Treating Metaphoric Senses in a Danish Computational Lexicon – Different cases of regular polysemy

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Abstract
The aim of the EU-project SIMPLE (Semantic Information for Multifunctional Plurilingual Lexica) is to provide harmonised semantic lexicons for Natural Language Processing for 12 of the European languages. The language specific encodings are performed on the basis of a unified, ontology-based semantic model representing an extended qualia structure. In this paper we focus on the high frequency of figurative senses in real text in order to find systematic solutions when adapting the universal model to our corpus data. We first propose a treatment where the figurative senses of a certain group of nouns are considered a case of regular polysemy by showing that in many cases it is possible to map parts of the qualia structure of the concrete sense systematically into the corresponding figurative sense. Second, we show that even though motion verbs produce a very large variation of metaphoric senses, it is also possible to find systematic patterns of sense derivations for these. One of the metaphoric senses, namely 'moving in time', has generally been overlooked in lexicon production, but we demonstrate a way of encoding this sense in our lexicon in a satisfying way.

1 Introduction

The aim of the EU-project SIMPLE (Semantic Information for Multifunctional Plurilingual Lexica) is to provide harmonised semantic lexicons for Natural Language Processing for 12 of the European languages. The SIMPLE lexicons are an extension of the LE-PAROLE lexicons, which contain 20,000 entries with corresponding morphological and syntactic information for each of the 12 languages that participated in the project, cf. [Ruimy *et al*, 1998].

In this paper we shall see how a kind of regular polysemy[1], namely figurative meaning derivations of nouns and verbs, can be represented in a predefined, multilingual model like SIMPLE. Basing our encodings on corpus data, we have noticed during the lexicon making process that there is a surprisingly high frequency of figurative senses in real texts, compared both to the word senses described in existing dictionaries and the word senses that the lexicographer would intuitively expect to find. Should these figurative senses - in those cases where they have a high frequency in the corpus - be represented in the SIMPLE dictionary even if they are non-existent in the traditional dictionaries that we use as our basis[2]? And if yes, is it possible to treat these figurative senses in the SIMPLE model so that an eventual systematicity between the meaning components (i.e. qualia structure) of a concrete and a figurative sense is reflected in the entries, for instance by mapping meaning components from one representation to another? For nouns we suggest a representation of figurative senses that reflects the fact that meaning components from the concrete meaning of the noun often map into a similar - although vaguer or broader meaning component in the figurative sense. For verbs we show that the high number of what appears at first sight to be very different and incidental figurative senses, in fact turn out to show a certain systematicity, which can be reflected in the verb lexicon as regular polysemy.

2 The SIMPLE model

Words in the SIMPLE model can be assigned an ontological type according to the entire ontology the core types of which are 'Concrete Entity', 'Property', 'Representation', 'Abstract Entity' and 'Event'. Each core type is again divides into subtypes. One specific type of noun of the ontological type 'Concrete Entity' is in focus here, namely those belonging to the subtype 'Artifact'. The elements of this class are objects that are characterised by the fact of being produced by man. Our purpose is to show that there is a systematic link between many of these concrete nouns and their corresponding figurative sense which we will assign ontological type 'Abstract Entity', and that this link enables the mapping of the information on meaning components from one lexical entry to another.

One of the fundamental assumptions behind the SIMPLE model is that word senses differ in terms of their internal complexity and that this complexity can be described on the basis of an ontology established along different dimensions [Lenci *et al.* 2000]. Some word senses can be described by means of *simple* types, which means that they inherit their information from only one mother node in the ontology; others are more complex and thus inherit information from several mother nodes following the principle of orthogonal inheritance[3]. These types are called unified types. The multiple dimensions of meaning are represented in SIMPLE by means of an extended qualia structure model based on [Pustejovsky 1995] encompassing a set of semantic relations such as *is_a, used_for, part_of, has_as_parts, is_the_result_of* etc. for each qualia role (see also [Alonge *et al*. 1998] for the use of similar semantic relations in EuroWordNet). Furthermore, regular polysemous classes are represented in SIMPLE via the additional type*complex* which establishes a link between systematically related senses.

