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Ergativity, Collocations and Lexical Functions

Abstract

In this paper, I examine the way in which the causative/inchoative alternation is represented in, and can be extracted from, the Collins-Robert English-French dictionary (Atkins & Duval 1978). This machine-readable dictionary, which has been transformed into a lexical-semantic database at the University of Liège, is enriched with lexical-semantic relations in the form of lexical functions à la Mel'čuk (Mel'čuk 1984) and the resulting collocational database (described in more detail in Fontenelle 1994 a & b, 1995) is used as a starting point to establish correlations between the transitivity alternation under scrutiny, the phenomenon of collocations and the lexical functions linking ergative verbs and their typical arguments.

1. Introduction

The assumption which underlies this paper is, to quote Levin (1993:1), that "the behaviour of a verb, particularly with respect to the expression and interpretation of its arguments, is to a large extent determined by its meaning". Levin's contention, which is largely shared by other linguists and lexicographers (Atkins *et al.* 1986, Boguraev 1991, Antelmi & Roventini 1992), is that knowing a verb entails knowing how the arguments of this verb can be realized syntactically. Consider, for example, the verb *boil* in the following sentences which illustrate the so-called causative/inchoative alternation:

1. John boiled the water.
2. The water boiled.

It has often been noted that this alternation is typical of change-of-state verbs and the verbs which participate in it are frequently referred to as **ergative** verbs (Levin 1993; Atkins *et al.* 1986...). In terms of semantic roles, the verbs involve an **agent** (generally an animate entity) and a **patient** (the entity that changes state). They have a causative and a non-causative use (inchoative refers to verbs expressing the beginning of a change of state). The semantic relations between the verb and its arguments may be expressed in two different ways since the causative (i.e. transitive) construction implies that the agent is realized as the subject

and the patient argument is the object. The inchoative (i.e. intransitive) construction only involves a patient (or theme) which is realized as the subject.

In earlier studies (Fontenelle & Vanandroye 1989, Boguraev 1991, Montemagni 1994), it was shown that ergativity is lexically governed and that this property should be coded at definition level if we want a computerized lexicon to account for the transitive and intransitive usages of this set of change-of-state verbs. It is indeed clear that not all change-of-state verbs are ergative: the verb *fracture*, for example, is definitely ergative (consider the two CIDE – Procter 1995 – examples: *She fractured her skull in the accident* vs. *Two of her ribs fractured when she was thrown from her horse*), but the verb *dislocate*, which also refers to a change of state and belongs to the same sub-class of "mutilation" verbs, can only be used transitively (*I dislocated my knee*). The problem is to be able to acquire and identify potential ergative verbs. Since these verbs are usually not explicitly tagged as such, the acquisition method is heavily dependent on the microstructure of the dictionary entries. In lexical resources such as LDOCE (Procter 1978) or OALD (Cowie 1989), for example, a set of definition patterns (or defining formulas, to quote Ahlswede & Evens 1988) may be tapped to provide evidence that a given verb is ergative (see Fontenelle & Vanandroye 1989 who study combinations of grammatical codes and definition patterns such as *(cause) to, make or become...*). Such definition patterns are, to some extent, the lexicographical application of the predicate decomposition approach developed by the generative semanticists in the 1960's.

2. The Collins-Robert dictionary database

Since bilingual dictionaries such as the Collins-Robert dictionary hardly ever make use of definitions, it is virtually impossible to tap defining formulae to recover ergative verbs, as is the case with monolingual dictionaries. A more structural approach is therefore better suited to the format of bilingual dictionaries and it is necessary to discover how a dictionary such as CR signals to the user that a given verb displays the causative/inchoative alternation. Before tackling this problem, however, a few comments are necessary to describe the collocational database constructed from the CR machine-readable version.

For space reasons, I cannot dwell on the full rationale of the construction of a lexical-semantic database from the CR dictionary (see Fontenelle 1992, 1994 a & b, 1995). Suffice it to say here that the availability of the computerized version of this dictionary has made it

possible to manipulate the information it contains on selection restrictions and collocational constraints. As is shown in the following examples, collocations are explicitly specified in the metalinguistic apparatus of the dictionary. The usual distinction, made by Hausmann (1979), between base (i.e. the main element in a collocation which is responsible for the selection of the other element) and collocator is clear in the following CR examples where the base is the element in italics and the collocator is the headword in the English-French part.

