Metaphors in Medical English Prose: A Comparative Study With French and Spanish

Françoise Salager-Meyer

Abstract — The purpose of this work is to determine the patterns of analogy underlying medically terminologized words which carry a metaphorical status. A corpus of medical texts in English, French, and Spanish was studied; the metaphors were recorded and classified according to their analogy patterns (or underlying semantic transfer). Two broad likeness categories were found in the three languages: morphological metaphors, which refer to forms and structures (geomorphical, anatomical, zoomorphical, phytomorphical, and architectural), and physiological (or functional) metaphors, which refer to processes and functions. The results show that the patterns of analogy underlying medical metaphors are language independent and differ from those underlying nonscientific metaphors. A closer linguistic analysis of medical English metaphorical words indicates that the vast majority: (a) belong to the nominal group, (b) modify specialist nouns or adjectives, and (c) are of the nominal-compound type (an additional linguistic difficulty for NNS). Because it is well known that nontechnical vocabulary used in technical ways is a source of difficulty for NNS, pedagogical guidelines are also provided so as to encourage students to relate new vocabulary to existing knowledge structures.

Introduction

In the introduction of a recent issue of the Journal of Reading, Johnson (1986) maintains that the decade of the 80's could be characterized as the period of rediscovery of the importance of vocabulary instruction. It is in fact now well established that word knowledge and vocabulary instruction are integral components of specific and general reading comprehension and that vocabulary recognition is the factor that makes the most difference in group ability (Laufer & Sim, 1985; Weiss, 1984). However, although reading strategies are important for comprehension, these strategies cannot be applied satisfactorily if students are below the threshold level of L2 competence (Clarke, 1919; Cummins, 1979; Cziko, 1980).

Moreover, psycholinguistic research has shown that lexical and conceptual difficulties are greater than syntactic difficulties in general reading in L1 and L2 (Alderson, 1984; Alderson & Richards, 1977; Anderson & Freebody, 1981), in ESP reading (Bramki & Williams, 1984; Loots, 1987; Namakura, 1986; Ulijn, 1984; Ulijn & Kampen, 1976), and in LSP reading in general (Lutjeharms, 1984; Namenwirth, 1984; Ulijn, 1980). In spite of all this, Silberstein (1987, p. 32) claims that "there seems to be a growing consensus that vocabulary
building has not received the attention it must if L2 students are to be efficient readers." Thus, and especially in Third World countries where the prime concern of foreign language courses for scientists is reading comprehension, LSP courses should concentrate on improving students' vocabulary comprehension and on teaching them adequate procedures for puzzling out the meaning of unknown words. It is this author's experience (an observation also made in other linguistic contexts by Cohen, 1979; and Walsh, 1982) that, at advanced reading levels, students who have otherwise reached a quite adequate reading comprehension of academic materials still have problems understanding what Nelson (1975, p. 623) calls "special meaning words of the context." These are context-bound lexemes borrowed from the general language (or from another branch of human activity or science) which take on a special meaning dictated by the subject matter. This is not the specific vocabulary of the discipline (mainly of Latin/Greek origin) but the general language of a technologically aware consumer society. These lexical borrowings, called for by the development of new techniques, are accompanied by a diachronic enrichment of the scientific signifié, which then becomes a concept. In a previous article on medical English lexis Salager (1985a) refers to these terms as "bimodal frequency words," or "bold medical metaphors," whose stylistic coloring fades away in the course of time and usage. As Gläser mentions (n.d.: 12):

It is a matter of experience that every technical word stock has a certain number of words which are in fact bold metaphors or comparisons. In most cases these technical metaphors show a motivation based on the principle of analogy between the designated object and a familiar one.

Morris justifies the use of metaphors in scientific-technical vocabularies as follows:

Metaphor is defined as the transference of meaning between words and phrases by analogy, or by a comparison which shows some unsuspected likeness. The language of the scientist and engineer would be poorer indeed without the use of phrases such as booster skirt, engine apron, rocket tail and wind sock. The comparisons are conventional now, but at one time they had to be invented by some mind busy at analogical extension of the language from the old to the new. (1966; p. 80)