First, as an illustration of a noun of the type 'unified', consider the four meaning components of the concrete sense of the Danish noun *puslespil* (puzzle):

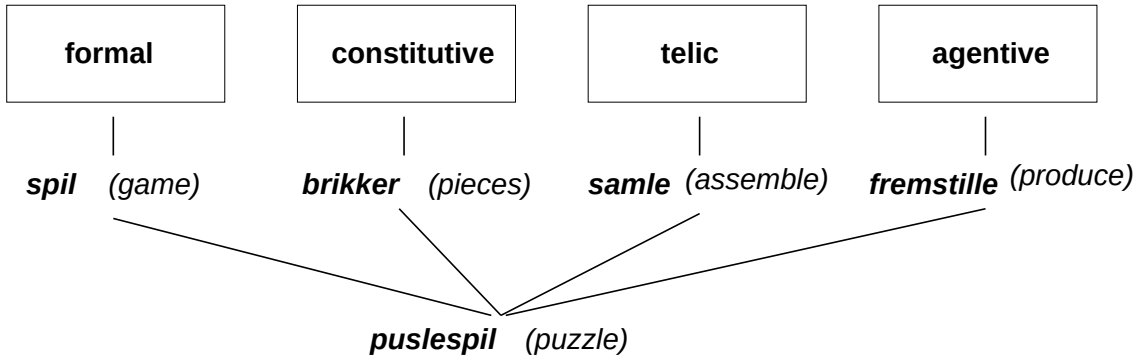

Figure 1: The meaning components of the noun *puslespil* (puzzle)

Four components are involved: (i) the formal role which provides information that distinguishes an entity within a larger set (in this case *is_a*), (ii) the constitutive role which expresses a variety of relations concerning the internal constitution of an entity (in this case *has_as_parts*), (iii) the telic role which concerns the typical function of an entity (here *used_for*), and (iv) the agentive role which concerns the origin of an entity (in this case*made_by*). These elements,

plus a long list of additional information types such as definition, domain, corpus example, polysemy relations etc. are represented in the lexical entry, see Figure 2:

Semantic Unit	*Puslespil_ART* (puzzle - artifact reading)
Definition:	*et spil med træ- el. papbrikker i forskellige faconer som skal lægges sammen så de danner et hele* (NDO)[4] (a game with wood or cardboard pieces in different shapes which must be assembled so that they make a whole)
Corpus example:	*nu var hun næsten ved at være færdig med det puslespil, hun var begyndt på lige efter påske* (now she had almost finished the puzzle she had started right after Easter)
Ontological type:	Artifact
Unification Path	Concrete_Entity | Agentive | Telic
Domain	General
Formal quale:	is_a = *spil* (game)
Agentive quale:	Created_by = *fremstille* (produce)
Telic quale:	used_for = *samle* (assemble)
Constitutive quale:	has_as_parts = *brikker* (pieces)
Complex:	ArtifactAbstract_entity = *puslespil_ABS* (puzzle - abstract reading)

Figure 2: A lexical entry in SIMPLE.

3 Figurative senses derived from nouns

We have made a small investigation on a group of concrete nouns which produce figurative meanings (including the puzzle example from above), namely words belonging to the group of artifacts in the SIMPLE ontology. Figure 3 below shows how often a figurative sense was represented in a corpus of 20 mill tokens[5] compared to its concrete counterpart:

As can be seen, several of the figurative senses of these nouns are very frequent even if they are not mentioned in the existing dictionary that we use. In fact, in some cases, *only* the figurative sense is found in the corpus. This gives a clear indication that such senses cannot be ignored in a computational lexicon meant for processing real texts. The last column of the table shows the telic role of the concrete senses. It is remarkable how the verbs or deverbal nouns which are related via the semantic relation *used_for* more or less create the meaning of the figurative sense as can be illustrated by the following corpus examples demonstrating figurative use of the words *skyklapper* (blinkers) and *puslespil* (puzzle):

