Locationals

Marcus Kracht
Department of Linguistics, UCLA
3125 Campbell Hall
PO Box 951543
Los Angeles, CA 90095–1543
kracht@humnet.ucla.edu
and
Magyar Tudományos Akadémia
Nyelvtudományi Intézet
Benczur u. 33
H-1068 Budapest
kracht@nytud.hu

30. October 2006

Abstract

The word *locationals* is used here as a cover term for words that in some way or another talk about locations.[1] They constitute a rather rich class of words including adverbs, adpositions, body part nouns, classifiers, verbal affixes and particular nouns such as "home". In this essay I shall survey the many ways in which space enters language and point at some of the intricacies surrounding the language of space. In particular, I shall outline a number of consequences of the commonplace view that locatives are layered. The focus of this talk will be Uralic languages, but examples will be drawn from a number of other languages and language groups.

[1] When I wrote the first draft of the paper I thought of using a neutral term. I have learned since then I am not the first to use it. It seems to back to [Clark, 1970].

1 Introduction

Space is so important in daily life that it is hard to imagine that it will not also shape the way natural language functions. Yet, it is perhaps surprising that linguistic theory has been preoccupied with studying other semantic phenomena, notably tense and aspect, and, with some noteworthy exceptions, ignored space and its expression in language. There is now a growing awareness of the semantic intricacies involving locative expressions (see the work of Joost Zwarts, for example). And there certainly has been a lot of work in cognitive linguistics. What is still missing, though, is an investigation of the various ways in which space enters language. In this present paper I shall try to make up for that deficit by looking in particular to *word classes* and the question whether there is something specific about words that in one way or another involve space.

2 Some Semantic Background

I assume that the human universe is filled with things of different *sorts*. To name just a few of the different sorts: *objects* (or *things*), *events*, *time points* (or *intervals*), *properties*, *numbers*, *degrees*—and *regions*. Objects of different sort are distinct by nature: a number is not a thing, a time point not a region, and so on. What shall preoccupy us mostly here is *regions*. By a *region* I understand what is called a *path connected subset* of the space we live in (say $\mathbb{R}^3$). Path connected means that any two points in the region can be connected by some curve inside the region. This condition of connectedness is needed. The way to tell that an object is not in fact two or three objects is to look at its shape. If it consists of several disconnected parts we consider it not an integrated whole, but consisting of several objects. Therefore, the singular noun `fleet` can be diagnosed to refer to a group of things, not just one: the ships that make up the fleet occupy disconnected parts of the space.[2] We shall assume that for every object that has a spatial trace that the spatial trace exists for an interval of time.

It is customary to point out the connection between syntactic classes (noun, adjectives, verb) and the sort of thing that the members denote. Nouns tend to refer to things, adjectives to properties, and verbs to events. While this has been shown to be too simplistic (nouns actually denote properties as well, at least in

[2] A similar observation can be made with respect to time. The path connected sets of reals are the *intervals*. And indeed, if an object has a lifespan that is not an interval, we rather think of it as several objects, not one.

standard type theoretical semantics), it has its merits, too, since there is at least *some* observable regularity. On the other hand until very recently the study of the semantics of word classes was rather rudimentary. The most popular approach is to study word classes from a syntactic viewpoint only. [3] This is in part structuralist heritage: word classes are defined through their distributional properties. In part it is just the result of the fact that most linguists are syntacticians by training and so are likely to look for syntactic explanations. I am inclined to disagree and hope to show that there are good cases to argue that the kind of denotations a word has does shape its morphology and syntax, and not conversely.

The first question therefore is: what kinds of denotations exist and how are they expressed in language? The simplest kind of denotation that we can imagine is a word that denotes a location. Such words exist: these are the *spatial demonstratives*, `here` and `there`, and also the interrogatives `where` (modulo the fact that they carry interrogative force they only talk about location). Additionally, there might be words can talk about the *shape* of the region, like classifiers, and its *position* (`otthon` 'at home'). It is important to realise that these words denote true locations, and not things. We shall develop some diagnostics for that later, but it is at least conceptually clear that `here` denotes a location, primarily because it can refer to a region that is not occupied by any object.[4]

The next more complex denotation is a *relation between regions*. This is a well-known class of prepositions in English (`in`, `under`, `next to`). Type theoretically, there is some maneouvering that one has to do to get at the syntax of these prepositions. Although they do accept locations (`in here`) they also accept objects (`in the Albert Hall`). It turns out, for example, that languages allow flexible transition from an object to its location, but not conversely. The word `train station` can be seen as a location, while `here` is never an object in English. There also is an issue about the syntactic side of not accepting two arguments but only one. The phrase `in England` has only one object (or location) in it. The object is called *landmark* or *ground*. The phrase `in England` therefore denotes a *set of regions*, namely all regions that are inside England.

Many prepositions either derive from obvious landmarks, or they derive from

[3] [Baker, 2005] presents an interesting mixture. While the distinction between verbal and nonverbal is semantic, the distinction between nominal and nonnominal is semantic, since it involves the ability to introduce an index. On the other hand, work in generative grammar is often not semantic in nature. The official doctrine wants us to view indices as syntactic elements, whether or not one factually thinks that they do not belong to syntax.

[4] I am hiding some complexity here: `here` denotes a location depending on the utterance, since it denotes the location of speaker at utterance time.

body part expressions. For example, `in front of` derives from Latin `frons` 'forehead'. Now, under its literal interpretation, `in front of` can only mean 'in the forehead of', and so would be restricted to the actual part of the body. However, the preposition is abstract: it can be used for the location of the body part rather than the body part itself, it can be used for things that are at a distance from the landmark, and with landmarks that have no forehead.

There are a number of languages which have so-called *locational verbs*. They describe the way in which an object is situated. Typically, they may express the region (`in a basket`), but often they express the shape of either object or the location it is in, and finally they might talk about the way the object is situated, for example, if both container and object are longish, whether the object is situated 'alength' the container or 'across'. An interesting class are *posture verbs*, like `kneel`, `bow`. They discuss the shape of an object, though sometimes in an indirect way.

