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A NEW APPROACH TO BILINGUAL LEXICOGRAPHY USING FRAME SEMANTICS[*]

This paper presents the results of work carried out with Charles J. Fillmore, University of California, Berkeley. I describe the way in which one particular theoretical framework (Fillmore's *frame semantics*, combined with *construction grammar*, the work of Fillmore and his colleague Paul Kay) may be applied in standard bilingual lexicography. This approach helps lexicographers to prioritize information from corpus data, so that the essential semantic and grammatical facts are recorded for use in the dictionary entry. Taking this further, I propose a new graphic method for showing equivalences and divergences between source and target languages in a bilingual dictionary. My practical examples use the English verb crawl and the French verb ramper.

Bilingual Lexicography

In the initial stages when an analysis is being made of the word's behaviour in the language, lexicographers creating entries for bilingual dictionaries are faced with the same problems as their colleagues working on monolingual dictionaries: they study the evidence (corpus data, their own notes etc.), record facts as they find them (meanings, constructions, collocates, idioms, register, style etc.), establish provisional sense distinctions, attempt to order the facts and the exemplifying sentences according to these distinctions, and thus create a rich database entry from which may be extracted the material needed for the particular dictionary they are working on. The greatest danger at this stage is that, if there is no theoretical basis for the analysis, the collection of facts will be patchy and inconsistent, without any means of checking whether

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[*] This essay expands slightly the lexical analysis set out in »Describing polysemy: the case of *crawl*« by Charles J. Fillmore and B. T. S. Atkins, in *Polysemy*, Oxford, OUP (2000, paperback edition 2001).

some important aspect of the word's behaviour has been overlooked.

When the bilingual dictionary editors come to the task of formulating the actual dictionary entry, they are of course faced with a double problem: first, the selection of material to go into the entry, and second, the identification in the target language of the most appropriate equivalent or set of equivalents for the headword in its various uses. Here again, in the absence of any theoretical underpinning, they have no means of ensuring that their approach to these tasks is consistent from A to Z of the dictionary — a process which may cover a number of years and involve a large team of lexicographers.

It is my experience that the most useful theoretical framework for a practical lexicographer is that offered by the work of Charles Fillmore, *frame semantics*, and the attendant approach to grammatical description, *construction grammar*, developed by Charles Fillmore and his colleague at the University of California at Berkeley, Paul Kay. In this essay, we show how frame semantics offers a new way not only of analysing data, selecting from it, translating from source language item to target language item, but also of displaying semantic relationships of polysemous words across languages.

Dictionary Recognition of Multiple Word Senses

The realization that a word can have more than one meaning becomes a part of the ordinary language user's awareness through everyday experiences with dictionaries. It is common for a dictionary entry to have numbered or lettered sub-parts, and these are understood as informing the user of meaning differences for the word. An example of such a division into separate senses can be seen in the entry for the verb **crawl** in the *American Heritage Dictionary of the English Language* (AHD), Houghton Mifflin Company, Boston, 1992, shown in Figure 1.[1]

crawl¹. *intr.v.* **crawled crawling crawls**
1. To move slowly on the hands and knees, or by dragging the body along the ground; creep.
2. To advance slowly, feebly, laboriously, or with frequent stops; *We crawled along until we reached the open road*.
3. To proceed or act servilely.
4. To be or feel as if swarming or covered with moving things: *The accident scene was crawling with police officers. My flesh crawled in horror*. See synonyms at **teem¹**.
5. To swim the crawl.

Figure 1: the AHD entry for verb *crawl*

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[1] Each of the first two dictionary definitions cited here is the first entry with the name "crawl", as indicated with the superfix "1". Each is followed by a second entry, based on a Dutch word *kraal*, a noun referring to an underwater enclosure for fish, lobsters, etc.

Ordinary dictionary users seldom have a need to look a word up in more than one dictionary, but if they do, they are likely to discover discrepancies from one dictionary to another in respect to the manner of representing the meanings a word can have. Figure 2 shows the entry for the same verb in the *Collins English Dictionary* (CED), HarperCollins plc, London 1991.

crawl[1] *vb. (intr.)*
 1. to move slowly, either by dragging the body along the ground or on the hands and knees.
 2. to proceed or move along very slowly or laboriously: *the traffic crawled along the road*.
 3. to act or behave in a servile manner; fawn; cringe.
 4. to be or feel as if overrun by something unpleasant, esp. crawling creatures: *the pile of refuse crawled with insects*.
 5. (of insects, worms, snakes, etc.) to move with the body close to the ground.
 6. to swim the crawl.

Figure 2: the CED entry for verb *crawl*

These two dictionaries agree in what each one identifies as senses 1, 2, 3 and 4; and sense 5 in AHD is identical to sense 6 in CED. Sense 2, involving slow and laborious movement, is illustrated with vehicular traffic in both dictionaries, but expressed metonymically in AHD (*We crawled* as opposed to *the traffic crawled*). And the illustration of sense 4 in CED refers to things that actually crawl (*insects*) but shows a figurative use in AHD. But CED gives as its sense 5 a separate sub-entry for the movement of *insects, worms, snakes, etc.* It is natural to assume, not that the AHD lexicographer was unaware of the use of **crawl** to include the manner of movement of snakes and insects, but that the movement of such creatures was taken to be adequately covered by what is given as AHD's sense 1.