According to Nuttall (1982), Ulijn (1985), and Carrell (1987), metaphors, metonymy, and similar kinds of transferred meanings are always potential problems for foreign learners. Although these words do not always hamper overall comprehension, they constitute a sufficient hurdle to reading fluency. As Voráček (1987; p. 56) states: "Terms based on metaphors . . . constitute a difficult area with which advanced ESP students must cope" Nelson-Herbert (1986) adds that these words must be taught, not changed, or eliminated. Of course, the native speaker, by virtue of living in a technological society, can easily understand these metaphorical terms, simply by widening the application of known semantic concepts. In fact, most of our everyday language is metaphorical. For a thorough and exhaustive analysis of this point, see
Lackoff and Johnson (1980), Johnson and Lackoff (1980) and Lackoff (1989). But foreign students are in a very different situation for three principal reasons:

1. They may lack the prior conceptual knowledge in their L1 and thus be unable to make the appropriate transfer. This is what Carrell calls “lack of schema availability.” (1987, p. 23)

2. They may be reluctant to use their extralinguistic competence to unlock the meaning of what Anders and Bos (1986) call “stopper words” (a rather frequent situation in Latin America, already noted by Akirov & Salager, 1985; Alderson, 1984). In such a case, the available schemata are not activated.

3. The students know the concepts in their L1 but their command of the target common language is far from sufficient. Indeed, the general English meaning of these metaphorical items is not part of the students’ reading vocabulary. This prevents them from making a positive transfer from the common language to the specific language. Such a deficiency precludes bottom-up text processing.

Little attention has been devoted to the study of the metaphorical language of science. Indeed, as has been pointed out (Graves, 1984; Swales, 1985; Varantoki, 1985), there is surprisingly little awareness among practicing speakers that many technical terms are of a metaphorical status. Furthermore, in the field of language teaching and learning, metaphors have not yet received the attention they deserve (Rössler, 1985) and their appearance in LSP has either been denied or overlooked and has seldom been taken as a matter of serious concern (Irgl, 1987). Only two researchers have dealt with this problem in depth: Pelletier (1980), who studied French metaphorical terms in the language of nutrition, and Irgl (1987), who analyzed metaphors in commercial English. Other researchers only briefly mention this topic: Morris (1976) and Gläser (n.d) in scientific-technical English in general, Salager (1977) in engineering English, Binon and Cornu (1985) in the English language of economics, Pica (1981) in legal French, and others who describe in general terms the relationship between specialized language and general language (Gallais-Hamonno, n.d.; Hoffmann, 1981; Qvisgaard, 1981; Voraček, 1985).

**Purpose and Corpus**

It is thus the purpose of this paper to identify and analyze metaphorical medical terms (quantitatively and qualitatively) so as to highlight their salient features. A classification of medical metaphors based on their patterns of analogy, or likeness, would allow us to present pedagogical guidelines which would facilitate the teaching of this component of medical lexis. “Since metaphors always involve an implicit comparison between A and B, one way of handling them is to analyze what A and B have in common” (Nuttall, 1982, p. 77).

The linguistic corpus is made up of 30 texts in medical English (ME), 30 in medical French (MF), and 30 in medical Spanish (MS) from 15 medical
specialities, totalling about 130,000 words. All the articles were randomly chosen from the University of The Andes Hospital Library. Two Spanish-speaking medical doctors, both fluent readers of French and English, acted as content specialists and helped classify the metaphorical expressions encountered in the corpus.

Results and Discussion

Global Quantitative Results

As Figure 1 shows, 1,597 metaphorical words or phrases were studied: 515 in ME, 549 in MF, and 533 in MS. Metaphors account for only 1% of the total number of words in the corpus. Although it is a small proportion, investigations into metaphorical scientific language are justified since the words which bear a metaphorical status usually refer to concepts which are crucial to an optimum understanding of the text and readers must be able to decipher their meaning. The incidence of these terminologized words is very similar in all three languages: 1.22% in ME, 1.14% in MF, and 1.18% in MS ($p < .001$).