Finally, shape often enters in *classifiers*. In Malay, for example, we find a classifier `batang` 'stick', used for longish objects (like cigarettes). There is some semantic affinity to locational verbs. We may think of the locationals as expressing ways of being, and classifiers as ways of individuation. But individuation can be effected only via a way of being (see [van Leeuwen, 1991] and references therein). Basically, every way of being has its own criterion of identity (some would say that a criterion of identity *is* a way of being), and the latter is what the classifier uses to get at an individual.

The previous categories all referred to location or shape at given moments. These can change, and there is way to express that change. Within verbs the fine classification (*manner of motion*, *direction of motion*, *orientational motion*) has been studied, but is only of marginal interest for us. What is interesting that there is a general class of words or morphemes to express change that I will call *phasals*. I earlier called them *modalisers*, but I change my mind for two reasons: one is that [Fong, 1997] had the correct idea to use the phase quantifiers of Löbner, which are howewer not general enough for our purpose, and the second is that the word *modaliser* itself is confusing. For a recent reevaluation of the semantics of locatives see [Kracht, 2006b]. Phasals simply refer to the way in which the truth of a proposition changes. Basic phasals: the proposition changes from true to false, and that it changes from false to true. If the proposition is `John is in the shop.` the the first will come out as `John moves into the shop.` and the second as `John moves out of the shop.`[5] There are however more ways.

[5] I ignore some subtleties here.

The proposition could change from false to true to false (`John moves through the shop.`) And we can also talk about the degree to which it is true. In terms of space, `John is in the shop.` becomes more true if John is closer to the shop. Though technically out of the shop, we might assign to John a degree for being out of the shop. This makes much more sense perhaps with prepositions like `near`. There certainly are degree of nearness. And this explains why you may say `nearest to John` but not `innest John`. Although the morphological explanation is that the first is an adjective while the second is a preposition, we may ask why it is that one locational concept is described using an adjective and the other using a preposition. Prepositions often express the change as well as the location, like `into` and `towards`, so the connection between meaning types and word classes is in fact many to many.

Space can enter in many ways as an argument of words. Some verbs require locations (like `live`). It is interesting to note that there is room for arbitrary decision. It is grammatical in English to say `We visited there.` but in German this is impossible (*`Wir besuchten dort.` 'We visited there.'). This indicates that German `besuchen` 'to visit' does not take locations, but rather people or things. German `arbeiten` 'to work' or `leben` 'to live', however, do take locations, as do certain verbs of motion (`sich verstecken` 'to hide', which takes as argumen `hier` 'here' and not `hierher` 'to here'). Also nouns occasionally do take locations as arguments, especially when they are derived from verbs.

3 The Layered Structure of Locatives

The structure of locative expressions is rather complex. Some parts of the formal apparatus have been worked out in [Kracht, 2002] and will not be repeated here. Instead, let us discuss an example:

(1) `az asztal alá` ('to under the table')

We start with the DP `az asztal` 'the table'. It denotes an object, and not a location. Let that object be o. The first step is to change from the object to a location. As the object may be in motion, we need to fix a time at which we determine the location. Thus put

(2) $A(t) := \mathsf{loc}(o, t)$

This is the location of o (here: the table) a t. Now that we have a location $A(t)$ (the solid of the table) we shall ask what it takes to be under that location. We need

not work out an exact definition. By way of example, we may say that a region B is under C if, say, every point of B in vertically under some point of C. So, 'under the table' is a set $S(t)$ of regions, namely the set of regions under $A(t)$. This is time dependent, so we end up with a set of regions:

(3) $S(t) := \{B : B \text{ under } A(t)\} = \{B : B \text{ under } \mathsf{loc}(o, t)\}$

We convert this into a proposition, namely the proposition 'x is in S at t', where x is an object. This means that the region that x occupies at t is one of the members of $S(t)$.

(4) $P(t)(x) := \mathsf{loc}(x, t) \in S(t)$

$P(t)(x)$ is the proposition that x is under the table at t. Finally, we add the phasal. The one under consideration here (called 'cofinal') says that the proposition changes from being false to being true during the interval $i = [t_0, t_1]$. A formal definition runs like this:

(5) $R(I)(x) := \neg P(t_0)(x) \wedge P(t_1)(x) \wedge (\forall t' t'')(t_0 < t' < t'' < t_1 \rightarrow (P(t')(x) \rightarrow P(t'')(x)))$

This says that during the interval in question the proposition 'x is under the table' is first false, and then changes to being true and never becomes false again.

These semantic operations surface in the following structure:

(6) [[[[az asztal] $\varnothing_L$] al] á]

We can immediately see that the expression alá contains both the *locator* al and the *phasal* á. Additionally, it also contains an empty element, glossed here as $\varnothing_L$, which converts things to regions (for evidence for this element see [Caponigro and Pearl, 2006]). To see that there is a difference between things and locations, look at the following contrast:

(7)

ez alatt	*itt alatt
alatta	*alatt itt

While alatt as a postposition cannot be used together with itt, it can be combined with a demonstrative ez. Thus we assume that alá subcategorizes for things, not locations.

Table 1: Hawaiian Case Markers

	SU	OB	SA	LO	DS	SR
personal names	ʻo	iā	iā	iā	iā	mai
place names	ʻo	iā	iā	i/ma	i	mai
locative nouns	ʻo	iā	iā	i/ma	i	mai
common nouns	∅	i	i	i/ma	i	mai

SU = subject, OB = object, SA = stative agent, LO = location, DS = destination, SR = source

It may perhaps be deemed unnecessary to assume this empty element and instead postulate that the underlying meaning of al is a relation between regions and objects. However, notice that there are languages in which these elements happily take spatial demonstratives. In German you may say hierunter 'hereunder' in place of unter dem. German in fact makes a systematic distinction between P+DP expressions, where DP is not spatial demonstratives, or affix+P, which use use the spatial demonstrative. Since intrinsically it is possible to have it both ways, we assume that sometimes the P subcategorises for locations, sometimes for things.