In this paper we shall observe and analyze corpus attestations of the verb **crawl**, but before that we shall examine definitions of the word taken from the four major British learners' dictionaries: the *Cambridge International Dictionary of English*, Cambridge University Press 1995 (CIDE), the *Collins-Cobuild Dictionary of English*, Harper-Collins 1995 (COBUILD), the *Longman Dictionary of Contemporary English*, Longman Publishers 1995 (LDOCE), and the *Oxford Advanced Learner's Dictionary*, Oxford University Press 1995 (OALD). Since these dictionaries, all published in the UK, have roughly the same coverage and are aimed at the same market, it might be expected that their descriptions of the lexicon will resemble each other. Their entries for the verb crawl are given in Figure 3.

CIDE

crawl MOVE /.../ v [I] to move slowly or with difficulty, esp. (of a person) with the body stretched out along the ground or on hands and knees • *We watched a caterpillar crawl up the leg of a chair.*

• *The child crawled* **across** *the floor.*

• *The lorry crawled noisily up the hill.* (...)

crawl TRY TO PLEASE /.../ v [I] *infml disapproving* to try hard to please in order to get an advantage

• *He crawled* (**up**) **to** *the group leader because he wanted a promotion.*

• *I don't like people who crawl.*

crawl FILL /.../ v [usually be crawling] *infml* to be covered or full.

• *The kitchen floor was crawling* **with** *cockroaches.*

• *The airport was crawling* **with** *photographers waiting for the rock star.*

• *Cambridge crawls* **with** *tourists in the summer.*

LDOCE

crawl /.../ v [I]

1 ♦ MOVE ON HANDS AND KNEES ♦ to move along on your hands and knees with your body close to the ground: [+ **along**//**across** **etc**] *She suddenly got down and crawled along behind the wall so that Carl wouldn't see her.* | *Is your baby crawling yet?* — see picture at KNEEL

2 ♦ INSECT ♦ if an insect crawls, it moves using its legs: [+ **by/along etc**] *Watch out! There's a wasp crawling up your leg.*

3 ♦ CARS ETC ♦ if a vehicle crawls, it moves forward very slowly: [+ **by/along etc**] *The traffic was crawling by at 5 miles an hour.*

4 ♦ TOO HELPFUL ♦ to be too pleasant or helpful to someone in authority, especially because you want them to help you: **crawl to sb** *Just look at Janice — crawling to the director of ♦ studies again!*

5 **be crawling with** to be completely covered with insects, people etc: *Eugh! This floor is crawling with ants.*

6 **make your skin crawl** if something or someone makes your skin crawl, you think they are extremely unpleasant: *The way Jonathan looks at her really makes my skin crawl.*

COBUILD

crawl /.../ crawls crawling VERB
crawled V
1 When you **crawl**, you move V prep/adv
forward on your hands and
knees. *Don't worry if your baby*
seems a little reluctant to crawl or
walk... I began to crawl on my
hands and knees towards the door...
As he tried to crawl away, he was
hit in the shoulder.
2 When an insect **crawls** VERB
somewhere, it moves there V prep
quite slowly. *I watched the moth*
crawl up the outside of the
lampshade.
3 If someone or something VERB
crawls somewhere, they move
or progress slowly or with great
difficulty. *I crawled out of bed at*
nine-thirty... The Polish economy is V prep/adv
crawling out of the mess it was in
when communist rule ended...
Hairpin turns force the car to crawl V
at 10 miles an hour in some places.
(...)
4 If you say that a place is VB only cont
crawling with people or
animals, you are emphasizing PRAGMATICS
that it is full of them; an
informal use. *This place is*
crawling with police... rock-hard V with n
earth littered with rubbish and
crawling with vermin.
5 The crawl is a kind of N-SING
swimming (...)
6 If something **makes** your **skin** PHRASE
crawl or **makes** your **flesh** V inflects
crawl, it makes you feel
horrified or revolted. *I hated this*
man, his very touch made my skin
crawl.

OALD

crawl /.../ v 1(a) to move slowly,
with the body on or close to the
ground, or on hands and knees:
[Vpr] *a beetle crawling along a leaf*
The wounded man crawled
painfully to the phone. [V]. *A baby*
crawls before it can walk. Šalso
Vp]. **(b)** (of vehicles) to move
very slowly: [Vpr] *The traffic*
crawled over the bridge. [also
V, Vp]. See also KERB-CRAWLING.
2 ~ (to sb) (*infml derog*) to try to
gain sb's favour by praising
them, doing what will please
them, etc: [V, Vpr] *I don't like*
crawling (to my boss). IDM **make**
one's/sb's flesh crawl/creep ⇒
FLESH. PHRV **crawl with sth**
(esp in the continuous tenses) to
be covered or filled with things
that crawl or with people: *The*
ground was crawling with ants.
• *The place is crawling with* (ie is
full of) *police.*

Figure 3: the verb crawl entries in the four EFL dictionaries

We can collate these four entries in such a way as to summarize the similarities and differences in their coverage of the senses identified in Figure 3: this is done in Table 1, where, under each dictionary, "1", "1a"

	Definitions	CIDE	COBLD	LDOCE	OALD
1	of person: dragging body	1	—	—	1a
2	of person: on hands and knees	1	1	1	1a
3	of baby : manner of motion	1—x	1—x	1—x	1a—x
4	of traffic: move slowly	1—x	3—x	3	1b
5	of insects, crabs etc.	—	2	2	1a—x
6	of snakes, worms etc.	1—x	—	—	—
7	of person: grovel, fawn	2	—	4	2
8	of place: be swarming with	3	4	5	Phrv
9	of skin etc.: creeping sensation	—	Phrase	6	Idm

Table 1: Comparative coverage of the verb crawl in four dictionaries 2.

etc. represent numbered definitions that dictionary; "1-x" or "1a-x" indicates that this meaning may be discerned not overtly in the first definition, but in an example following that definition; Phrase, Phrv (phrasal verb), and Idm (idiom) are the names of sections in the entry; and "—" indicates that this meaning is not covered anywhere in the dictionary entry.