A functional analysis of these terms allowed us to classify them into two broad categories: morphological, or structural metaphors, referring to forms and structures, and physiological, or functional metaphors, which refer to processes, functions, and relations. The number of metaphors in each group is displayed in Figure 2. This figure shows that metaphors in the morphological group are about three times more frequent than those in the physiological group (1129 vs. 468). In the corpus as a whole, the former account for 70.6%
of the total number of metaphors recorded and the latter for 29.2%. It can also be pointed out that the difference observed in the ratios of morphological to physiological metaphors in ME, MF, and MS is not statistically significant (p < .001): 2.26 (69.3/30 or 6%) in ME, 2.71 (73/26 or 9%) in MF, and 2.23 (69.6/30 or 3%) in MS. The following factors might account for the difference observed in the number of metaphors in each group:

1. Medical sciences have tended through the course of history to maintain the Greek/Latin origin of the terms which denote functions much more frequently than for the terms which refer to structures. It is indeed more difficult to refer analogically to processes than to structures. For example, physicians refer to functional states, such as "lipolysis, diuresis, and hematopoiesis" with words directly imported from the classical languages, whereas they refer to structures such as abdominal wall, mitral valve, and coronary tree with words from the general language which have undergone an analogical semantic transfer.

2. Unlike the narrative quality of literary writing, medical language, like any scientific language, is basically descriptive. It thus much more frequently makes use of concept-expressing nouns and descriptive qualifying adjectives than of action- (or process)-expressing verbs.

Patterns of Analogy of Medical Metaphors

As previously noted, medical metaphors can be divided into two broad categories: morphological and physiological. In the coining of morphological
metaphors, scientific writers make use of a variety of conceptual domains (or semantic subgroups) which are, in decreasing order of frequency: architectural, geomorphical, phytomorphical, anatomical, and zoomorphical. The patterns of analogy underlying nonscientific metaphors are quite different. Carbonell (1981) showed that nonscientific metaphors are mostly used to say something about goals and plans, often about causal structures and functional attributes, sometimes about temporal ordering, attributes and tendencies, but almost never about descriptive properties and object identity. All the examples provided in Tables 1 and 2 express a unitary concept, idea, or phenomenon in an economical and condensed way thus corresponding to what Boyd (1979) has called "theory constitutive metaphors," for example, their function is to offer a new scientific terminology and to give the opportunity to accommodate the language to new facts or new hypotheses. They all have a definite and precise professional terminological meaning and present the following linguistic features:

1. The vast majority of the metaphorically used words belong to the nominal group: 88.5% (ME), 84.4% (MF), and 85.1% (MS), and to a much lesser extent to the adjectival and verbal groups (cf. Figure 3).

2. An analysis of the internal structure of metaphorical expressions shows the following results (see Figure 4). In English, the terms are mainly of the "compound-word" type (57.2%), followed by the "adjective-noun" type (37%), and by the "linking-preposition" type (5.7%). Within the "compound-word" group, the following structures are observed: "N+N" (40%), "N+N" (8.7%), "adjective+N+N" (5.7%), and "adjective+N+N+N" (2.8%). Modifying adjectives generally belong to a medical field (e.g., cardiac, pulmonary) and modifying nouns to what has been called elsewhere (Salager, 1983) "fundamental medical English lexis." In contrast, in French, the most frequent structures are of the "N+adjective" type (58.9%) and of the "N+linking-preposition" type (de, à, du, des, de la: 40.2%). It is interesting to note that the four examples of the "N+N" type (solution tampon, plaquette témoin) recorded in the French sample follow a typically English word order. Goffin (1968, p. 139) called this phenomenon paresse linguistique (linguistic laziness) because, for the sake of linguistic economy, such expressions violate French syntax. As far as Spanish is concerned, the most frequently encountered structure is of the "N+adjective" type (69.2%), followed by the "N+linking preposition" type (en, a, de, con, par: 30.7%). Not a single example of the "compound-word" type was recorded in the Spanish sample. The fact that most ME metaphorical expressions are of the "compound-word" type represents an additional linguistic difficulty for nonnative English speakers. Indeed, it is now well known that such compound nominals are characterized both by semantic unpredictability and syntactic ambiguity and that their decoding depends on the readers' prior knowledge of the relationship between the nouns (Kočourek, 1979; Salager, 1985b; Williams, 1984; and 1985).