do away with *vt fus* **(a)** *custom, law, document* supprimer; *building* démolir
entertain *vt* **(c)** *intention, suspicion, doubt, hope* nourrir
flap 3 *vi* **(a)** *[wings]* battre; *[shutters]* battre, claquer; *[sails]* claquer
harbour 3 *vt* **(b)** *suspicions* entretenir, nourrir; *fear, hope* entretenir

CR is not a collocational dictionary but, in keeping with current thinking about access to collocational information (see Heid 1994), the machine-readable version of the dictionary makes it possible to focus on the various occurrences of the base of the collocations (the italicized items) and to identify the collocators (the headwords) under which this base appears. The base *suspicion*, for example, can be used as the direct object of the verbs *entertain* and *harbour* in the examples above (querying the whole database against all the occurrences of the italicized word *suspicion* reveals that one can also *arouse, awake, rouse, confirm, verify, avert, dissipate...* suspicions). This information is not readily accessible in the printed dictionary because of the inherent constraints of the alphabetical order. Being able to access information via any element of the microstructure of the dictionary adds a significant thesauric dimension to the potential use of the database.

The CR database has been systematically enriched with lexical-semantic relations based on Mel'čuk's apparatus of lexical functions (LFs; Mel'čuk 1984). The general form of these LFs is f(X)=Y, where X is the keyword (the base of the collocation, the italicized item in CR) and Y is the collocator which has to be selected to express the meaning denoted by f(X). The examples above are therefore re-interpreted as follows in the Liège database ($Oper_1$ applied to a noun yields the semantically impoverished – support – verb taking the keyword as direct object; Liqu yields "liquidation" or "eradication" verbs; Son refers to the typical sound or noise of the keyword...):

$Oper_1$ (suspicion) = entertain, harbour
Son (shutter) = flap
Son (sail) = flap
Liqu (law) = do away with...
Liqu (custom) = do away with...

Whenever possible, each of the 70,000 combinations in the database has been labelled with a lexical-semantic relation borrowed from Mel'čuk's set of about 60 standard LFs (to which other semantic relations have also been added, e.g. **Part** for part–whole relations). Indexing the database on the base, the collocator, the LF or the French translation makes it possible to pose semantically complex questions such as: list the verbs which can refer to the "destruction" of a law (*abolish, do away with, repeal*, etc); list the verbs expressing the typical sounds made by brakes (*scream, screech, squeal*). The realization of individual functions can also be studied with a view to making generalizations about the structure of the lexicon (see Fontenelle 1994b and 1995).

3. Ergative verbs and the Collins-Robert dictionary

Bilingual dictionaries usually adopt the "splitting" strategy in organizing senses. Atkins *et al.* note that "they [bilingual dictionaries] adopt strict divisions by parts of speech, supplemented with transitivity indications for verbs" (1986:9). They argue that there are pragmatic reasons for grouping all transitive senses together and treating intransitive senses separately: in their opinion, dictionary users are only able to guess the part of speech and the transitivity of an unknown word if it is contextualized (provided they are at all able to identify whether a given word is a verb, of course). This means that a prototypical ergative verb will be treated in CR as follows (the entries have been slightly edited for the sake of clarity):

turn **3** *vt g milk* faire tourner
4 *vi d [milk]* tourner

lessen **1** *vt* (...) *pain* atténuer; (...) (*Pol*) *tension* relâcher
2 *vi* (...) *[pain]* s'atténuer; *[tension]* se relâcher

Several things ought to be noted here. First, unlike what happens in monolingual dictionaries such as LDOCE, the information given in the entry is not restricted to the verb since the patient argument is here specified explicitly. The nouns *milk*, *tension* and *pain* in the examples above all refer to the entity which changes state. It must be borne in mind that the patient argument appears unbracketed in the transitive sense (direct object) and surrounded by square brackets in the intransitive sense (subject). This information is of cardinal importance since it is used to extract verbs which pattern in a similar fashion. In fact, the

structure of the CR database makes it possible to extract all the verbs which can be transitive (POS = vt) and intransitive (POS = vi) and for which a given item in italics (the field "itword" in the database) can be used either as the subject of the verb (the field "typ" houses the typographical nature of the italicized item; typ = C for the square brackets which surround the subject – "crochet" in French) or as its direct object (typ = S – surface level – unbracketed). Access to ergative verbs is therefore made possible via the typical patients with which they can be combined. Figure 1 illustrates the five ergative verbs (*burn, congeal, curdle, sour, turn*) which can be extracted when the noun *milk* in italics is chosen as primary access key:

Itword (italicized indicator)	Typ	Enhead (headword)	Pos	Frtran (French translation)
milk	C	burn	vi	attacher
milk	S	burn	vt	laisser attacher
milk	C	congeal	vi	se cailler
milk	S	congeal	vt	faire cailler
milk	C	curdle	vi	se cailler
milk	S	curdle	vt	cailler
milk	C	sour	vi	tourner
milk	S	sour	vt	faire tourner
milk	C	turn	vi	tourner
milk	S	turn	vt	faire tourner

Figure 1

(Itword = word in italics; Typ = typographical information, C = bracketed; S = unbracketed; Enhead = English headword; Pos = part of speech; Frtran = French translation)

Montemagni (1994) points out that knowing whether a verb is ergative or not is necessary to characterize the linguistic properties of verbs, but she adds that it is far from being sufficient. In addition to that, she argues, the lexical-semantic description of a verb must also include restrictions on the possible arguments a verb can take. Such restrictions account for the well-formedness of (3) and (4) and the ill-formedness of (5) in the following contrastive pairs:

3. John rang the bell.
4. The bell rang.
5. *John rang the telephone.
6. The telephone rang.

These sentences make it abundantly clear that the ergative property of the verb *ring* is restricted to cases where it co-occurs with specific patients such as *bell* to the exclusion of other potential nouns such as *telephone*, which can only be used as subject. Some explanation may also be found in the hypothesis that the causative use of an ergative verb seems to entail that there is a direct action, often with some kind of contact between the agent and the patient. This could perhaps account for the ungrammaticality of *John rang the telephone* above, since there is no direct contact between John and the other person's telephone. As a matter of fact, Montemagni's criticism of traditional approaches to the extraction of ergative verbs is justified in the case of monolingual dictionaries which usually do not include any explicit reference to such restrictions. The CR dictionary, on the other hand, enables linguists to readily identify this syntactic property together with the lexical set of arguments which make this type of alternation possible.

4. Ergativity and translation

It is generally admitted that knowledge about the syntactic behaviour of verbs is essential for the development of practical natural language processing systems. Ergativity is therefore undoubtedly a property we wish to identify since it is crucial for the assignment of semantic roles. In a translation perspective, it is equally important since several patterns are possible to render the transitive and intransitive uses of English ergative verbs into French.

4.1 No modification

The causative and inchoative uses of the verb are expressed by the same verb in French. Consider *increase/augmenter* in the sentences below:

(a) The government has decided to increase the price of bread.
Le gouvernement a décidé d'augmenter le prix du pain.
(b) The price of bread will increase in January.
Le prix du pain augmentera en janvier.

Other examples are *diminuer* (<*diminish*), *refroidir* (<*cool*), *cristalliser* (<*crystallize*), *baisser* (<*lower*)...

4.2 Pronominalization

A pronominal verb is frequently used in French to account for the intransitive usage of an English ergative verb:

(a) Joy lightened his face.
La joie éclaira son visage.
(b) His face lightened.
Son visage s'éclaira.

Other examples are *(se) combiner* (<*combine*), *(s')ouvrir* (<*open*), *(s')intensifier* (<*intensify*)...

4.3 Causative operator: Faire + infinitive

The introduction of the causative operator *faire* followed by an infinitive in French allows for the representation of the transitive construction in English:

(a) The worker rotates the axes.
L'ouvrier fait tourner les axes.
(b) The axes rotate.
Les axes tournent.

Other examples are *(faire) bouillir* (<*boil*), *(faire) fructifier* (<*fructify*), *(faire) fondre* (<*melt*)...

4.4 Causative operator: Rendre + adjective

Some monolingual dictionaries often define ergative verbs in terms of the defining formula "to make or become + Adj" (**shorten** = make or become short or shorter – LDOCE). The translation of English ergative verbs sometimes requires that the French equivalent in a bilingual perpective should resort to a parallel structure, using the verb *rendre* for the causative reading and *devenir* for the inchoative interpretation. Consider the following entry from the CR dictionary:

toughen **1** *vt metal, glass, cloth, leather* rendre plus solide, renforcer
2 *vi [metal, glass, cloth, leather]* devenir plus solide

4.5 Passive construction

The inchoative reading of an ergative verb is also frequently expressed in French in terms of a passive structure, as in the following examples from CR:

transfer **1** *vt employee, civil servant, diplomat* transférer, muter
2 *vi [employee, civil servant, diplomat]* être transféré *or* muté

camber **1** *vt road* bomber; *beam* cambrer
2 *vi [beam]* être cambré; *[road]* bomber, être bombé