2. Corpus Evidence

All of the usages in Table 1 are supported by corpus evidence. Table 2 shows the same brief definitions, together with an abridged example illustrating each, drawn from the British National Corpus (BNC), a corpus of 100,000,000 words of written and transcribed spoken text.

	Definitions	Corpus examples
1	of person: dragging body	*with a last effort he crawled up the path*
2	of person: on hands and knees	*I crawled smartly after him*
3	of baby : manner of motion	*the moment a child can crawl, everything ...*
4	of traffic: move slowly	*cars crawl along at fifteen miles per hour*
5	of insects, crabs etc.	*a beetle began to crawl up his leg*
6	of snakes, worms etc.	*larvae of worms crawl up the blades of grass*
7	of person: grovel, fawn	*the way you crawl to them makes me sick*
8	of place: be swarming with	*the area was crawling with caterpillars*
9	of skin etc.: creeping sensation	*his skin crawled and his hair prickled on his neck*

Table 2: Dictionary senses of the verb *crawl*, with corpus examples

Figure 4 is a collection of sentences containing the verb **crawl**, all taken from the BNC except for numbers 49—52, which come from a larger text collection in the archives of Oxford University Press, and which are quoted here with their permission.

1	From the moment a child can	crawl,	everything at a baby's level must be safe.
2	At times they could barely	crawl,	let alone walk, in the glutinous mud.
3	You've got little brown insects	crawling	about all over you.
4	Sometimes he awoke to find a rat had	crawled	across his face.
5	Dark heavy clouds were	crawling	across the sky, blotting out the stars.
6	We'll get dozens of men	crawling	all over this building again.
7	Most cars	crawl	along at fifteen miles an hour.
8	You	crawl	along the ground looking for worms.
9	His skin	crawled	and his hair prickled on his neck.
10	His flesh	crawled	at the thought of Eloise.
11	This leaves the unfortunate animal to	crawl	away and die.
12	They had nothing for it but to	crawl	back to Mr Scully and pay it out of their own pockets.
13	The weeks	crawled	by and they reached December.
14	Mr Barrett had to	crawl	for help after being hit in the leg and stomach.
15	He watched the approaching fog	crawling	forward, swallowing the town, piece by piece.
16	The two hedgehogs	crawled	from the nest at sunset.
17	They would never find her if she	crawled	into a cupboard and hid away.
18	It would be wonderful to	crawl	into bed, to ask Matron for an aspirin.
19	I	crawl	into my sleeping bag and curl up in a tight ball.
20	The surveyor will	crawl	into the loft, looking for defects.
21	A beetle began to	crawl	laboriously up Rincewind's leg.
22	She peered out and saw him	crawling	on hands and knees along the ledge.
23	He	crawls	on the ground like a snake.
24	A small baby	crawled	out on its hands and knees, its face covered in grime.
25	Literally on hands and knees, his men	crawled	over every inch of the area with plastic bags and tweezers.
26	There are MPs who	crawl	over everything we do.
27	The morning	crawled	past.
28	He reduced speed and began to	crawl	round the bends, his foot poised over the accelerator.
29	A cloud of steam	crawled	slowly upwards from the chimney of Wellshot Baths.
30	I	crawled	smartly after him.
31	From there they	crawled	the last ten yards to the edge of a rise.
32	Nicola took over an hour to	crawl	the three miles from Holborn.
33	A cat can	crawl	through any hole it can get its head through.
34	Darkness	crawled	through the suburbs like a flood of black ink
35	I would have to	crawl	to have any hope of finding it.
36	A reporter's job is to tell us what she can, even if it means	crawling	to objectionable people.

37	»The way you	crawl	to them makes me sick,« said Mallachy.
38	Let's stop trying to get women to support us by	crawling	to them.
39	I can	crawl	under the wire where it's broken.
40	David Attenborough was	crawling	up behind two copulating lions.
41	The larvae of red worms	crawl	up the blades of grass and are eaten by horses.
42	As the [snow disappeared] the arctic plants would	crawl	up the now uncovered mountains.
43	With a last effort, he	crawled	up the path and fell exhausted on the step.
44	The party's share of the vote	crawled	up to barely 35 per cent.
45	The stuff can be	crawling	with anthrax germs.
46	The area was	crawling	with caterpillars.
47	ʻThe countryside round here was	crawling	with CIA men!«
48	The street buzzed and	crawled	with police activity for the next hour.
49	She felt his hand	crawling	up her thigh
50	She was having little chats as she	crawled	down the list.
51	Exhausted fugitives	crawl	from the lake.
52	There was a little sheep trail	crawling	up the hillside.

Figure 4: *crawl* sentences (some abridged) from corpus data

A quick glance at the sentences in Figure 4 reveals that the number of sense distinctions that show up in the corpus far exceeds the number of distinctions that are provided for us in the definitions we have seen. There are uses of **crawl** represented here and present in multiple examples in the corpus which are not described at all in any of the six dictionaries surveyed (the four learners' dictionaries, AHD and CED).

One instance of this relates to the type of non-human creature which may be said to crawl, restricted by the dictionaries to insects and limbless invertebrates, and excluding therefore cats, hedgehogs and injured animals:

> 33 *A cat can crawl through any hole it can get its head through.*
> 16 *The two hedgehogs crawled from the nest ...*
> 11 *This leaves the unfortunate animal to crawl away and die.*

Nor is there any place in the dictionaries for the many varied metaphorical uses to be found in the corpus, where *inter alia* hands, clouds, fog, steam and even darkness are said to be crawling:

> 49 *She felt his hand crawling up her thigh.*
> 5 *Dark heavy clouds were crawling across the sky ...*
> 15 *He watched the approaching fog crawling forward ...*
> 29 *A cloud of steam crawled slowly upwards from the chimney ...*
> 34 *Darkness crawled through the suburbs like a flood of black ink*

A different type of metaphorical extension is found in:

> 12 *They had nothing for it but to crawl back to Mr Scully ...*

when the verb is selected to underline the abject nature of the event.