3. One example only of a colorful metaphorical expression (of the phytomor-
<table>
<thead>
<tr>
<th>Subgroup</th>
<th>English</th>
<th>French</th>
<th>Spanish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architectural</td>
<td>fibrillation threshold</td>
<td>cloison membraneuse</td>
<td>células piramidales</td>
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<td></td>
<td>dual chamber system</td>
<td>pont musculaire</td>
<td>luz de la artera</td>
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<td></td>
<td>acetabular floor</td>
<td>étauage de l’hernie</td>
<td>pilares del corazón</td>
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<td></td>
<td>aortic arch</td>
<td>tunnel sous-pectoral</td>
<td>clóbita cranial</td>
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<td></td>
<td>tunnel syndrome</td>
<td>toit du cotyle</td>
<td>bóveda cranial</td>
</tr>
<tr>
<td></td>
<td>abdominal wall</td>
<td>vestibule du vagin</td>
<td>trombo mural</td>
</tr>
<tr>
<td></td>
<td></td>
<td>paroi artérielle</td>
<td>pared abdominal</td>
</tr>
<tr>
<td>Geomorphical</td>
<td>geographic tongue</td>
<td>plateaux vertébraux</td>
<td>canal costo-clavicular</td>
</tr>
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<td></td>
<td>urinary stream</td>
<td>lit d’aval</td>
<td>antro del piloro</td>
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<td></td>
<td>visual field</td>
<td>corps cavernex</td>
<td>territorio vascular</td>
</tr>
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<td></td>
<td>peak plateau effect</td>
<td>défilé bronquial</td>
<td>cráter de la úlcer</td>
</tr>
<tr>
<td></td>
<td>constellation of signs</td>
<td>fosse nasale</td>
<td>lecho vascular</td>
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<tr>
<td></td>
<td>cumulus cells</td>
<td>labrynthede de l’oreille</td>
<td>fosa nasal</td>
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<td></td>
<td>stellar angioma</td>
<td>golfe de la veine</td>
<td>campo visual</td>
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<td></td>
<td>vertebrabasilar territory</td>
<td>carrefour ventriculaire</td>
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<td></td>
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<td>vallées sylvienes</td>
<td></td>
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<td></td>
<td></td>
<td>traversée bronchiale</td>
<td></td>
</tr>
<tr>
<td>Phytomorphical</td>
<td>coronary tree</td>
<td>faisceau de His</td>
<td>núcleo reticular</td>
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<tr>
<td></td>
<td>circumflex branch</td>
<td>bourgeois génital</td>
<td>árbol bronquial</td>
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<td></td>
<td>nerve roots</td>
<td>feuillots péricardiques</td>
<td>flora intestinal</td>
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<td></td>
<td>brain stem embolus</td>
<td>végétations aortiques</td>
<td>tronco arterial</td>
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<td></td>
<td>valve vegetations</td>
<td>tronc commun</td>
<td>bloqueo de rama</td>
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<td>florid P. carinii pneumonia</td>
<td>rameau supérieur</td>
<td>raíz nerviosa</td>
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<td></td>
<td>brainstem</td>
<td>branches du faisceau</td>
<td>yema pulmonar</td>
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<td></td>
<td>cauliflower ear</td>
<td>pédoncule cérébelleux</td>
<td>hojas embrionicas</td>
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<td></td>
<td>main trunk of MCA</td>
<td>racine du tronc porte</td>
<td>fractura en talio verde</td>
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<td></td>
<td></td>
<td>rétrécissement en</td>
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<td></td>
<td></td>
<td>trognon-de-pomme</td>
<td></td>
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<tr>
<td>Anatomical</td>
<td>coronary sinus</td>
<td>corps vertébraux</td>
<td>cara externa (huesos)</td>
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<tr>
<td></td>
<td>vertebral bodies</td>
<td>tete du pancréas</td>
<td>cuello femoral</td>
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<td></td>
<td>sperm head</td>
<td>col vésical</td>
<td>pelvis renal</td>
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<tr>
<td></td>
<td>femoral neck</td>
<td>bords dentelés</td>
<td>núcleo dentado</td>
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<td></td>
<td>dorsal tip</td>
<td>bras de la capsule</td>
<td>cabeza del metatarsio</td>
</tr>
<tr>
<td></td>
<td>foreign bodies</td>
<td>en empreinte de pouce</td>
<td></td>
</tr>
<tr>
<td>Zoomorphical</td>
<td>double pig-tail catheter</td>
<td>bruit de galop</td>
<td>murmullo de paloma</td>
</tr>
<tr>
<td></td>
<td>butterfly rash</td>
<td>sutures en sauterelles</td>
<td>nicho de la úlcer</td>
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<td></td>
<td>horse-shoe nuclei</td>
<td>fournillement</td>
<td>caracol del oído</td>
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<td></td>
<td>buffalo hump</td>
<td>cellules en oeil-de-hibou</td>
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<tr>
<td></td>
<td>bull’s eye lesion</td>
<td>sonde queue-de-cochon</td>
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<td></td>
<td>ostrich behavior</td>
<td>hemi-syndrome en queue de cheval</td>
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</tr>
</tbody>
</table>
TABLE 2
Most Frequently Encountered Physiological Metaphors in English, French, and Spanish Medical Prose