5. Ergative verbs and lexical functions

It has already been pointed out that ergativity is typical of change-of-state verbs. Since our lexical database is now enriched with information on lexical functions, it is natural to try to find a possible correlation between this lexical-semantic phenomenon and the lexical functions which hold between an ergative verb and its patient. Not surprisingly, the key LFs which play a crucial role in this respect are **Caus** and **Incep**, which account for causative and inchoative readings respectively. These functions are frequently associated with operators denoting an upward (Plus) or downward (Minus) movement, as in the following examples:

CausPredPlus (price)= $increase_{vt}$, $advance_{vt}$

CausPredMinus (price)= $drop_{vt}$, $lower_{vt}$

IncepPredPlus (price)= $increase_{vi}$, $advance_{vi}$

IncepPredMinus (price)= $drop_{vi}$, $lower_{vi}$

Interestingly, several ergative verbs expressing an increase or decrease in intensity are associated with nouns belonging to the field of emotions and feelings, which can be readily explained since the feelings experienced by someone are frequently associated with the agent or cause that stirs them up. Consider the following examples:

Caus/IncepPredMinus (anger)= soften
Caus/IncepPredMinus (courage)= wear down
Caus/IncepPredMinus (hope)= wither
Caus/IncepPredMinus (pain)= lessen
Caus/IncepPredPlus (fear)= heighten
Caus/IncepPredPlus (joy)= increase
Caus/IncepPredPlus (sorrow)= increase
Caus/IncepPredPlus (pride)= increase
Caus/IncepPredPlus (rage)= increase
Caus/IncepPredPlus (pain)= increase, sharpen

Another feature of ergativity is that it seems to involve a significant number of verbs expressing noises or sounds. The complex LF which accounts for the transitive reading is **CausSon** while **Son** is used for the intransitive reading. The CR entry makes it clear that one can *swish* a *cane*, for example, but that a *cane* can also *swish*, which appears in the database as in Figure 2:

Lexfunc (Lexical function)	Itword (Italicized indicator)	Enhead (headword)	Pos	Frtran (French translation)
CausSon	cane	swish	vt	faire siffler
Son	cane	swish	vi	siffler

Figure 2

As could have been expected, the patients (i.e. the italicized items) which can be combined with an ergative verb of sound are most often **inanimate** entities:

(Caus)Son (whip)= snap, swish, crack
(Caus)Son (bell)= chime, peal, ring, sound, toll
(Caus)Son (rubber band)= snap
(Caus)Son (cane)= swish
(Caus)Son (chalk)= grate
(Caus)Son (coin)= ring
(Caus)Son (cymbal)= clash
(Caus)Son (leaf)= rustle
(Caus)Son (metallic object)= clash
(Caus)Son (box)= rattle

This is probably due to the fact that animate patients are unlikely to be caused to produce a sound, although it is clear that they can be forced to do other things (compare *The farmer was grazing his cattle* vs. *The cattle were grazing in the meadow*). In our database, animate entities are usually combined with verbs of movement, which confirms Levin's remark that verbs such as *walk, march, gallop*, or *jump* exhibit the Induced Action Alternation (*The girl jumped the horse over the fence* vs. *The horse jumped over the fence*) (Levin 1993:31). A noun such as *troop*, for example, typically appears several times as the patient argument of ergative verbs expressing movement: *advance, fall in, gather, mass, move, move forward, rally, turn out* and *withdraw*. The military context in which these verbs can be used accounts for the causative usages (e.g. *The captain fell the troops in*).

Another category of ergative verbs includes items referring to the *degradation* of the patient argument. The LF which typically expresses

this specific change of state is **Degrad** for the inchoative interpretation and **CausDegrad** for the causative one.

(Caus)Degrad (tooth)= decay	(Caus)Degrad (flower)= wilt
(Caus)Degrad (milk)= curdle, sour, turn	(Caus)Degrad (fruit)= bruise
(Caus)Degrad (beauty)= wither, dim	(Caus)Degrad (cloth)= fray
(Caus)Degrad (health)= break	(Caus)Degrad (plant)= wilt, wither
(Caus)Degrad (sight)= dim	(Caus)Degrad (rubber)= perish

Another LF referring to a specific change of state is **Obstr**, which is used with verbs meaning that something is not working properly (obstruction). The patient is typically an artifact such as *brake, pipe, gun* or *rope*, as in the following triples:

(Caus)Obstr (brake)= jam	(Caus)Obstr (rope)= snarl
(Caus)Obstr (pipe)= slog	(Caus)Obstr (gun)= jam

More abstract notions, though, can also be prevented from working properly:

(Caus)Obstr (traffic)= snarl up

Another subset of ergative verbs includes 'eradication' or 'nullification' verbs. When used transitively, these verbs are described in terms of the **Liqu** function, while the inchoative reading is accounted for in terms of the complex LF FinFunc$_0$ (≈ cease to be):

Liqu/FinFunc$_0$(allowance)= stop	Liqu/FinFunc$_0$ (series)= end
Liqu/FinFunc$_0$ (hope)= wither	Liqu/FinFunc$_0$ (wound)= heal
Liqu/FinFunc$_0$ (process)= stop	Liqu/FinFunc$_0$ (writing)= rub off

A word should eventually be said about the semantic field of cooking terms, which is described in detail by Lehrer (1974). Several cooking verbs display the ergative alternation and are associated with the type of food which is being prepared. The function which means 'to prepare before using' is **Prepar**, which is usually combined with the LF **Fact$_0$**. Of course, this semantic field is lexically very rich because there is very often more than one way of cooking or preparing a given foodstuff. This means that applying the same function to a given type of food is likely to result in a set of cooking terms which are not interchangeable by any means, which provides evidence that **Prepar** should actually be viewed more as a semantic (1→n) relation than as a lexical function (1→1

relation) in the purely mathematical sense of the term. The following examples illustrate a few such ergative verbs:

$PreparFact_0$/$ProxFact_0$ (food)= cook	$PreparFact_0$/$ProxFact_0$ (soup)= simmer
$PreparFact_0$/$ProxFact_0$ (vegetable)= simmer	$PreparFact_0$/$ProxFact_0$ (meat)= roast, stew
$PreparFact_0$/$ProxFact_0$ (stew)= simmer	$PreparFact_0$/$ProxFact_0$ (tea)= brew, draw
$PreparFact_0$/$ProxFact_0$ (fruit)= stew	$PreparFact_0$/$ProxFact_0$ (beer)= brew

As can be seen above, *roast* and *stew* can both co-occur with *meat* and refer to possible ways of preparing this food. Since these two verbs are not substitutable, meaning distinctions should ideally be made, either in terms of subscripted modifiers such as those used by Mel'čuk to refine his lexical functions, or in terms of semantic features and distinguishers such as those used by structural semanticists (see also Lehrer 1974 who resorts to componential analysis to structure the field of cooking terms).

It should finally be noted that one of the prototypical ergative verbs, viz. *bake* (which is described at great length by Atkins *et al.* 1988), does not appear as an ergative verb with foodstuffs as patients in our database. This absence is due to the different treatment of the transitive and intransitive constructions in the printed version of the dictionary. The printed entry appears as follows:

bake **1***vt* **a** *(Culin)* faire cuire au four. **She bakes her own bread** Elle fait son pain elle-même; **to bake a cake** faire (cuire) un gâteau; **baked apples/potatoes** pommes / pommes de terre au four (...)
b *pottery, bricks* cuire (au four)
2 *vi* **a** *[bread, cakes]* cuire (au four)
(...) **c** *[pottery etc]* cuire

Among the various items in italics which form the basis of our collocational database, only *pottery* appears under both the transitive and intransitive readings. The culinary reading of *bake* is clear but the ergative property of the verb is left implicit because the typical patient (*cake*) appears explicitly as a typical subject (sense 2 a) but is buried as an example when used as an object (*to bake a cake*). This inconsistency means that, for our database, *bake* displays the causative/inchoative alternation only when it co-occurs with *pottery* (note that *brick*, which

appears in the transitive reading, is no longer mentioned in the intransitive reading and can only be recovered if one succeeds in interpreting the word *etc*, this little space-saving device which can be seen as the lexicographer's failure to account for very complex collocational phenomena – the automatic interpretation of *etc* could probably be the topic of another research project).

6. Conclusion

In this paper, I have described an attempt to extract a class of verbs which display an interesting linguistic property lying at the syntax-semantics interface, viz. the causative/inchoative alternation. As we have seen, a correlation needs to be established between this property and the patients with which an ergative verb typically appears. The Collins-Robert database proves to be an interesting starting point for the extraction of such verbs. Francis & Sinclair (1994:198) note that knowing whether a verb is ergative or not is a fact that must be collected by lexicographers in the course of their work, and then handed over to grammarians for generalization and explanation. I have tried to show that, in some cases, it is possible to correlate this property with the verb's belonging to one of the many sub-classes of change-of-state verbs (verbs of sound/noise, cooking verbs, verbs of impairment, etc). The very organization of the database, with its numerous types of lexical-semantic relations, enables the linguist to shed some new light on the interface between lexical semantics and syntax.

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