The use of **crawl** to describe slow movement by vehicles is covered in all the dictionaries: however the metonymous use seen in sentences such as

> 32   *Nicola took over an hour to crawl the three miles from Holborn.*

showing that the people in the vehicle may also be said to be crawling is not specifically mentioned, perhaps because of an assumption that such metonymies are commonplace in the language and need not be included specifically in every relevant verb entry. The verb is also used to emphasize the slowness of other activities, as may be seen from

> 50   *She was having little chats as she crawled down the list.*
> 44   *The party's share of the vote crawled up to barely 35 per cent.*
> 42   *As the [snow disappeared] the arctic plants would crawl up the now uncovered mountains.*

The BNC contains a number of sentences in which **crawl** is used to describe the activity of examining something in great detail, with the intention of discovering errors or omissions:

> 26   *There are MPs who crawl over everything we do.*

This sense is not defined in any of the dictionaries.

While all the dictionaries include specifically a definition of the type 'to be completely covered or swarming with' (*the area was crawling with caterpillars*), the metaphorical extension of this sense, exemplified by

> 47   *The countryside round here was crawling with CIA men!*

although quite prominent in the BNC is not mentioned in their entries.

Finally, periods of time may be said to crawl by, or crawl past, if they seem to be interminable:

> 13   *The weeks crawled by ...*
> 27   *The morning crawled past.*

There are very many examples of this use in the BNC and it is surprising to find that none of the dictionaries records it.

The four dictionaries we are examining were all designed for learners of English as a foreign language, and all claim explicitly to give the user the necessary information about the combinatorial properties of the words they include. All these dictionaries are based on an analysis of late 20th century English corpus data, and it might be expected that they would display a certain consistency in their interpretation of what the learner needs to know about the way the verb **crawl** combines with other words. That this is not the case may be seen in Table 3, which summarizes the information given in the four dictionaries. In the columns showing the dictionaries' coverage, 'Y' indicates that this information is explicitly coded in the entry; 'N' that there is no mention of it; and 'x' that it is shown in an example sentence, but not specifically spelled

out; '—' means that this use is not mentioned at all.

	Definitions	CIDE	COBLD	LDOCE	OALD
1	of person: dragging body [usually + Direction Adjunct]	x	—	—	Y
2	of person: on hands and knees [usually + Direction Adjunct]	N	Y	Y	Y
3	of baby: manner of motion [never + Direction Adjunct]	N	Y	x	Y
4	of traffic: move slowly [usually + Direction Adjunct]	x	N	Y	Y
5	of insects, crabs etc. [+Direction Adjunct]	—	Y	Y	Y
6	of snakes, worms etc. [+Direction Adjunct]	x	—	—	—
7	of person: grovel, fawn [+ PP/to]	x	—	Y	Y
8	of place: be swarming with [in progressive tenses, + PP/with]	Y	Y	Y	Y

Table 3 : Grammatical information for the verb *crawl* in four dictionaries

We have seen many discrepancies in the descriptions given in the four dictionaries of the semantics and grammar of a common English verb: consideration of these differences leads us to ask whether the division of word meanings is arbitrary, or whether there is a way of getting it right. Are there precise criteria for polysemy, criteria that would allow everybody who accepted them to come up with the same decisions? These are all highly regarded dictionaries, and we believe that in general the differences we see reflect responsible decisions on the part of the lexicographers, rather than simply errors in the formulations of meanings. Similarly, omissions of corpus-supported uses must also in many cases be deliberate, some usages being omitted because of shortage of space, on the grounds that the rarer figurative extensions are seen as building on basic meanings in clear and regular ways and therefore do not require explicit mention.

3. Discussion

Lexical semantics is in a poor position to solve the problem of polysemy. To the lexical semanticist, polysemy is a prototype concept, in which the paradigm case is quite clear, but departures from the prototype provide us with all

sorts of unsolvable problems. (See chapter 2 by Cruse in this volume.) The prototype for a situation of polysemy can be thought of as having the following features:

    (1) the multiple senses of the word can each be clearly traced back to the same word (this is the polysemy/homonymy distinction);

    (2) the set of senses permits a network-like description in which pairs of adjacent senses in the network are related by motivated linguistic processes (such as one or another type of metaphoric mapping) that recur across the lexicon; and

    (3) in all of such links there is a cognitive asymmetry in that the understanding of each derivative sense is aided by knowledge of the sense from which it is derived.

An example of one such clear case is the relation between the use of the adjective **sad** to express an experiencer's feelings (*I am extremely sad*) and its use to describe something which evokes such a feeling (*a sad day*). It is clear that (1) both senses of **sad** trace back historically to the same word, (2) the relation between these two senses is matched by similar links for such adjectives as **melancholy, happy, cheerful,** etc., and (3) we can understand that a day can be sad by imagining a situation in which someone living through it becomes sad, whereas we can imagine a person being sad without thinking about a time-period containing the experiences that brought it about; hence the feeling is central, the other is an extended meaning.

Instead of engaging in the theoretically slippery work of trying to classify word meaning descriptions in respect to cases where the prototype fits and then classifying the varieties of departures from the prototype, we can examine situations in which it matters in practice whether sense distinctions are recognized or not. Such situations include corpus-based lexicography, a study of the combinatorial properties of lexical items, and the design of inference systems built on natural language texts.