(1) *valutahandlerne har skyklapper på i øjeblikket og vil kun se på de faktorer som vil føre til en styrket dollar* (the currency brokers are wearing blinkers at the moment and only want to look at the factors which will lead to a strengthened dollar)

(2) *det har været et puslespil at få udstillingen på benene*

(it has been a puzzle to arrange the exhibition)

	Concrete Artifacts	**Figurative Sense**	**Figurative sense in existing dictionary**	**Telic Role 'Used_for' of concrete sense**
vindue(window)	92 %	8% (15)	no	*se* (look)
våben (weapon)	90 %	10 % (100)	no	*kæmpe* (fight)
bro (bridge)	75 %	25 % (75)	yes	f*orbinde* (connect)
bombe (bomb)	50 %	50 % (150)	no	*ødelægge* (destroy)
panser (armour)	40 %	60 % (10)	yes	*beskytte* (protect)
nøgle(key)	30 %	70 %(274)	yes	*åbne* (open)
piedestal (pedestal)	25 %	75 % (12)	yes	*placere højt* (put in high place)
spændetrøje (straitjacket)	20 %	80 % (34)	yes	*fastholde* (keep in place)
puslespil (puzzle)	20 %	80 % (67)	no	*samle* (assemble/put together)
glidebane (slide)	20 %	80 % (12)	no	*glide* (slide)
rygstød (back of a seat)	11 %	89 % (16)	yes	*læne* (lean)
vifte (fan)	10 %	90 % (72)	no	*afkøle* (cool)
narresut (comforter)	8 %	92 % (11)	yes	*trøste* (comfort)
sovepude (sleeping pillow)	0 %	100 % (14)	yes	*sove på* (sleep upon)
skyklapper (blinkers)	0%	100%(14)	yes	*afskærmning* (limit. of visual field)
springbræt (springboard)	0%	100%(38)	yes	*sætte af* (take of)

Figure 3: Figurative senses of nouns

In the first example the 'limiting of visual field' is what creates the new sense of *skyklapper*: the currency dealers sight is limited by their preoccupation with the dollar to such an extent that they cannot see anything else; they are blinded so to speak. In the second example, the metaphor *puslespil* is used to indicate that all the sub-events need to fall into place in order to establish an exhibition, so again the telic quale of parts coming together plays a central role.

The question is now to which extent we can directly map this qualia role into the semantic structure of the figurative sense. In our view, the qualia structure with its four meaning dimensions is best suited for the description of concrete nouns, especially for nouns denoting artifacts. This can also be seen from the fact that there are less type-defining quales[6] to be expressed obligatorily in the abstract part of the ontology (see [Lenci *et al.* 2000] for an overview of the complete SIMPLE ontology including its type-defining quales).

For instance, for the core type 'Abstract entity' (which we assign to all the senses in Figure 3 since none of the abstract subtypes are relevant) no type-defining quales are predefined apart from the formal role (*is_a*). This, we believe, is not just a particular problem of the SIMPLE model, but rather a general problem relating to the fact that abstract nouns are much more difficult to classify coherently and thus assign type-defining semantic components to. However, in the case of the figurative senses that we are dealing with here – which all originate from concrete artifact senses – the relevant qualia roles can be mapped more or less systematically onto the figurative senses; not as type-defining for the entire type 'Abstract entity', but as an essential feature of these particular senses. However, since the *used_for*-relation is too restricted for the abstract senses because it indicates a volitional act with the concrete sense as

the object, we suggest to broaden the quale and thus apply the more general semantic relation *object_of_the_activity*. The semantic relation is in any case rather vague and differs slightly depending on whether the figurative sense denotes something negative or something positive; what seems most important is the information given by the related verb or the deverbal noun. The resulting figurative lexicon entry is shown in Figure 4 for *puslespil*:

Semantic Unit	*Puslespil_ABS* (puzzle - abstract reading)
Definition	*en kompleks sag der består af enkeltdele* (a complex matter which consists of separate parts)
Corpus example	*Det har været et puslespil at få udstillingen på benene* (it has been a puzzle to arrange the exhibition)
Ontological type	Abstract entity
Unification Path	Entity
Domain	General
Formal quale	is_a = s*ag* (matter)
Telic quale (essential)	Object_of_the_activity = *samle* (assemble)
Constitutive quale	Has_as_parts = *dele* (parts)
Complex	Abstract_entityArtifact = *puslespil_ART (puzzle - artifact reading)*

Figure 4: The entry of *puslespil*, figurative reading

4 Representing figurative verb senses in SIMPLE

In the SIMPLE ontology, verbs are classified under the node 'Event' which again dominates a whole subhierarchy of types to be used when classifying different kinds of events cf. [Lenci *et al.* 2000: pp. 29-30]. The ontology for events is based on several sources including in particular WordNet [Miller *et al.*1990], EuroWordNet [Alonge *et al.* 1998] and Levin's verb classes [Levin 1993]. One of the aims has been to find a number of event classes which is richer than that of WordNet comprising 15 classes and less detailed than Levin's 234 classes. Thus, the SIMPLE event ontology comprises 59 classes grouped into 7 core categories: 'Phenomenon', 'Aspectual', 'State', 'Act','Change','Cause change' and 'Psychological event'. These 7 categories are again grouped in subcategories, e.g. 'Act' is grouped into the categories 'Non-relational act', 'Relational act', 'Move', 'Cause act' and 'Speech act', and the categori 'Change' is grouped into 'Relational change', 'Change of location', 'Change possession', 'Acquire knowledge' and 'Natural transition'. Three fundamental aspects have been considered in the classification: (i) event type, i.e. basically whether a verb sense denotes a state, an act or a transition, (ii) argument structure; i.e. arity and type of arguments subcategorised for by the verb sense, and (iii) causativity; i.e. whether a verb sense is causative or non-causative; the former always being represented by a unified type.

In the following we examine a group of verbs with a concrete basic sense, namely motion verbs, and the corresponding figurative senses derived from these verbs. Verb senses denoting motion are to be assigned either the ontological type 'Change of location' or the ontological type 'Move', depending on their event type, i.e. whether the verb sense denotes a transition or a process. As regards the internal structure of the semantic unit, consider Figures 5 and 6 below

which give the contents of the semantic unit of the motion verb *komme* (come) (transition) and of *gå* (walk) (process).

Semantic Unit	*komme_CHL* (come)
Definition	*Bevæge sig hen til et sted* (NDO) (move to a certain place)
Corpus example	*Så let kan man også komme over Atlanten* (that easy you can also come across the Atlantic Ocean)
Ontological type	Change of location
Unification Path	Change/Agentive
Domain	General
Argument Structure	ARG1 (ARGDirection)
Selectional Restrictions	ARG1 = Human/Animal/ Vehicle ARGDirection = Concrete
EventType	Transition
Formal quale	Is_a = *ændring* (change)
Agentive quale	Agentive = *flytte_sig* (move)
Constitutive quale	Resulting_State = *være* (be) Direction = Underspecified

Figure 5: The lexical entry of the verb *komme*

The suffixes CHL and MOV refer to the semantic types 'Change of location' and 'Move', respectively. The first 5 slots correspond to the slots in the noun entries. 'Argument structure' should be self-explanatory; however, it should be noted that each language group has been relatively free regarding how to analyse predicates. The Danish lexicon is based on the linguistic specifications developed within an EU-grammar project (LINDA - Linguistic Specifications for Danish cf. [Underwood *et al*. forthcoming]). As regards 'Selectional restrictions', the concepts of the ontology are applied; thus 'Animal', 'Human' and 'Vehicle' are concepts of the ontology applied for concrete nouns. 'Event type' ('state', 'process' or 'transition') is meant to refer to the 'neutral' interpretation of the verb in question. Event type is followed by the four qualia roles which we described in Section 2, (i) the formal role (e.g. *komme* 'is_a' *ændring* (come 'is_a' change)), (ii) the agentive role (in the case of *komme flytte_sig* (move from one place to another)) (iii) the telic role (both *komme* and*gå* have no such function), and finally (iv) the constitutive role (in the case of *komme* the relations 'Resulting State' (which is to be in a different place (*være)*) and 'Direction' (which is 'underspecified')).

