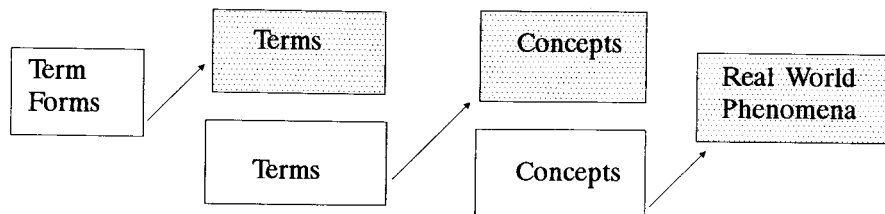


Fig. 2: Model of the representational chain (implying the use of natural LSP language).

The frame format is used to represent prototypical characteristics of knowledge units. In the case of domain-specific concepts such frames might include reference to the historic development of the concept (e.g. technological stages in the development of optical storage devices), functional or structural characteristics of a concept. In the case of a term-frame typical categories might include history of the use of this term as representation of a particular concept, its use across text types, audience, fields of discourse and languages (cf. again the case of *computer*, quoted above), competition with other terms within a language and across languages, common collocations, or (orthographic and phonological) realizational variants.

Relations between units of knowledge as, for example, between concepts or between terms and concepts, are most suitably represented in a network format. A specific derivative is the semantic network, in which directed (optional) and labelled graphs are added to specify the links. Most frequently epistemic primitives such as IS\_A, IS\_ELEMENT\_OF, IS\_EXAMPLE\_OF, or IS\_REPRESENTED\_BY are used as labels. Between concepts hierarchical relations normally obtain. For example, HARDDISK IS\_A STORAGE DEVICE, and STORAGE DEVICE IS\_ELEMENT\_OF COMPUTER.

In the context of multilingual representation particular complications emerge. For example, if there is reason to assume, or if it is the intention of the author to show that the structure of the domain-specific concepts is language-independent, it seems advisable to avoid using terms in favour of LGP means. Fig. 3 (see opposite page) displays a directed IS\_ELEMENT\_OF concept-concept relation of this type.

If, however, for other purposes, specific categories of a computing device were to be listed, terms rather than LGP units impose themselves to represent the respective concepts. Note that in Fig. 4 (see page 92) the lists of terms are open ones and differ across languages, implying that from this display discrete conceptual categories cannot be immediately read off.

As the previous figures suggest LGP as well as LSP knowledge may be required as representational languages to display associative links (relational types of knowledge) within semantic networks.

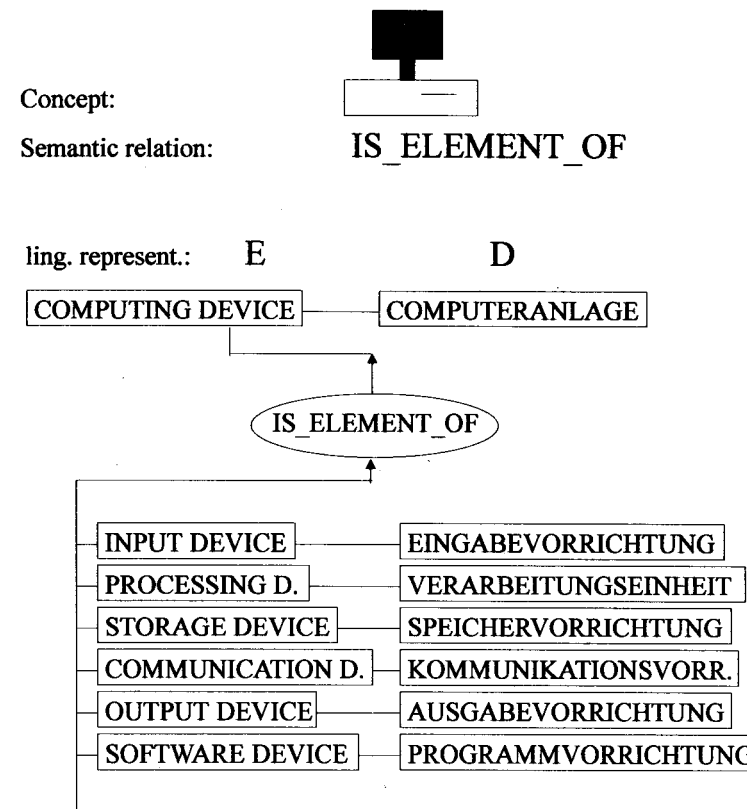


Fig. 3: IS\_ELEMENT\_OF relations between the concept COMPUTING DEVICE and subordinated concepts as part of a semantic network.