In corpus-based lexicography, one of the tasks we obviously have to face is that of coverage: to what extent does the list of sense descriptions proposed for a lemma succeed in accommodating the examples encountered in the corpus? If we find that a tentative entry we have devised for **crawl** specifies the use of limbs for one of its meanings, and our corpus includes **crawl** sentences referring to snakes and worms, we need to decide whether the definition should be changed to include the new examples, or whether we need to make room for another sense description. Corpus-based lexicography requires, in principle at least, that there should be something to say about all attested examples that are taken as representing appropriate uses of the words in the language or dialect being studied. If the definitions do not directly allow us to sort the examples, there must at least be clear principles by which the unclassified examples can be linked to existing senses.

In studying the combinatorial properties of lexical units, we will find that certain generalizations are only going to be possible if we make certain sense distinctions. For example, if we are recording collocates for particular words or word senses, a decision to separate the animal-sense and the meat-sense of **turkey** will be required in order to satisfy the generalizations we discover. Consider **gobble**, one of the verbs of animal noise emission, versus **roast**, a culinary term: we would rather say that **gobble** goes with the animal sense and **roast** with the meat sense, rather than merely observing that the monosemous word **turkey** collocates with both of these words . That is, our recording of these pairings will fit into a general picture of selectional properties (involving verbs of animal noises and cooking terms) if the distinction is recognized by the researcher.

If we are constructing a natural language understanding system and we need to develop an inference-generating mechanism so that we can derive understandings from text samples based on the occurrence of a particular word in a particular context, we will need to make sure that certain sense distinctions are available to us. As an example, suppose we wanted to inquire about the speaker's/author's beliefs in the case of these two uses of **argue**: (1) *In those days philosophers argued that the earth was flat.* (2) *The mariners' observations argue that the earth cannot be flat.* The first of these is a Communication use and merely reports what the philosophers stated; the person who says (1) is not necessarily taken as believing what the philosophers said. The second example is an Epistemic use and reflects the reporter's reasoning process. In the absence of neighboring text evaluating alternative conclusions, it is possible to infer that the speaker of (2) entertains the conclusion that the earth is round.

It is clear from what we have seen that even for lexicographers there are no objective criteria for the analysis of a word into senses or for systematically extracting from corpus data the kinds of information useful to dictionary users. It seems to us that this will be achieved only by a corpus-based research program looking at a large number of attested examples of each word, sorting these according to the conceptual structures (or 'semantic frames') which underlie their meanings, examining the kinds of supporting information found in sentences or phrases containing the word (in terms of semantic role, phrase type and grammatical function), and building up an understanding of the word and its uses from the results of such inquiry. These are the aims of the FrameNet project, which is briefly described in the appendix.

In the case of the verb **crawl**, we would begin by noticing that the »literal« sense of **crawl** (moving by muscular activity while the body is close to the ground or other surface) can be instantiated under importantly different conditions. We can refer to these as uses, rather than senses, of the word, but we will want them to be described separately because it is from these ways of enacting the crawl activity that the extended senses are derived.

(1) certain creatures move about with their bodies close to the ground because that is the way their bodies are built: from our perspective, when they travel on the ground they are always close to the ground;

(2) human babies attain a capacity, as a result of a maturing process, in which they are not restricted to lying down and flailing their limbs, but can locomote with the use of these limbs;

(3) adult humans can lower their bodies in order to get closer to the ground, possibly because they want to do something that requires them to be low — looking for contact lenses, avoiding gunfire, etc.;

(4) adult humans crawl if by injury or exhaustion they are too weak to stand up.

All of these are instances of a central idea of 'moving while holding one's body close to the ground'. It is our opinion that, as noted, these four uses exemplify or are elaborations of the core sense of the verb, from which others have developed. Looked at from the point of view of the Lakoff (1987) notion of *radial categories*, we could say that the core meaning involves self-movement with the body located close to the surface, and that the various conditions just listed — low-built bodies, maturing babies, the mover deciding to get low, or being unable to stand up — correspond to the *experiential basis* of sense extensions (Lakoff 1987, esp. chapter 6).

When adult humans resort to crawling, the speed with which they can get from one place to another is greatly reduced. The verb is used to refer to moving slowly, independently of the manner of motion; and we find that this idea of slow motion can be applied to vehicles and traffic, to the motion of clouds, fog and water, and then metaphorically to the speed of any kind of activity (*she crawled down the list of names checking each one carefully*) and in fact to experiences of the passing of time (*the days were crawling past*).

Motivated by the knowledge that a tired or injured person moves with pain and difficulty, the word **crawl** can be used to refer to the effortfulness of a motion or an activity, independently of the body position of the mover.

Based on the fact that human beings can choose to lower their bodies to the ground, and on the additional fact that the act of doing so can serve as a gesture of submission, the word **crawl** has been extended to include other ways of communiating the submission of one's will to that of another: the 'grovel' sense.

From the fact that the class of animals whose bodies are close to the ground includes animals whose presence human beings often wish to avoid, such as snakes and insects, and perhaps based on the fact that we feel especially strongly about these animals when they are abundant, we find examples of the use of **crawl** like *ants were crawling all over the pastries*. The speaker of such a sentence is less concerned with how the ants are locomoting as with the fact that they are there in abundance.

The idea of numerous entities moving about in a place leads to a sense of **crawl** that concerns an unwelcome number of people carefully and closely examining something. (*Detectives were crawling all over the crime scene; IRS agents were crawling over the company's records*.) The fact that such activity can be taken as characterizing the place where it is happening invites the valence alternation that Levin (1993) describes as »the *swarm* alternation«, connected with a common locative inversion valence alternation that many verbs are subject to, yielding in our case such expressions as *the kitchen was crawling with cockroaches*.