As was the case for nouns, a semantic unit (Semu) is established for a verb preferably on the basis of other dictionary sources and corpus examination. Looking at corpus examples[7] of a group of 14 different motion verbs we discovered that many of them, as was the case for nouns, show a high number of figurative senses in real text. The verbs differed from the examined nouns which normally had only one figurative sense, in showing a surprisingly large variation of different metaphoric senses. And as in the case of the nouns, these figurative senses were far

Semantic unit	*gå_MOV* (walk)
Definition:	*Komme frem ved at sætte den ene fod foran den anden* (NDO) (Proceed by putting one foot in front of the other)
Corpus example	*Vi skal* **gå** *hen til telefaxen, vente mens den kalder op osv.* ('(we have to **walk** over to the fax machine, wait while it makes the call etc.')
Ontological type	Move
Sem. Supertype	Act
Domain	General
Argument Structure	ARG1 (ARGDirection)
Selectional restrictions	ARG1 = Human/animal ARGDirection = Concrete
Event type	Process
Formal quale	isa = *bevæge sig* (move, stir)
Constitutive quale	Manner = yes

Figure 6: The lexical entry of the verb *gå*

from all described in our existing dictionary (NDO, Nudansk Ordbog). And again, especially because of the very high frequency of many of these verbs, it is important to try to cover as many of the conventionalised metaphorical senses as possible in a computational lexicon. In Figure 7 we have tentatively assigned ontological type to the different figurative senses.

It can generally be noted, that the higher the percentage of figurative senses, the higher the number of different ontological types found. An exception to this is the verb *stige* (rise), where the 'Change of value' sense is the only metaphoric sense found.

At first sight the figurative senses that each verb produces might seem more or less incidental or unsystematic, but as can be noted, many of the figurative senses appear several times in the table. This is for instance the case for the senses 'Change', 'Change of value', and 'Act', as well as for the time senses. The group of verbs that produce the figurative sense assigned ontological type 'Change' are *bevæge sig* (move), *gå* (walk), *hoppe* (jump) and *springe* (jump). Consider some examples of metaphoric uses with the meaning 'Change':

(3) *Han sprangfra en akademisk karriere som universitetslærer i psykologi til DRs nye afdeling i Århus*

(lit: He jumped from an academic career as university teacher in psychology to DR's new division in Århus) (He changed from an academic career as a university teacher in psychology to the new division of the Danish Radio in Århus))

	Concrete Sense	**Figurative Sense**	**Figurative sense in NDO**	**Ontological type of the figurative sense**
kravle (crawl)	93%	7%	No	Change of Value (5%), move in time (2%)
sprinte (sprint)	90%	10%	No	move in time (10%)
ride (ride)	89%	11%	not all	Act (6%), State (3%), others (4%)
køre (drive)	71%	29%	Well covered	Non-Relational Act (19%), Act (7%), others (4%)
passere (pass)	66%	34%	No	Move in time (16%) Change of Value (11%) Caused Experience Event (2%), others (5%)
bevæge sig (move)	62%	38%	No	Change (14%) Act (10%) Cognitive Event (4%) Change of Value (3%) Psychological Event (3%), others (3%)
hoppe (jump)	61%	39%	No	Purpose Act (20%) Judgment (10%) Aspectual (3%) move in time (2%) Change (1%) Change of Value (1%)
galoppere (gallop)	58%	42%	not all	Change of Value (37%) Non-Relational Act (4%)
rende (run)	56 %	44 %	no	State (12%) Change Possession (11%) Event (8%) Relational Act (8%) Directives (2%) Identicational State (2%) move in time/time passing (3%)
springe (jump)	50%	50%	Well covered	Act (16%) Change (14%) Purpose Act (5%) Change of Value (3%) move in time (2%), others 10%
komme (come)	36%	64%	not all	Event (36%) Speech Act (7%) Constitutive Change (6%) Act (2%) move in time (2%), Cognitive Event (2%), others (9%)
skøjte (skate)	15%	85%	not all	Speech Act (55%), Act (25%) Relational Act (5%)
gå (walk)	12%	88%	Well covered	Aspectual (25%) Relational Act (21%) Event (9%) Change Possession (6%) Change (5%) Non-relational Act (5%) Constitutive State (4%) Cognitive Event (3%) time passing (4%)
stige (rise)	10%	90%	Yes	Change of Value (90%)