<table>
<thead>
<tr>
<th>English</th>
<th>French</th>
<th>Spanish</th>
</tr>
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<tbody>
<tr>
<td>escape rhythm</td>
<td>age osseux</td>
<td>risa sardónica (del tétanos)</td>
</tr>
<tr>
<td>drug reservoir</td>
<td>exploration vasculaire</td>
<td>migración de fibras</td>
</tr>
<tr>
<td>opportunistic infections</td>
<td>rinçages vésicaux</td>
<td>gasto cardíaco</td>
</tr>
<tr>
<td>mechanical ventilation</td>
<td>vérouillage du genou</td>
<td>soplo piante</td>
</tr>
<tr>
<td>host reaction</td>
<td>pompe cardiaque</td>
<td>la íntima arterial</td>
</tr>
<tr>
<td>bacterial trapping</td>
<td>solution tampon</td>
<td>radicales libres</td>
</tr>
<tr>
<td>vehicles of infection</td>
<td>plaquette témoin</td>
<td>tránsito intestinal</td>
</tr>
<tr>
<td>endometrial echo</td>
<td>fuite auriculo-ventriculaire</td>
<td>inversión vascular</td>
</tr>
<tr>
<td>buffer solution</td>
<td>transit oesogastrique</td>
<td>doble enlace</td>
</tr>
<tr>
<td>double blind study</td>
<td>vidange vésicale</td>
<td>bomba cardíaca</td>
</tr>
<tr>
<td>migratory pain</td>
<td>appareil a balayage manuel</td>
<td>soplo rasposo</td>
</tr>
<tr>
<td>mitral valve</td>
<td>caisse du tympan</td>
<td>vesícula perezosa</td>
</tr>
<tr>
<td>bypass grafting</td>
<td>abdomen ballonné</td>
<td>bloqueo de rama</td>
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<tr>
<td>cell migration</td>
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<tr>
<td>intraaortic balloon pump</td>
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<tr>
<td>antibody titre</td>
<td></td>
<td></td>
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<tr>
<td>aggressive therapy</td>
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</tbody>
</table>

phical group) was found in the conclusion of a French article: "la moisson de descellement coxoidiën va être florissante." Surely, this is atypical of medical prose. No such example was recorded in the other two corpora. This means that, altogether, "witty" metaphors are rare in medical literature.

4. The fact that the same semantic transfer categories (or underlying analogies) are observed in very similar proportions in the corpus studied suggests that medical metaphorical expressions, at least in the three
Latin-based languages considered here, are not complicated by culture-specific idiosyncrasies. It is in this sense that Widdowson (1979) has claimed that scientists belong to one academic culture regardless of nationality. It would of course be essential to carry out similar studies in non-Indo-European languages before asserting that the above mentioned underlying analogies are semantic universals in the coining of scientific metaphors. However, because science is a product of Western thought, it could be expected that scientific metaphors do not differ cross-linguistically. The results of previous rhetorical contrastive analyses would also support such an hypothesis: Vasquez Correa (1987) and Mage (1978) in EST and SST (Spanish for Science and Technology), Konečni (1978) in EST and Macedonian, and Sugimoto (1978) in EST and technical Japanese, all state that similarities exist in the type, amount, and manner in which information is conveyed in scientific discourse, hereby confirming Widdowson's hypothesis on the universals of scientific and technical discourse.

Pedagogical Implications and Recommendations

Although explaining teaching methods was not the purpose of this paper, a strategy that focuses on the process of comparison and activation of prior knowledge can be proposed. Assuming that medical metaphorical terms have been generally mastered in the students' L1 (but not in the L2), instructors might consider the following interrelated instructional points:

1. Strive to activate the learners' underlying prior knowledge by stimulating deep processing and schemata in order to enable them to relate new vocabulary to existing knowledge structures. Indeed, activating students'
preexisting knowledge helps them merge new information with old knowl-
edge (Rumelhart, 1980) and, as Thompson claims (1986, p. 105), "under-
standing metaphorical language is the real instructional goal and the means
to the goal is the thought process of comparison which relates the old to the
new." For example, if the metaphorical expression "pig-tail catheter" is
encountered, the instructor could activate his/her students’ prior knowl-
edge by asking them what different kinds of catheters they know.