### 3. Developmental view of multilingual expert competence

In this section an attempt is made to distinguish different stages of developing multilingual expert competence with reference to different types of knowledge and knowledge representation. The division into stages as proposed may not apply to the last category (implementation), which may constitute a separate learning problem applying to all stages. Particular reference is made to the term – concept domain of the representational chain where the core problem of acquisition is assumed to be located. The following (tentative) proposals rest in part on observations made during a 2-year experience of teaching ESP to Austrian students of the computer sciences.

#### – Growth of inventories of (holistic) units:

It is assumed that in the case of verbal representation of domain-specific knowledge the term – concept relation is initially experienced as a holistic unit, possibly in association with a particular context; i.e. the concept is represented as

Concept: COMPUTING DEVICE  
 Semantic relation: IS\_A  
 ling. repr. (terms):

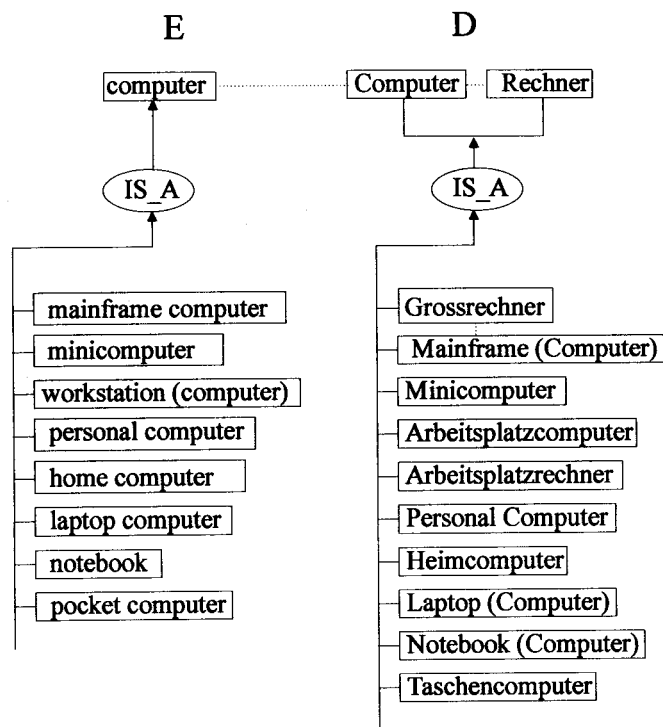


Fig. 4: IS\_A relations between the concept COMPUTING DEVICE and associated concepts represented by English and German terms as part of a semantic network.

a language-specific phenomenon by a language-specific term, as long as one (LGP) code is predominantly used. This assumption is based on observations that most monolingual LSP users do not feel that they can or should make a distinction between term and concept, that the respective German terms *Fachterminus* and *Begriff* are normally (i.e. outside translation and knowledge theory) used in free variation, and that German terms borrowed from English are integrated into the language as if they were indigenous lexical items; examples typically indicating such integration are formations like *eingeloggt* ("logged in"), now in general use, *Feintuning* (c't Magazin für Computertechnik, Oktober 1993:78), or *Power-Check-karte* (ibid.:82).

#### – Decomposition:

Decomposition is here used to refer to a transitional stage, in which learners begin to dissociate terms from concepts; such dissociation is apparently difficult to make and needs some crucial catalyzing factors, such as use of different LSPs on the basis of two different (LGP) codes or a sufficiently unique (language- and culture-independent) concept system. Although answers to the logical question in which way domain-specific knowledge would then be represented in the mind are beyond reach of this paper, reference to alternative representations as outlined in the previous section (such as semantic networks) can be made. Learners at this stage typically report on naming problems for concepts which for them are fairly well defined and for which they want to find the most appropriate (of several possible) terms. At this stage, moreover, the list of potential term candidates may typically extend across linguistic boundaries, including near-equivalent items which are normally not substituted within a particular language (e.g. *rename* and *umbenennen*).