Figure 7: Figurative senses of verbs

(4) *Det sociale arbejde har i en årrække bevidst bevæget sig hen imod, at eksakt viden og teknisk kunnen skulle være det dominerende*

(lit. The social work has for a number of years deliberately moved against, that exact knowledge and technical know-how should be the most important. (The social work has for a number of years deliberately been changing to a stadium where exact knowledge and technical know-how is the most important))

(5) *Jeg tror, det inderst inde er et stort ønske hos mange forretningsfolk, at man gik tilbage til den gamle ordning med lovbestemte datoer*

(lit. I think that deep down it is many business people's big wish to walk back to the old system with dates fixed by law. (I think that deep down it is many business people's big wish to change back to the old system with dates fixed by law))

The group of verbs that produce the figurative meaning 'Change of value' consists of: *bevæge sig* (move) *galoppere* (gallop), *hoppe* (jump), *springe* (jump), *kravle* (crawl), *passere* (pass) and *stige* (rise) . Here we see three examples of a metaphoric use with 'Change of value' sense :

(6) *Gajdars økonomiske reformer har fået priserne til at galoppere i Rusland*

(lit. Gajdar's economic reforms have made the prices gallop in Russia)

(Gajdar's economic reforms have made the prices rise in Russia)

(7) *Temperaturen bevægede sig fra lidt over frysepunktet til lidt under*

(lit. The temperature moved from a bit above freezing point to a bit below)

(The temperature changed from a bit above freezing point to a bit below)

(8) *Samtidig er også dollarskursen de seneste uger kravlet op ad*

(lit. At the same time also the dollar exchange rate has crawled upwards the last weeks*)*

(At the same time also the dollar exchange rate has slowly risen the last weeks)

We propose that these cases of systematic derivation of figurative senses should be reflected in the lexical entries as cases of regular polysemy, i.e. as complex types, as in the case of the nouns already described. And at least in some cases it is possible to map information from the qualia structure of the concrete sense into the qualia structure of the figurative sense. Consider for instance the case of motion verbs belonging to the 'Change of location' ontology type and mapping into the figurative sense 'Change of value'. When the direction of the movement is *forward* or *up* (constitutive quale) the constitutive role *resulting state* of the 'Change of value' sense will be *higher* and the direction will be *up*. In contrast, the directions *down* and *backwards* from the motion verb will result in a figurative 'Change of value' sense, where the resulting value is *lower* and the direction of the value change is *down.* See information on the qualia structure and on regular polysemy from the two entries of the verb *passere* ('Change of location' reading and 'Change of value' reading) in Figure 8 for an illustration:

Semantic Unit	*Passere_CHL* (pass - Change of location reading)
Corpus example	*Hun passerer et hus* (she passes a house)
Formal quale	is_a = ændring (change)
Agentive quale	Agentive = flytte_sig (move)
Constitutive quale	Resulting_State = *være* (be) Direction = *forward*
Complex	Change_of_location_ Change_of_Value = *passere_CHV*