As a summary of these and other observations about sense connections among the corpus sentences, it is possible to devise a network diagram like Figure 5, in which each of the uses/senses is given amnemonic ('Baby', 'Creatures teeming' etc.), followed by an indication of corpus sentences from Figure 4 which support the interpretation. The lines connecting the central meaning to its closest neighbors can be thought of as leading to the experiential bases of further extensions; the lines connecting these to the further sense extensions can be taken as representing (recurring) principles of sense extension.
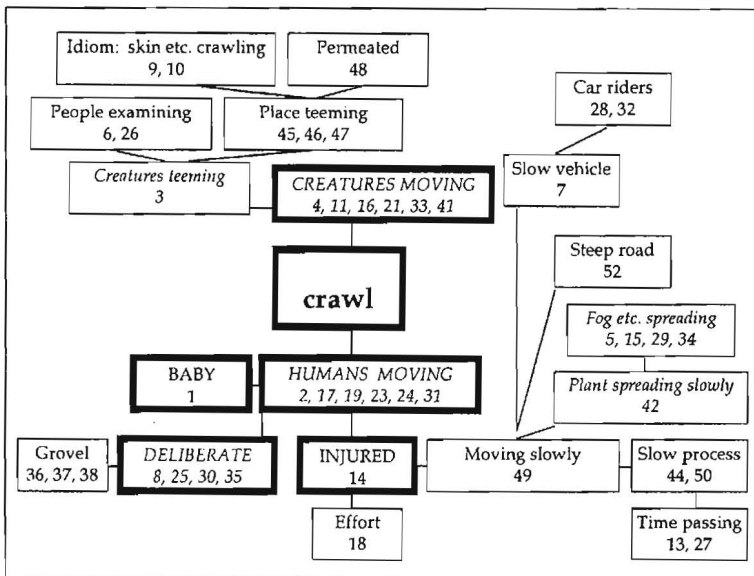

Figure 5: the verb *crawl* semantic network

It is clear that such a systematic description of word meanings, together with their grammatical expression, would allow dictionaries — and, more importantly, computer lexicons — to be more comprehensive and internally consistent. If the lexicographers who compiled the dictionaries surveyed earlier

had been able to consult such a description for the verb **crawl**, their task would certainly have been easier and the results more in harmony with each other.

4. The Cross-linguistic Perspective

The 'network' method of describing word meaning is of use in bilingual, as well as monolingual, lexicography. In most bilingual dictionaries involving English and French, the verb **crawl** occurs as the principal equivalent of **ramper** in the motion sense (see Figure 6).

> **ramper** ... *verbe intransitif* ... **1** [*reptile, personne*] to crawl; [*chat, fauve*] to creep; **s'approcher/s'éloigner en rampant** to crawl near/away; **2** [*plante*] to creep; **3** *fig* (*s'humilier*) to grovel (**devant** to).

Figure 6: *ramper* entry in OHFED

It is interesting to consider this entry (from the *Oxford-Hachette French and English Dictionary*, Oxford University Press 1994)[2] in the light of the **crawl** sentences in Figure 4 and sentences containing **ramper** from a French corpus (see Figure 7).

1   Comme un léopard sûr de sa proie rampe longtemps derrière sa proie sans bondir, il ...
2   ... fenêtres obscurcies par les abeilles ... [qui] ne pouvaient ni ramper ni voler ...
3   ... elle avait touché un insecte mou qui rampait sur la muraille
4   [les fleurs] seront étranglées ... surtout par le cornichon qui les enlacera et les étouffera avec ses tiges qui rampent et ses vrilles.
5   à cette heure indécise où rampent les ténèbres ...
6   et vous ... mineurs qui cheminez sous terre, le corps rampant ...
7   c'est [le catholicisme] seul que nous puissions offrir aux lamentables qui rampent sur ce sale globe
8   le dragon rampait comme un serpent
9   Nous ne chercherons point à comprendre le mécanisme des choses de par dessous, comme un chauffeur qui rampe sur le dos sous sa locomotive
10 Bêtes qui rampent, bêtes qui sautent, bêtes qui plongent ...
11 ... au milieu de tout ça ces grands vers ... qui remuaient, rampaient, rentraient dans l'eau ..
12 Bang s'était fait garder par tous ses amis, qui l'avaient suivi en rampant.

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13 ... les maisons des faubourgs, au nord, ont l'air de ramper en avant.

14 c'est la force du soleil ... qui rampe dans les buissons, qui s'élève
dans le chêne ...

15 ... tous les serpents de la Sologne s'en vont rampant vers un étang
des bois ...

16 Il pleuvinait ... des flaques de boue rampaient sous les tables ...

17 les pipes ... se couvrirent de flammes jaunes, rouges ... qui
rampaient, s'élevaient ...

18 ... la boue où rampe la vipère ...

19 Anne-Marie entendit quelqu'un sortir en rampant de sous le lit.

20 Elle se demandait si elle voyait là–bas un homme tapi, ou bien une
souche, quelque grosse racine rampant à fleur de sol

21 ... et le flot ... rampait sournoisement le long de ses flancs lisses, en
bavant

22 les inquiétudes noires commencèrent de ramper au fond de son
être ...

23 les lamproies ... rampent, se soulèvent, se dressent ...