We give yet another example where the difference between location denoting nouns and other nouns is overtly marked. The language is Hawaiian, and the data is from [Cook, 2002]. Hawaiian marks case by means of prepositions. However, the prepositions depend on the kind of noun. There are four kinds of nouns: *personal names*, *place names*, *locative nouns* and *common nouns*. Locative nouns are nouns that denote spatial regions. If used in this construction, they are preceded by o 'of'.

(8) Aia ka nūpepa ma luna o ka pākaukau.
there the newspaper on top of the table
'The newspaper is on top of the table.'

Table 1 shows the case markers for the various types of nouns.

(9) Aia ka puke a ke kumu iā ʻAulani.
there the book of the teacher at Aulani
'Aulani has the teacher's book.'

(10) Ke noho nei au i Mānoa.

PRS live PRS I in Mānoa.'
'I live in Manoa.

(11) `Aia ka haukapila ma ʻō.`
there the hospital at there
'The hospital is over there.'

(12) `Aia ke kumu i ka hale.`
there the teacher in the house
'The teacher is in the house.'

In (10), `ma` would have been appropriate, too, in place of `i`, but in (9) no other choice is available. (The quoted source does not say where there is a choice for (11) and (12).)

This structure can be found in many languages. It is necessitated by the fact that we first need to establish a location from an object and then a phase expression telling us how the trajector changes position with respect to the landmark.

4 Interaction Between Syntax and Semantics

4.1 Decomposing Cases

Heads can select complements of various category. Moreover, some semantic distinctions can be neutralised. For example, the Finnish verb `jäädä` 'to stay, remain' cannot be used with a stative locative, while `pysyä` must be so used:

(13) `Jussi jäi *talossa/taloon.`
`Jussi pysyi talossa/*taloon.`
Jussi stayed in the house.

This is not due to the fact that Jussi changed location in any sense. ([Alhoniemi, 1975] is quite clear on that point.) Rather, I claim that `jäädä` simply selects a directional complement, while `pysyä` selects a static complement. In [Kracht, 2003] I have proposed a theory that handles the idiosyncrasies arising from selection. The theory works as follows. Language consists of signs; these have three components: an exponent, a category, and a meaning. Here is an example:

(14) ASZTAL = $\langle$/asztal/, N, $\lambda x.\mathsf{table}'(x)\rangle$

A few notes are in order. The name of the sign is ASZTAL, but it could be XYZ. The name is used only to identify the sign and is actually not part of the dictionary. Names are spelled using small caps. We shall assume for simplicity that exponents are strings quoted here by means of slashes: /asztal/ is nothing but the string asztal. However, slashes are also used to abstract, for example in /V/, which denotes an unspecific vowel whose nature is specified by the context or by rules that we shall not spell out. Meanings are typed expressions, as in Montague Grammar. Notice that $\lambda x.\mathsf{table}'(x)$ is the same as table'; the additional operator is only for the eye, to reveal the type of the expression (which would otherwise remain implicit). Finally, categories are formed from basically as in categorial grammar, with the exception that the basic categories are attribute value structures. In particular, they contain an attribute 'case', whose values are cases. Cases will however not be what cases usually are taken to be, namely single features or feature bundles; rather, they will be taken to be sequences of morphemes. We can isolate the following parts in the locatives:

(15)
$$\begin{array}{lcl} M & : & \text{STA(TIC)},\ \text{COF(INALIS)}, \text{COI(NITIALIS)} \\ L & : & \text{AT}, \text{IN} \end{array}$$

The actual cases correspond to sequences of these two. Any combination of the two results in a local case of Finnish.

(16)

adessive	ablative	allative
STA + AT	COI + AT	COF + AT
inessive	elative	illative
STA + IN	COI + IN	COF + IN

Finnish also has an essive and a translative, which can be analyzed by proposing a morpheme ESS and proposing the cases to be produced as follows.

(17) essive : STAT + ESS, translative : COF + ESS

Notice that Finnish has no case corresponding to the combination COI + ESS. Hungarian differs from Finnish only by adding a third localizer, namely ON. This much for semantic segmentation. This segmentation is also syntactically relevant. Therefore, we regard all these cases as bimorphemic. Our main assumption is that cases are nothing but exponents of signs. However, this applies only to monomorphemic cases. Polymorphemic cases require more sophistication.

Definition 1 (Cases) *A sequence of morphemes is called* ***potential syntactic case****. A potential syntactic case γ is a* ***syntactic case*** *of a language L if there is a head selecting an argument containing the feature* [CASE : γ].

The idea of this definition is that rather than postulating a feature for some case, say, accusative, we let the exponent of the accusative case morpheme itself be the syntactic case. The marking for the case consists in putting that very function as the value of the attribute CASE. We shall explain in detail how this works. Notice also the following. Cases do not generally correspond to exponents of signs, therefore this definition had to be chosen. Second, it is not the signs themselves that are the syntactic cases, only their exponents. This avoids postulating distinct homophonous syntactic cases.

The general idea is now this: a sign can engage in basically two ways in a structure. It can either engage normally, with all its syntax, semantics, and form. Or it can add itself in the form of a marker. In the latter case the semantics is inactive, and so is its syntax. All that happens is that it adds itself as a case to the existing structure.

Consider for example the Finnish word /laiva/ 'ship'. We assume that the root of this word, denoted here also by laiva, has the case ε, where ε is the empty string. [CASE : ε] means that the item has no case. We may now add, for example, the morpheme /l/ and get the sequence /laiva/^/l/. Two alternatives are open:

1. /laiva/^/l/ means *at/on the ship*. Then the syntactic case of this unit is again ε, its semantic type is that of a location.

2. /laiva/^/l/ means again *the ship*. Then the syntactic case of this unit is /l/, its semantic type is that of a thing.

Suppose we have chosen the first alternative. Now we add the phasal 'from':

1. /laiva/^/l/^/ta/ means 'from the ship'. Then the case of this unit is again ε, its semantic type is that of an adverbial phrase.