Semantic Unit	*passere_CHV* (pass - Change of value reading *blive større end* (become bigger than)
Corpus example	*I år ventes på ny rekord , når salget formentlig passerer 300 mia. kroner* (this year a new record is expected, when the sale, as it is supposed, passes 300 bill. kroner)
Formal quale	is_a = *ændring* (change)
Agentive quale	agentive = *årsag* (reason)
Constitutive quale	resulting_state = *større* (higher), direction = *up*
Complex	Change_of_Value_Change_of_ Location = *passere_CHL*

Figure 8: Qualia structure for the concrete and figurative entries of *passere* (pass)

5 Figurative time senses

A sense which was also found several times during our examination of the metaphoric verb senses, is the sense describing moving in time or time passing (see among others [Atkins 1996] describing the verb *crawl*). Considering the high frequency in the corpus of the verbs in question, these senses are in fact quite common.

It is not easy to find an appropriate ontology type for these senses in the SIMPLE model (therefore the notion *moving in time/time passing* in Figure 7). The group of verbs having a time sense in our table consists of: *gå* (walk), *rende* (run), *sprinte* (sprint), *hoppe* (jump), *springe* (jump), *passere* (pass) and *komme* (come). The following corpus examples show some of these verbs used with a time sense:

(9) *mens månederne gik blev hoppen tykkere og tykkere*
(lit. as the months walked the mare became thicker and thicker)
(as the months went by the mare became thicker and thicker)

(10) *for hver dag kommer vinteren nærmere*
(each day the winter comes closer)

(11) *faktisk mener jeg , at tiden er rendt fra ISAK-messen*
(lit. in fact I think that time has run from the ISAK fair)
(in fact I think that the ISAK fair has had its day)

(12) *i næste måned vinker "Pärnu Postimees" endeligt farvel til blyet og hopper flere generationer ind i edb-alderen*

(next month "Pärnu Postimees" (a newspaper) finally waves goodbye to the lead (used for printing) and jumps several generations into the computer age)

(13) *vi skal passere år 2000, før alle danske biler kører med katalysator*

(we will have to pass the year 2000 before all Danish cars run with catalytic converter)

The fact that the SIMPLE model has no appropriate ontological type for these senses might be due to the fact that it is fully conventionalised that we use motion verbs both to describe moving in space and moving in time. Even dictionaries often seem to consider these two senses as one sense. As an example of this, the Danish dictionary 'Nudansk Ordbog' gives the following definition with both a concrete and a figurative example in the entry of the verb *passere* (to pass): *gå, rejse el. på anden måde bevæge sig forbi el. igennem nogen el. noget* (walk, travel or in another manner move by or through somebody or something*). De passerede grænsen. Han har passeret de 70.* (They passed the border. He has passed the age of 70).

Another reason might be that only very few words (at least in the case of Danish) have a time sense only. This makes time senses easy to overlook as a semantic group. E.g. [Levin 1993] does not treat these verbs as a special group. The verb *last* thus is categorised as a 'cost verb'. Some examples from Danish verbs with a time sense only are *rinde, forløbe* and*hengå* ('elapse', 'slip by', 'pass'*), vare* ('last') and *henslæbe* ('drag on (a miserable existence)'). Other examples where time is an aspect of the meaning of a word are verbs like *feriere* (to holiday), *overnatte* (to stay the night), *tilbringe* (to spend (the night)), classified by [Levin 1993: 275-76] as 'Week-end verbs'. But these verbs also have the sense of stative location, and have therefore without problems been assigned the state ontological type 'Stative location' in the Danish SIMPLE lexicon.