2. Point out the similarity of the semantic transfer (i.e., of the metaphorical
conceptual links) between the students L1 and the L2. In other words,
underline the lexical enrichment of the technical language with respect to
the general language (metaphorical meaning is derived from literal meaning)
in both languages. It is precisely at this point that a real transfer of
knowledge takes place between teachers who generally lack the conceptual
network hidden behind the words or have only a hazy idea of the concepts,
and students, who possess the scientific concepts in their L1. For example,
the terminological meaning of the metaphorical expression “drawer test”2
(a test used in orthopedics/traumatology to explore the stability and integrity
of the knee ligaments) is very likely to be unknown to the ESP instructor,
and the general meaning of the lexeme “drawer” may be unknown to the
students. Since the same semantic transfer is used in Spanish for referring
to this particular test (prueba de la gaueta), the ESP instructor will simply
have to explain to his/her students what a “drawer” is in general English.
and the students, helped by their background knowledge, will be able to
make the necessary semantic transfer. The same teaching technique could
be applied to the French metaphorical term (used as such in MS and ME
cardiology articles) torsade de pointe, which refers to a type of ventricular
tachycardia.3

3. Actively involve the students in the “discovery process” of metaphorical
meanings. As an old Chinese proverb, slightly adapted by Benjamin
Franklin, says: “Tell me and I forget, teach me and I remember, involve me
and I learn.” By giving students time to think critically and respond,
classroom interaction will become more enlightening for all concerned. The
phytomorphical “family” of metaphors (branch, tree, trunk, root, stem) can
simply be taught by underlining the relationship which exists between the
anatomical structures and the concept of a tree in the common language.

4. Present metaphors in their natural habitat use contextual notation to
unlock their meaning: “A clear understanding of metaphors independently of
context is impossible.” (Bosch, 1984, p. 9). The context is obviously crucial
(as it is in almost all language learning activities) if we want our students to
quickly and efficiently unlock the meaning of the metaphorical expression
“butterfly rash,” — a sign typical of lupus erythematosus.

These suggestions lead to certain implications with respect to the role the
mother tongue plays in such a situation. As was said before, comparisons with
the L1 can be used to stress the similarity of analogy between L1 and L2
metaphorical lexis. A comparative analysis would show, as Widdowson (1979)
has already stated, that there is more in common between certain varieties in
different languages than among different varieties in the same language.
Therefore, lists of the most frequent patterns of underlying analogy along with
some examples will prove helpful, especially at the graduate level where
English is taught in the course of the students' specialization. Referring to the
designing of a French reading course for economists and social scientists to
Dutch-speaking students, Ulijn (1981, p. 264) says that:

"the inclusion in the course material of an index with specialized terms which
have another meaning in general French would increase the possibilities of
systematic lexical training."

On the other hand, Gläser (n.d., p. 14) notes that most textbooks on
semantics do not include technical vocabularies. To her viewpoint, this is "a
shortcoming since semantic processes affect the whole field of lexis of all
registers."

Lastly, we can at this point reiterate Williams' advice to reading teachers
(1985): examine your own cognitive strategies and apply a pragmatic, common-
sense approach to the selection and invention of suitable exercise types which,
we may add, should allow the students to mobilize their knowledge of the
discipline and that of the foreign language in order to combine them with a view
to effective understanding. The results, undoubtedly, would then be growth in
reading ability.

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(CONICIT).

NOTES

1Hutchinson and Waters (1981, p. 63) mentioned "silicon" as one of the most
recent pieces of linguistic borrowing which, along with other terms and
because of the spread of home computers, have become far more frequent in
every day context as well as expressions such as "floppy disks," "memory
capacity," "modems," and "interface." We can also mention the French words
logiciel and matériel which have been coined lately to refer to computer
"software" and "hardware."

2The drawer metaphor here is based on the movements of the knee and the
kneecap.

3A torsade is a "twisted cord." By analogy, the peaks (pointe) of a torsade de
pointe ventricular tachycardia are "wavy". These "waves" can be seen on the
electrocardiogram.

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