2. /laiva/^/l/^/ta/ means again 'at/on the ship'. Then the syntactic case of this unit is /ta/, its semantic type is that of a location.

Next suppose that we have chosen the second alternative for the localiser. Then due to the types we must assume that the phasal morpheme /ta/ is semantically empty in the construction, and that /laiva/^/l/^/ta/ means again 'the ship'. Then the case of this unit is ablative (which is a shorthand for the sequence /l/^/ta/). Its semantic type is that of a thing.

4.2 Formal Analysis

We shall present a detailed formal account. For reasons that will become clear we shall start with Hungarian. We will write at', under' etc. for the respective functions from DPs to locations, and stay', to' and from' for the respective functions from locations to event modifiers, which define the motion with respect to the location. We have, for example the following signs in Hungarian:

$$
\begin{array}{lcl}
\textsc{sub} & = & \langle /\texttt{\#al}/, DP\backslash LP, \mathsf{under}'\rangle \\
\textsc{stat} & = & \langle /\texttt{Vtt\#}/, DP\backslash LP, \mathsf{stay}'\rangle \\
\textsc{cof} & = & \langle /\texttt{V\'{}\#}/, LP\backslash ADVP, \mathsf{to}'\rangle \\
\textsc{coi} & = & \langle /\texttt{V\'{}l\#}/, DP\backslash LP, \mathsf{from}'\rangle \\
\textsc{ine} & = & \langle /\texttt{ban\#}/, DP\backslash ADVP, \mathsf{stay}' \circ \mathsf{in}'\rangle \\
\textsc{subla} & = & \langle /\texttt{ra\#}/, DP\backslash ADVP, \mathsf{to}' \circ \mathsf{on}'\rangle
\end{array}
\tag{18}
$$

(Notice, that $f \circ g := \lambda x.f(g(x))$ is as usual function composition.) Here, *ADVP* is the category of adverbial phrases (which can be either VP/VP or $VP\backslash VP$), *LP* the category of location phrases, and *DP* the category of DPs. We have used /V/ here to denote a vowel, and /V́/ to denote a long vowel. However, notice that what we really have is functions which, when applied to a string add some other string to it. Finally, # is the word boundary marker. We allow among other these modes of composition:

$$
\begin{array}{lcllcl}
\langle E, \alpha/\beta, M\rangle & \circ & \langle E', \beta, M'\rangle & := & \langle E^\frown E', \alpha, M(M')\rangle \\
\langle E, \beta, M\rangle & \circ & \langle E', \beta\backslash\alpha, M'\rangle & := & \langle E^\frown E', \alpha, M'(M)\rangle \\
\langle E, \alpha/\beta, M\rangle & \bullet & \langle E', \beta/\gamma, M'\rangle & := & \langle E^\frown E', \alpha/\gamma, M \circ M'\rangle \\
\langle E, \gamma\backslash\beta, M\rangle & \bullet & \langle E', \beta\backslash\alpha, M'\rangle & := & \langle E^\frown E', \gamma\backslash\alpha, M' \circ M\rangle
\end{array}
\tag{19}
$$

These are the usual modes of backward application and backward function composition. With these signs we can successfully analyse the adverbial phrases /az ágy alá/, /a házban/, and so on.

For the case signs extra machinery is needed. We assume that the value of the feature CASE is a sequence of morphemes (where morphemes are meant to be string function, though we actually pretend the morphemes to be strings). In order to manipulate these sequences, we introduce a variable $\bullet$ for a stack. By means of this variable, string substitutions are defined. In particular, our operations consist in adding something at the end or the beginning of the sequence or removing it from there.

Definition 2 (Substitution) *Let σ a sequence of morphemes, and let Σ be an attribute value structure. Then $\Sigma\{\textsc{case} : \bullet \cdot \sigma\}$ denotes the result of the following replacement.*

$$
\begin{array}{lll}
\Sigma\{\textsc{case} : \bullet \cdot \sigma\} & := & \Sigma[\textsc{case} : \bullet \cdot \sigma] \\
(\beta/\gamma)\{\textsc{case} : \bullet \cdot \sigma\} & := & (\beta\{\textsc{case} : \bullet \cdot \sigma\})/\gamma \\
(\gamma[\textsc{case} : \bullet \cdot \sigma]\backslash\beta)\{\textsc{case} : \bullet \cdot \sigma\} & := & \gamma[\textsc{case} : \bullet \cdot \sigma]\backslash(\beta\{\textsc{case} : \bullet \cdot \sigma\})
\end{array} \tag{20}
$$

Dually, $\Sigma\{\textsc{case} : \sigma \cdot \bullet\}$ is defined:

$$
\begin{array}{lll}
\Sigma\{\textsc{case} : \sigma \cdot \bullet\} & := & \Sigma[\textsc{case} : \sigma \cdot \bullet] \\
(\beta[\textsc{case} : \bullet \cdot \sigma]/\gamma)\{\textsc{case} : \sigma \cdot \bullet\} & := & (\beta\{\textsc{case} : \sigma \cdot \bullet\})/\gamma \\
(\gamma[\textsc{case} : \bullet \cdot \sigma]\backslash\beta)\{\textsc{case} : \sigma \cdot \bullet\} & := & \gamma\backslash(\beta\{\textsc{case} : \sigma \cdot \bullet\})
\end{array} \tag{21}
$$

(I obliterate the distinction between head substitution and full substitution, made in [Kracht, 2003].) These replacement operations are different from unification, since they operate in a specific way on sequences. Now consider the following mode:

Definition 3 (Stacking Mode) *The operation $\circledS$ is defined as follows.*

$$
\begin{array}{lll}
\langle E, \alpha, M\rangle \mathbin{\circledS} \langle E', \beta\backslash\gamma, M'\rangle & := & \langle E^\frown E', \alpha[\textsc{case} : \bullet^\frown E'], M\rangle \\
\langle E', \gamma/\beta, M'\rangle \mathbin{\circledS} \langle E, \alpha, M\rangle & := & \langle E'^\frown E, \alpha[\textsc{case} : \bullet^\frown E'], M\rangle
\end{array} \tag{22}
$$

Otherwise, $\sigma \mathbin{\circledS} \sigma'$ is undefined.