Unless further systematic evidence is collected, the issue may remain controversial. Related findings from SLA research are difficult to compare with the present proposal. For example, the observation made in studies on L2 English morpho-syntax that the acquisition of the standard formal mechanisms of the verbal complex precedes the standard representation of extra-linguistic concepts like aspect or time (Havranek 1988; Wieden 1993), is not directly comparable to the proposal made above, since the L2 acquisition of the formal morpho-syntactic mechanisms constitutes a problem in itself, a problem which LSP 2 learners do not face. Findings based on word association tests, suggesting that such association are first formally, later semantically motivated (Meara 1984) and similar proposals for assumed type of lexical storage (Cook 1977) are again not comparable with the present proposal since they address a phenomenon among representational units rather than one between representational and represented units of knowledge.

#### – Tuning:

Tuning, a term borrowed from O'Malley and Chamot (1990), is here used to refer to a developmental stage in which domain-specific concepts have been principally dissociated from the respective LSPs and refinements in the conceptual structure can be made prior to the (multilingual) representation by terms. Such refinements may be required to mitigate what may be inherent status characteristics of conceptual knowledge: incompleteness, vagueness, uncertainty, and inconsistency. For that reason tuning processes are normally infinite and may need some cognitive motivation.

We do not have observations that would indicate tuning processes in multilingual LSP use. The learners under observation did not seem to have been sufficiently advanced for that purpose. However, wants and needs collected among experts in the field with multilingual experience appear to testify in particular to an aspect of tuning which is basically representational: the consideration of

pragmatic knowledge. For example, informants reported on a need for information on the use of terms (often cross-linguistically used terms such as *computer*) in the respective language communities, within particular text types, and with audiences of different degrees of expert knowledge; moreover, a need for details on the historic development of the term was expressed, in particular with respect to its LGP and metaphoric roots. A typical example mentioned was the term *font* (derived from French *fondre*, "casting characters of a particular type in lead"), which in the German-speaking area (for lack of insight and different from expert speakers of English) is frequently used to denote various concepts, for example those represented in German by the terms *Schrift*, *Schriftart*, *Schriftsatz*, and *Zeichensatz*. Yet another type of request related to the recommended use of native terms vs. borrowed terms vs. native LGP formations for the precise or most appropriate representation of concepts (if LSP varieties of different formality are assumed). Typical examples from recent texts include use of *tragbarer Computer* or *Notebook (Computer)* for *Laptop (computer)* within German LSP (comparable substitutions can also be observed within the respective English LSP), or the expression *Daten schaufeln* ("to shovel data", e.g. c't, *Magazin für Computertechnik*, Oktober 1993:84) instead of the established term *Datentransfer*.

– Abilities to implement that knowledge:

In the context of teaching ESP it could be frequently observed that even fairly advanced learners under higher degrees of mental workload (e.g. complex conceptual tasks, time constraint) exhibited fairly inferior language output, formally as well as representationally. These observations were selectively further investigated. Firstly, a random sample of 16 formal deviancies, such as missing adverb/adjective distinctions, was selected from 5 different papers in English (written as a test on a software engineering topic) to which the respective authors were exposed. Interestingly, in all cases the correct forms could be offered and in half of the cases the type of deviation could be named. Analogously, a sample of cases reflecting representational problems was further investigated. Here the results seemed to be divided: In some cases a missing term or a more adequate LGP solution could be supplied, in other cases this was not possible since the required conceptual knowledge was apparently still missing (confirmed by an expert colleague). Although the given evidence is far from conclusive, it is at least suggestive: On occasion knowledge already acquired may not be sufficiently available (as procedural knowledge) under complex tasks.

Problems of the latter kind have immediate relevance to the question of what can and should be done in support of the respective learning tasks. This question, although outside the scope of this paper, also becomes one of serious concern when intelligent self-access resources suitable for life-long vocation-oriented multilingual learning are to be developed.

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