24 J'avais rampé vers lui.

25 Sur les carreaux d'azur rampait la fleur du givre.

26 Vous êtes pareils à des fourmis qui rampent aux pieds d'un roi.

27 ... les guetteurs. On les vit ... s'éloigner en rampant, traînant leur
fusil dans la boue

28 Ils coupaient les racines qui rampaient à la surface du sol.

29 Tout ce qui rampait, nageait, trottait ou volait servait à le
documenter.

30 Devant le parloir, des pourpiers ... rampent et fleurissent entre les
pavés.

31 Et quelques semaines après tu rampais aux pieds d'un autre qui ne
le valait pas.

32 Le faux jour livide hésita d'abord, rampa le long des hauts rideaux,
puis ...

33 ... rendre compte des craintes vagues, des pressentiments, de toutes
ces choses aveugles et rampantes au fond de sa conscience ...

34 [il] lui demandait, non sans prodiguer les signes d'une politesse
rampante: 'et alors ...'

35 ... un feu sournois qui rampe sous la brande, embrase un pin, puis
l'autre ...

36 ... s'élevait un mur au long duquel rampait un vieil escalier de bois

37 Après avoir rampé toute sa vie auprès de lui, comme auprès d'un
homme à qui il devait tout

38 Les philistins rampent dans la boue.

39 Malgré ces ailes que je prêtais au genre humain, je le voyais ce qu'il
est, rampant, malpropre, et misérable.

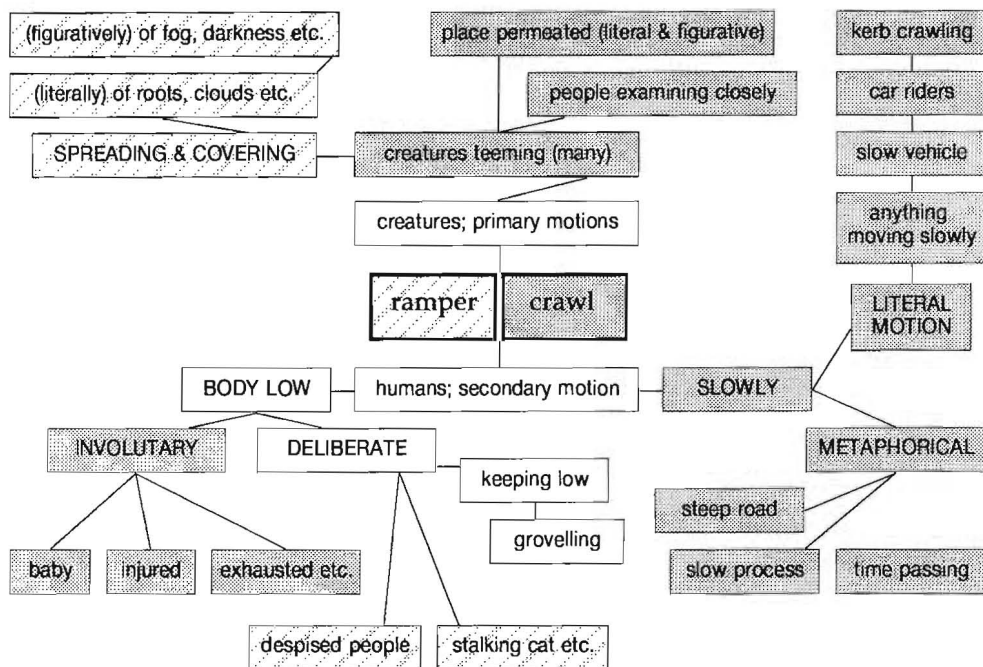Figure 7: Uses of *ramper* from the ARTFL 20th c. corpus

Figure 9: *crawl* and *ramper* intersection

The equivalences engendered by this operation are neatly summarized in the bilingual dictionary entry as far as ramper is concerned. Looking first at the expression of the remaining ramper uses in English, we see that 'Stalking cat etc.' (chat, fauve) requires creep, as does 'Roots etc.' (plante); indeed creep would also cover 'Fog etc.' and its figurative extensions (doubts, fears, darkness etc.). Although both ramper and crawl may be used to refer to someone behaving in a servile way ('Grovel'), the bilingual lexicographer avoids crawl for this, preferring the verb grovel itself as a safer alternative. We shall return to this point later. Finally, to translate the 'Despised' sense — a rather rare use, justifiably omitted in this one-volume dictionary — a phrase such as *live in misery* is required.

In the other half of a bilingual dictionary, the entry for **crawl** will naturally be much more detailed, offering *marcher à quatre pattes* for the 'Baby' sense, *se traîner* for some of those stressing slowness: 'Injured', 'Effort', 'Time passing' and 'Slow process'. However, the other senses which stress slowness require a different expression of this aspect of movement: 'Slow vehicles' and metonymically 'Car riders' are said to *rouler au pas* (literally: move at walking pace, or slowly); and 'Steep road' calls for *monter péniblement* (literally: move upwards with difficulty). The extensions of 'Creatures moving', building on the multiplicity of movers, will require completely different French verbs or verb phra-

ses: *grouiller* for 'Creatures teeming', and *grouiller de* for 'Place teeming'; *être pénétré de* for 'Permeated'; and *fouiller partout* for 'People examining'.

Finally, in this contrastive analysis of **crawl** and **ramper**, we must consider how far these two verbs are true equivalents even in the senses indicated by clear boxes in Figure 9. The way in which these senses have been extended differently implies that some semantic divergences exist. Further study of these leads us to infer that, while **crawl** tends to carry with it in its various figurative manifestations the sense of limbs which by moving displace some kind of body (so that, for instance, a branch of ivy may be said to crawl up a wall), **ramper** focuses on the fact that the crawling entity expands and covers more and more of a surface; examples of this are *des flaques de boue* (pools of mud), *flammes* (flames), *un feu* (fire), *la fleur du givre* (hoarfrost), and *les ténèbres* (darkness), and in a slightly different way, *les tiges du cornichon* (the stems of the gherkin plant) and *les racines* (root system).