The combination rules are quite free as they stand. We assume however that morphological considerations restrict the applicability of these rules. Here are instances from Hungarian.

$$
\begin{array}{lll}
\textsc{on} & = & \langle /\mathtt{r}/, DP\backslash LP, \mathsf{on}'\rangle \\
\textsc{in} & = & \langle /\mathtt{b}/, DP\backslash LP, \mathsf{in}'\rangle \\
\textsc{at} & = & \langle /\mathtt{t}/, DP\backslash LP, \mathsf{at}'\rangle \\
\textsc{cof} & = & \langle /\mathtt{V\#}/, LP\backslash ADVP, \mathsf{to}'\rangle \\
\textsc{stat} & = & \langle /\mathtt{Vn\#}/, LP\backslash ADVP, \mathsf{stay}'\rangle \\
\textsc{coi} & = & \langle /\mathtt{\acute{V}l\#}/, LP\backslash ADVP, \mathsf{from}'\rangle
\end{array} \tag{23}
$$

This generates on the one hand case marking postpositions and on the other case suffixes in the appropriate way. For example, the illative case marked DP `hajóra`

is generated as follows.

$$
\begin{array}{lll}
 & (\textsc{hajó} \mathbin{Ⓢ} \textsc{on}) \mathbin{Ⓢ} \textsc{cof} & \\
= & (\langle /\texttt{hajó}/, DP[\textsc{case} : \varepsilon], \mathsf{ship}' \rangle \mathbin{Ⓢ} \langle /\texttt{r}/, DP\backslash LP, \mathsf{on}' \rangle) & \\
 & \qquad \mathbin{Ⓢ} \langle /\texttt{V\#}/, LP\backslash ADVP, \mathsf{to}' \rangle & (24) \\
= & \langle /\texttt{hajór}/, DP[\textsc{case} : /\texttt{r}/], \mathsf{ship}' \rangle \mathbin{Ⓢ} \langle /\texttt{V\#}/, LP\backslash ADVP, \mathsf{to}' \rangle & \\
= & \langle /\texttt{hajóra}/, DP[\textsc{case} : /\texttt{r}/ \cdot /\texttt{V\#}/], \mathsf{ship}' \rangle &
\end{array}
$$

Notice that there is no allative case marker */tV#/; rather, the allative is marked by /hoz/. So, we have /t/$^\frown$/V#/ = /hoz#/. This must be handled by the string functions.

Finally, we can now also generate the intermediate example, namely the cofinalis.

$$
\begin{array}{lll}
 & (\textsc{hajó} \circ \textsc{on}) \mathbin{Ⓢ} \textsc{cof} & \\
= & (\langle /\texttt{hajó}/, DP[\textsc{case} : \varepsilon], \mathsf{ship}' \rangle \circ \langle /\texttt{r}/, DP\backslash LP, \mathsf{on}' \rangle) & \\
 & \qquad \mathbin{Ⓢ} \langle /\texttt{V\#}/, LP\backslash ADVP, \mathsf{to}' \rangle & (25) \\
= & \langle /\texttt{hajór}/, DP[\textsc{case} : \varepsilon], \mathsf{on}'(\mathsf{ship}') \rangle \mathbin{Ⓢ} \langle /\texttt{V\#}/, LP\backslash ADVP, \mathsf{to}' \rangle & \\
= & \langle /\texttt{hajóra}/, DP[\textsc{case} : /\texttt{V\#}/], \mathsf{on}'(\mathsf{ship}') \rangle &
\end{array}
$$

Thus, the present proposal captures the facts of Hungarian cases quite adequately. However, as we shall show in the next section, even this is not enough when we want to analyse the data of Finnish. The problem lies, curiously enough, in the DP internal case agreement. For Finnish, we must propose that in addition to stacking there is also unstacking. This mode takes the last member of the case sequence and converts it into the real case sign that it once was and enters it into the structure. I will not go into the details of why it is needed (see [Kracht, 2003]). Rather, let me point out that [Niikanne, 1993] once made a proposal to the effect that all local cases in Finnish are structural and that the local cases are selected by a specific preposition. For example, the allative case is a structural case and is selected by an empty preposition $\varnothing_{\text{ALL}}$. Niikanne saw this as a counterproposal to the theory that local cases are not structural. His stance at the matter is that they are *always* structural. We make no such commitment. The dichotomy structural/nonstructural does not even arise in the present connection. Also, if it were, it would not be tied to a particular case qua morphological affix, but rather only to a particular case qua member of the case stack. Thus, whether or not an occurrence of accusative is structural or not would at best depend on the context. Our theory here is the simplest possible since it also reveals what the empty prepositions of Niikanne's actually are: they are the case signs themselves, unstacked.

We propose a new mode of composition, ®:

(26) $$\begin{aligned}&\langle E^\frown E', \alpha[\textsc{case} : E'^\frown \bullet], M\rangle \circledR \langle E', \alpha\backslash\beta, M'\rangle\\ &\quad := \quad \langle E^\frown E', \beta[\textsc{case} : \bullet], M'(M)\rangle\end{aligned}$$

We assume also the following the dual law

(27) $$\begin{aligned}&\langle E', \beta/\alpha, M'\rangle \circledR \langle E'^\frown E, \alpha[\textsc{case} : E'^\frown \bullet], M\rangle\\ &\quad = \quad \langle E^\frown E', \beta[\textsc{case} : \bullet], M'(M)\rangle\end{aligned}$$

In this way, the meaning of the morpheme ON can be recovered even if it has functioned earlier only as a case marker. We shall analyse in detail the composition of the phrase

(28) `isolta laivalta` ('from the big ship')

Here are the relevant signs.