Since the SIMPLE ontology is our basic instrument for assigning ontological types to a sense, we are however in the encoding process of the Danish lexicon encouraged to distinguish between the two senses 'concrete moving' and 'moving in time', and create two different entries. What we propose is to consider it another case of regular polysemy. The case where the subject is a time entity (examples 9, 10 and 11) and where the sense is 'time entities passing by', is described by [Pedersen 1999] as a systematic derived sense for motion verbs. We think that also the case where the subject is human and the complement is a time entity (examples 12 and 13) could be treated as a case of systematic sense derivation. One could discuss whether these senses should simply be assigned the top ontology type 'Event' in the SIMPLE model. Another possibility would be to encode them as the abstract ontology subtype called 'Time', where nouns like *dag* (day), *måned* (month) etc. are placed, based on the argument that these verbs do not denote 'real' events, but more the background of events. The abstract 'Time' ontology type is intended for nouns referring to temporal expressions and give the possibility of assigning constitutive qualia information like 'iterative' and 'punctual'. This kind of information is also relevant in the case of the time senses of verbs. However, we would propose an extension of the SIMPLE model by an extra ontological type dedicated to the event time senses, where information from the abstract subtype 'Time' and the core type 'Event' is unified. In some cases it might also for these time senses be possible to map information from the concrete sense to the figurative sense. E.g. if the event type of the concrete sense is *process*, the corresponding figurative time sense will be 'time passing' (see [Atkins 1996], the example of *crawl*), and the constitutive quale of

the time sense will in these cases always be *durative.* In Figure 9 we show the lexical entry of the verb *gå*, 'Event time' reading, linked by the field *complex* to the entry of *gå* shown in Figure 5.

Semantic Unit	*Gå_ETI* (walk - event time reading)
Definition	(om tid) bevæge sig fremad (about time – move forward)
Corpus example	*mens månederne gik blev hoppen tykkere og tykkere* (as the months walked (went by) the mare became more and more thick)
Ontological type	Event_time
Unification Path	Event|Time
Domain	General
Predicative rep.	ARG1
Selectional Restr.	ARG1 = time
Formal quale	is_a = hændelse (event)
Constitutive quale	Durative
Complex	Event_Time_Move = gå_*MOV* (walk - move reading)

Figure 9: The entry of *gå* (walk), time sense

6 Conclusions

In this paper we have described the treatment of figurative senses in the Danish SIMPLE-lexicon. Using corpora as our most important information source, the treatment of figurative senses has become a crucial matter because of their high frequency. We have suggested a systematic solution to the treatment of these senses: if they are frequent in the corpus they should be represented in our lexicon even if they are not represented in the traditional dictionary we use as our other important background resource. Furthermore, we have for a group of nouns chosen to map the telic role from the concrete senses into a more general telic role, realised by the semantic relation *object_of_the_activity*.

Thereby we systematically account for the parallelism that holds between the concrete and figurative senses. As regards a group of motion verbs, a much more dispersed picture of mapping into figurative senses has been shown. However we have illustrated some patterns of systematic sense derivation, which seem to be more or less conventionalised in language. One of these is the case where change of location is mapped into change of value, and where the direction of the concrete movement determines whether the resulting value becomes higher or lower. Another frequent sense derivation is the time metaphor, where motion in space is mapped into motion in time. For the treatment of this case of regular polysemy we have suggested to extend the SIMPLE event ontology with the ontological type 'Event time'.

Notes

[1] Regular polysemy is defined by Apresjan (1980:243-46 apud Malmgren 1988:182) as cases where there are at least two words displaying the same type of polysemy.

[2] We base our encodings on the medium-sized Danish dictionary 'Nudansk Ordbog' from 1998.

[3] By 'orthogonal inheritence' we understand multiple inheritance with the restriction that a feature can only inherit its value from *one* mother node from the same partition. Thus, in SIMPLE each meaning dimension (each qualia role) establisshes its own partition.

[4] NDO indicates that the definition is taken from the Danish dictionary 'Nudansk Ordbog'.

[5] We use a corpus of Danish newspaper texts, the Berlingske Korpus of 20 mill. tokens.

[6] With 'type-defining' quales we mean quales which define a certain type and which are therefore obligatory for a word belonging to that type; in case of an artifact for instance it is a type-defining aspect that it is made in order to be used for something.

[7] In the case of less freqent verbs we examined all corpus examples, otherwise we examined an extraction of 100 examples.

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