There are two ways in which these different shades of meaning seen in **crawl** (limbs scurrying) and **ramper** (extension over a surface) seem to affect the equivalence of these lexical units: first, as noted above, "crawling to someone" and "ramper devant quelqu'un, or aux pieds de quelqu'un" do not have wholly the same meaning, the English verb being proactive, implying action on the part of the person described as crawling to another, while the French verb can be used of someone who simply abandons all initiative and acquiesces in another's demands. The second point concerns apparent parallels: in English you can make your hand "crawl across the table", while in French "une main rampe sur la table". In our experience, speakers of English when asked to show this movement use their fingers as limbs, in the manner of a spider running across the table, while French speakers turn their hand palm upwards and drag it limply across the surface.

To summarize: we have tried to demonstrate, in our discussion of the verb **crawl**, an approach to word meaning analysis which allows a more detailed description of the factors involved, and which facilitates a more delicate cross-linguistic matching of senses. We have also proposed that making available a comprehensive and consistent description of the lexicon to lexicographers would result in dictionaries becoming richer and internally more consistent. The description itself would constitute the basis of a vast computer lexicon. Devising such a description is of course the job of lexical semanticists, not lexicographers, who are neither trained for such a task nor able to carry it out in the time allowed to them by publishing budgets, although their classifying skills will be vital to the analysing and recording of corpus data on a large scale.

Appendix: the FrameNet Project

A start has been made on devising a comprehensive and internally consistent account of word meanings and their combinatorial properties in the FrameNet project, a research effort now in its second three-year phase, managed

through the International Computer Science Institute and funded by the U.S. National Science Foundation.

This project is building a lexicon of several thousand English lexical units described in terms of frame semantics. At its centre is the collection and annotation of sample sentences, giving evidence for the full use of each of the words targeted for the study, analyzed and annotated in respect to the manner in which they represent instances of the underlying semantic frames. The project work on the verb **crawl** builds on the semantic analysis set out in Figure 5, and the central uses, indicated in bold boxes, now constitute one sense, being instances of a frame that we can speak of as Self-Movement (the mover is the energy-source for its own movement) and the associated "frame elements" (aspects or components of the frame that are realized as constituents of sentences containing the word) include the Mover (the entity that moves), the Area over which it moves, the Path it follows in a linear motion, the Source or starting point of a journey, the Goal or destination of a journey, and the Distance travelled. These are illustrated in Table 4.

Frame element as exemplified in a corpus sentence

MOVER	DAVID ATTENBOROUGH was crawling up behind two copulating lions.
AREA	Literally on hands and knees, his men crawled OVER EVERY INCH OF THE AREA ...
PATH	A cat can crawl THROUGH ANY HOLE it can get its head through
SOURCE	The two hedgehogs crawled FROM THE NEST at sunset.
GOAL	They would never find her if she crawled INTO A CUPBOARD and hid away.
DISTANCE	From there they crawled THE LAST TEN YARDS to the edge of a rise.
MANNER	A small baby crawled out ON ITS HANDS AND KNEES, its face covered in grime.

Table 4. Elements in the motion frame

The work of the FrameNet project is to document the particular patterns by which words combine with frame elements as well as the grammatical ways — in terms of phrase type and grammatical function — in which such frame elements are realized within the phrases and sentences built around individual words.

The product of the FrameNet project will be a registry of descriptions of semantic frames (the Frame Database), the lexicon (the Lexical Database), and

the collection of annotated sentences. The lexical entry for **crawl** will include numerous senses (perhaps not as numerous as what is suggested by the polysemy network in Figure 7), and each will be further characterized according to its combinatorial properties. For example, the 'Baby' sense is clearest in sentences which do not involve specification of path or distance, since it concerns only the attainment of a physical ability; in the 'Grovel' sense the word will be accompanied by a **to**-phrase; in the 'Teeming' sense it will be accompanied by Area phrases but not Path phrases; and in the 'Swarming' sense it will be accompanied by a **with**-phrase.

The database created by the first phase of the project (1997—2000) may be queried on the FrameNet web page, *http://www.icsi.berkeley.edu/~framenet/*.

References

Our thinking on motion verbs has been informed by the work of many scholars not cited specifically in the text, in particular George Miller and Philip Johnson Laird (1976), Beth Levin (1993), Ray Jackendoff (1983), Leonard Talmy (1985), George Lakoff (1987), Alan Cruse (1986) and of course the work done in the WordNet project by George Miller and his colleagues (Fellbaum 1990).

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Nov pristup dvojezičnoj leksikografiji pomoću semantike okvira

Sažetak

U ovom članku iznosim rezultate svoga rada s Charlesom J. Fillmoreom (University of California Berkeley). Opisuje se način na koji se konkretni teorijski model (Fillmoreova semantika okvira u kombinaciji s konstrukcijskom gramatikom, proizašlom iz Fillmoreove suradnje s Paulom Kayem) može primijeniti u standardnoj dvojezičnoj leksikografiji. Takav pristup pomaže leksikografima odrediti kojim informacijama iz korpusnih podataka valja dati prednost kako bi bitne semantičke i gramatičke činjenice bile zabilježene i uvrštene u rječnički članak. U daljnjoj razradi predlažem novu grafičku metodu za predočavanje ekvivalencija i divergencija između izvornoga i ciljnoga jezika u dvojezičnom rječniku. Konkretni primjeri prikazuju obradu engleskoga glagola *crawl* i francuskoga glagola *ramper*.

Ključne riječi: dvojezična leksikografija, semantika okvira
Key words: bilingual lexicography, frame semantics