(29) $$\begin{aligned}\textsc{laiva} &= \langle /\texttt{laiva}/, N[\textsc{case} : \varepsilon], \mathsf{ship}'\rangle\\ \textsc{iso} &= \langle /\texttt{iso}/, N[\textsc{case} : \varepsilon]/N[\textsc{case} : \varepsilon], \mathsf{big}'\rangle\\ \textsc{on} &= \langle /\texttt{l}/, N\backslash LP, \mathsf{on}'\rangle\\ \textsc{coi} &= \langle /\texttt{ta}/, LP\backslash ADVP, \mathsf{from}'\rangle\end{aligned}$$

Here are three possible analyses of (28).

(30) $((\textsc{iso} \circledS \textsc{on}) \circledS \textsc{coi}) \circ (((\textsc{laiva} \circledS \textsc{on}) \circledS \textsc{coi}))$

(31) $((\textsc{iso} \circledS \textsc{on}) \circledS \textsc{coi}) \circ (((\textsc{laiva} \circledS \textsc{on}) \circledS \textsc{coi})) \circledR \textsc{on}$

(32) $((\textsc{iso} \circledS \textsc{on}) \circledS \textsc{coi}) \circ (((\textsc{laiva} \circledS \textsc{on}) \circledS \textsc{coi})) \circledR \textsc{on} \circledR \textsc{coi}$

We then get after some calculations:

(33) $(\textsc{iso} \circledS \textsc{on}) \circledS \textsc{coi} =$
$\langle /\texttt{isolta}/, N[\textsc{case} : /\texttt{l}/ \cdot /\texttt{ta}/]/N[\textsc{case} : /\texttt{l}/ \cdot /\texttt{ta}/], \mathsf{big}'\rangle$

Notice the way the substitution works here to distribute the case marker to both sides of the slash in the adjective. Further,

(34) $(\textsc{laiva} \circledS \textsc{on}) \circledS \textsc{coi} = \langle /\texttt{laivalta}/, N[\textsc{case} : /\texttt{l}/ \cdot /\texttt{ta}/], \mathsf{ship}'\rangle$

If we compose these two we get the sign of (30):

(35) $\langle /\texttt{isolta laivalta}/, N[\textsc{case} : /\texttt{l}/ \cdot /\texttt{ta}/], \mathsf{big}'(\mathsf{ship}')\rangle$

Finally, we compose with ON using the mode ® and obtain the sign for (31):

(36) $\langle$/isolta laivalta/, *LP* [CASE : /ta/] , on′(big′(ship′))$\rangle$

as required. It is possible to apply ® again (this time with COI) and get the sign for (32).

(37) $\langle$/isolta laivalta/, *ADVP* [CASE : ε] , from′(on′(big′(ship′)))$\rangle$

(35), (36) and (37) represent exactly the observed signs in Finnish.

5 Space in Uralic Languages

In this section I collect some special facets of Uralic languages as far as I have become aware of them. They may or may not be truly special to Uralic languages; my limited knowledge of other languages (except for some Indo-European languages) forbids me to make universal claims. Rather, I'd like to suggest that the observed facts below can and should be integrated into the theory outlined above.

Uralic languages express location or space using the following:

① verbs of motion,

② adverbs,

③ spatial demonstratives and question words,

④ local adpositions,

⑤ local cases,

⑥ verbal prefixes.

Most languages share one or the other of these categories. Across languages we do tend to find verbs of motion, adverbs (or location and motion), spatial demonstratives and question words, and adpositions. Some languages, in particular Uto-Aztecan have verbs of location, which express the location rather than motion. Many languages do have one or two local cases; it is rare for languages to have as many as Finnish and Hungarian (a notable exception is formed by the Caucasian languages). Verbal prefixes are not uncommon in other languages. Notice that

local adjectives are not as common as local adverbs, but they do exist (for example, horizontal). On the positioning of local expressions as well as the wider context of what counts as 'local' see also [Rijkhoff, 2002] and references therein.

The previous discussion has revealed that the cases and adpositions provide means for systematic transition between the classes. Cases can transform an entity denoting expression (DP) into a location denoting expression (LP) or an adverbial (ADVP). Moreover, a single case can do all of the three, depending on context. I now turn to discuss certain special aspects of the Uralic languages.

5.1 More Cases in the Nominal Paradigm

It is interesting to look at question words for locations. In Finnish, they are formed from the word /mitä/ 'what'. Interestingly, what you get is

(38)

missä	mistä	mihin
where-INE	where-ELA	where-ILL
where	*wherefrom*	*whereto*
*millä	*miltä	*mille

This means that /mitä/ reduces in the inner locative cases to a question word for locations. In Hungarian, by contrast, we not only have all nine local cases of /mi/, but none of them can be used to ask for locations as such. For that, there is a series of three words, hol, hova and honnan.

Finnish therefore must be assumed to have not six, but actually 9 local cases. Similarly, Hungarian will have 12 in place of 9. The missing three are the *stativus*, *cofinalis* and the *coinitialis*. One should not think of the cases as forming a hierarchy. The allative is not a special kind of cofinalis. The cofinalis is a case for locations, the allative for things. Therefore there is no talk of a type hierarchy whatsoever. It might be a little funny to think that there are cases which are specialized to certain semantic types. But there are plenty of examples of this kind. For example, there is a morphological case in Hungarian, which is reserved for times: nap-onta means *every day*. Here the case suffix is onta.[6] The Finnish essive and translative are reserved to properties. And so on. The notion of semantically restricted cases is therefore far from dubious.

[6]However, by our definition, the suffix /onta/ does not form a syntactic case in Hungarian. The reason is that there is to our knowledge no verb selecting this particular element. It always enters with its full meaning and in free competition with other temporal adverbials denoting time points.

5.2 Using the Right Locator

Eexpressing location is not only a matter of choosing the right kind of relation. Consider a place like a garden or a street. There is a normal way of being in the location associated with these objects. The normal way of being in the location associated with the garden is expressed by saying: `in the garden`. However, we would rather say `on the street`, and `on board the airplane`. Deviating from these expressions serves to express a non-normal way of being there (`in the ship`, `above the garden`). But, more specifically, there is often not much sense in making certain distinctions in the first place. For example, there is not much sense to distinguish to be *in* a city from being *on* a city. Such differences could be motivated from differences in the way the city is conceptualised (whether, for example, it is a burrough, or whether it is elevated, and so on). Independently from the motivation, however, Hungarian allows to say only `Szgeden` 'in Szeged' and `Berlinben` 'in Berlin'. Moreover, remnants of an ancient locative are found in `Kolozsvárott` 'in Kolozsvár'. Similarly, Finnish requires to say `Tamperella` 'in Tampere' but `Helsingissä` 'in Helsinki'. These expressions are fixed; similarly, in Hungarian one is required to say `az esküvőn` 'at the wedding' but `a lakodalomban` 'idem'. The conditions that determine the choice of cases here are—I speculate—phonological. There is no inherent semantic reason why one should be used rather than the other. There is, as far as I can see, no meaning distinction between, in this case, the inessive and the superessive.

A similar case is provided by the contrast between `iskolába járni` 'to go to school' versus `egyetemre járni` 'to go to university'. The motivating factor is here that the concrete meaning difference between 'at', 'on' and 'in' in Hungarian, and 'at' and 'in' in Finnish makes no sense for abstract institutions. There are two solutions that languages can adopt: one is to fix a particular preposition or case to be used in all examples, and the other is to arbitrarily regulate the use of the preposition or case on an individual basis. These are, in general, only tendencies. Languages must be prepared for the unkown, so default rules will normally exist no matter whether there are many individual patterns. For example, cities go with the inessive (illative, elative) by default in Hungarian. But other than that they can decide to depart in one or the other way from the default. Often, a motivating fact exists, but over time it inevitably gets lost, creating the appearance of arbitrariness.

5.3 Directionality in Finnish

Directionals in Finnish have been the object of study in [Fong, 1997]. Fong concludes on the basis of verbs such as `jäädä` 'to remain', `unohtaa` 'to forget' and many others that the Finnish directionals do not convey actual movement but only that the event in question has two phases—whatever they may be.

(39) `Pekka unohti kirjan autoonsa.`
Pekka forgot the book in (lit. into) the car.

(40) `Kirja jäi autoon.`
The book remained in (lit. into) the car.

This analysis faces a number of problems. First, saying that the meaning of a directional is simply 'there are two phases in the event' obliterates the difference between illative, stative and elative. How do we, for example, guarantee that

(41) `Pekka meni huoneeseen.`
Pekka went into the room.

does not mean that Pekka left the room (or even: remained in it)? Second, the meaning of 'to remain' in English is a static event, it does not even have two phases.

I proposed a different solution in [Kracht, 2006a] (which is in fact implicit in the approach outlined above). The idea is basically that the verbs above do not select the illative but rather only cofinalis. This means that they are compatible with the allative. They can even be used with a PP as long as it is in the cofinalis. The merit of this approach is that the selectional properties transfer also to other domains. The verbs `jäädä` and `pysyä` can be used in connection with possession and in predication. In all these cases it turns out that `jäädä` wants a directional (`Talo jäi minulle.` 'The house remained mine.' versus `Talo pysyi minulla.`; and `Isä jäi saairaksi.` 'Father remained sick.' vs. `Isä pysyi saairana.`). All that needs to be assumed is that the verbs allow to be used in terms of possession and predication.

5.4 The Lative

There is an interesting case, where on the one hand the sentence predicates movement but on the other hand the associated phasal is static (this is sometimes re-

ferred to as the *prolative*):

(42) `John is walking on the roof.`

There is no contradiction: John is moving, but at the same time his relation with respect to the landmark (the roof) does not change; he is not going onto it nor is he jumping off. As we can see, English (and German, as far as I checked) require the use of the static phasal. Intuitively, there is a further distinction that we can make, namely between no change in the local relation and no movement at all. Another case is provided by

(43) `The ink is spreading on the paper.`

seems to me that one of the uses of directional cases is actually to denote *change* rather than change of location.

In a series of paper, Alhoniemi has expounded the use of the directionals in Mari, see [Alhoniemi, 1967; Alhoniemi, 1968; Alhoniemi, 1970]. He uses the term 'wohin-Kasus' ('whereto'-case) to refer to cases containing a cofinal phasal, since they answer to the question 'whereto'. He classes the lative as such a case. [Fong, 1997] has claimed for Finnish that directionals tend to have a rather reduced meaning, namely that the verb denotes a diphasic event. While I have criticised this theory for being underexplanatory (see [Kracht, 2002]), there is a need for an explanation of this sort when it comes to Mari. On the one hand, in 'neutral' contexts we have cases that denote a direction. Yet there are numerous exceptions to this rule. One peculiar expection is in connection with eating. Verbs of eating and drinking require the directionals (as if to say one is eating the food out of the kitchen, for example). In this connection it seems that rather than predicating a direction, here the emphasises is on the fact that the verb expresses a *change* without there necessarily being an accompanying change of location. Another point concerns the paper [Alhoniemi, 1970], where Alhoniemi points out that the directionals can be used to express the means. Later he describes the difference as follows:

> Der Illativ zeigt im Tscher[emissischen] den Ort an, wohin irgendetwas kommt oder befördert wird, und zwar von irgendwoher außerhalb des durch den Wohin-Kasus ausgedrückten Ortes. So steht der Illativ z. B. bei den Verben des Laufens, Bringens, Holens, Werfens, usw. Der Lativ dagegen drückt den Ort aus, wohin zwar etwas Neues kommt, aber ohne daß daran gedacht würde, daß dieses

> Neue eigentlich anderswoher an diesen Ort käme. Z. B. Verben, die Geborenwerden, Sichsetzen, Bauen, Ergreifen oder Töten bedeuten, werden mit dem Lativ angewandt.
>
> *In Cheremiss, the illative shows the place where something is coming to or is being transported, and it is getting there from outside the place specified by the place expressed by the whereto-case. For example, the illative is used with verbs of running, bringing, getting, throwing, etc. The lative on the other hand expresses the place where something new is coming without the thought that it came there from somewhere else. For example, verbs expressing being born, sitting down, building, catching or killing are used with the lative.*

Alhoniemi continues to note that the Illative cannot be used to express the means, only the Lative. The conclusion that I draw from this is the following: the lative actually expresses no motion at all, only change. This ties in with the fact that it can be used as a means. Notice that many language like to group the means with the sociative ('with'), but there is a natural oscillation between expressing it using a locative. [Alhoniemi, 1970] gives among other these examples (the lative has in both cases the ending `eš`):

(44) `imńieš kejät`
They are going on horseback.

(45) `pum traktôreš kantat`
They are carrying wood with a tractor.

In German, you may express (45) as follows:

(46) `Sie brachten das Holz auf dem Traktor.`
They carried the wood on the tractor.

The difference is that (46) literally only says that the wood is on the tractor, but the idea that the tractor is the means of getting the wood somewhere else is clearly present. (Alhoniemi himself quotes such a case where the common translation of the lative used to be "into", while he claims it to be rather "with".) It is only a short step to claim that also the sociative in essence derives from a location (as the possessive is often expressed by a locational). Thus, the original locative meaning gave rise to an instrumental reading. Though, as I have emphasised, there is with respect to the lative, no idea of change of location; it is not a genuine whereto-case, even though it historically might have been.

In a reply to [Alhoniemi, 1970], János Gulya quotes the following uses of the Ostyak lative:

(47) lŏg kata mənwəl
He goes into the house.

(48) lög jenkəs kölas
He drowned in the water.

(49) lŏg juga mənəs
He went to get wood.

This shows that the lative of Ostyak allows similar use of the lative as does Mari. Ostyak shares with Finnish and Mari the peculiar use of the lative with internal change, as in (48). (49) is an interesting case which is paralelled by dialectal expressions in German (in die Pilze gehen (lit. 'to go into the mushrooms') 'to go to search for mushrooms'), where the goal is inferred from the location where you are going.

6 Conclusion

In this paper I have studied the way space enters into language. My particular focus were the Uralic languages, which offer quite a different aspect on space than Indo-European languages. Although space does not figure in the definition of major classes, it is a major force to be reckoned with. One of the most intricate aspects is the layering of PPs (or locative cases) into several heads, a fact that has repercussions in syntactic theory.

References

[Alhoniemi, 1967] Alho Alhoniemi. *Über die Funktion des Wohin–Kasus im Tscheremissischen*. Number 142 in Suomalais–Ugrilaisen Seuran Toimituksia. Suomalais–Ugrilainen Seura, Helsinki, 1967.

[Alhoniemi, 1968] Alho Alhoniemi. Suomen ja tšeremissin kielen suuntaijärjestelmien funktionaalisesta rakenteestä. (The functional structure of the direction–case systems in Finnish and Cheremis.) Finnish with English summary. *Sananjalka*, 10:66–77, 1968.

[Alhoniemi, 1970] Alho Alhoniemi. Zur Ausdrucksweise des Mittels durch die Wohin-Kasus im Tscheremissischen. In Wolfgang Schlachter, editor, *Symposium über Syntax der uralischen Sprachen*, number 76 in Abhandlungen der Akademie der Wissenschaften in Göttingen, pages 11–22. Vandenhoek Ruprecht, 1970.

[Alhoniemi, 1975] Alho Alhoniemi. Erästä suomen kielen paikallisijojen keskeisistä käyttötavoista. (On some characteristic usages of Finnish local cases). Finnish with German summary. *Sananjalka*, 17:5–24, 1975.

[Baker, 2005] Mark C. Baker. *Lexical Categories*. Cambridge University Press, 2005.

[Caponigro and Pearl, 2006] Ivano Caponigro and Lisa Pearl. Silent (spatial) prepositions: Evidence from free relatives. Handout for "Syntax and Semantics of Spatial P", 2006.

[Clark, 1970] Eve V. Clark. Locationals: a study of the relation between “existential”, “locational”, and “possessive”. (3), 1970.

[Cook, 2002] Kenneth W. Cook. The case markings of Hawaiian locative nouns and place names. In Giovanni Bennardo, editor, *Representing Space in Oceania*, pages 91–104. ANU Press, Canberra, 2002.

[Fong, 1997] Vivienne Fong. *The Order of Things: What Directional Locatives Denote*. PhD thesis, Stanford University, 1997.

[Kracht, 2002] Marcus Kracht. On the semantics of locatives. *Linguistics and Philosophy*, 25:157–232, 2002.

[Kracht, 2003] Marcus Kracht. Against the Feature Bundle Theory of Case. In Ellen Brandner and Heike Zinsmeister, editors, *New Perspectives on Case*. CSLI, 2003.

[Kracht, 2006a] Marcus Kracht. Directionality selection. In Patrick Saint-Dizier, editor, *Linguistic Dimensions of Prepositions*, pages 101–114. Springer, 2006.

[Kracht, 2006b] Marcus Kracht. The Fine Structure of Local Expressions. manuscript, 2006.

[Niikanne, 1993] Urpo Niikanne. On assigning semantic cases in finnish. In Holmberg and Niikanne, editors, *Case and Other Semantic Categories in Finnish Syntax*. Mouton de Gruyter, Berlin, 1993.

[Rijkhoff, 2002] Jan Rijkhoff. *The Noun Phrase*. Oxford Studies in Typology and Linguistic Theory. Oxford University Press, 2002.

[Steedman, 1990] Mark Steedman. Gapping as Constituent Coordination. *Linguistics and Philosophy*, 13:207 – 263, 1990.

[van Leeuwen, 1991] Jacques van Leeuwen. *Individuals and Sortal Concepts. An Essay in Logical Metaphysics*. PhD thesis, University of Amsterdam, 1991.