

# THE ASSESSMENT OF SEMANTIC CASES USING ENGLISH POSITIONAL, PREPOSITIONAL AND ADVERBIAL CASE MARKERS

KEN BARKER

Department of Computer Science, University of Ottawa  
Ottawa, Ontario, Canada K1N 6N5  
kbarker@csi.uottawa.ca

## ABSTRACT

Semantic analysis of text is often based on semantic roles drawn from a small, closed set. The set of roles describing relationships between a verb and its arguments within a clause are cases. This report assesses the cases used in the TANKA project (Text ANALYSIS for Knowledge Acquisition) according to the distribution of the words and syntactic constituents that mark them. The definitions of TANKA's cases, the number of instances of each case in a test text and numerous English example sentences and counterexamples are also used in the assessment. Results show that TANKA's cases are supported by the marker data.

## 1 *Background*

The aim of the TANKA project is to acquire knowledge from unedited English technical text using a minimum of pre-coded semantic information. To realize this goal, semantic analysis in TANKA semi-automatically identifies relationships among the different elements of English sentences—clauses, verbs, verb arguments, noun phrases—found in parse trees produced by the DIPETT parser (Delisle 1994). The HAIKU semantic analyzer determines which pairs of elements are involved in relationships, based on the presence of particular words and syntactic constituents. There are three kinds of relationship in this framework: clause-level relationships (between two or more clauses); case relationships (between a verb and its arguments) and noun-modifier relationships (between a noun and its modifiers). A more detailed discussion of the semantic relationships in TANKA appears in Delisle *et al.* (1996). The work described in this report deals only with case relationships.

A case is a generalization from a particular verb-argument pair to one of a finite set of semantic role labels. The cases used in TANKA are listed in section 3 and defined in Appendix III. A case marker is a lexical or syntactic element that indicates the presence of a case. Detailed discussions of case theory and case markers can be found in Fillmore (1968), Bruce (1975), Somers (1987) and Palmer (1990).

The purpose of this report is to use the distribution of case markers among TANKA's case set to support the inclusion of individual cases in the set. Instances of the cases in an English text will also be considered to determine if there is any empirical support for the inclusion of cases that are relatively weakly represented by the markers.

## 2 The Case Markers

We distinguish three types of case marker: positional, prepositional and adverbial. The positional markers are the syntactic subject (psubj), direct object (pobj) and indirect object (piobj) of the verb. These syntactic positions often mark cases such as Agent, Beneficiary, Experiencer, Object and Recipient. The constituents in these positions fill the cases marked by the position itself.

A prepositional phrase consists of a preposition and a noun phrase complement. The preposition expresses a relationship between its complement and some other constituent in a sentence (see Quirk *et al.* 1985, section 9.1). A preposition expressing a relationship between its complement and a verb marks a case. We say the prepositional phrase is attached to the verb and the prepositional complement is the case filler. A preposition expressing a relationship between its complement and some other noun phrase does not mark a case. The complement is instead considered a modifier of the other noun phrase and is not analyzed as a case but as a noun-modifier relationship.

In sentence 1, the prepositional phrase *on the printer* is attached to the verb *printed*. The noun phrase *the printer* fills the Instrument case. In sentence 2, the prepositional phrase *on the printer on his desk* is also attached to the verb *printed*. The noun phrase *the printer on his desk* fills the Instrument case. However, the prepositional phrase *on his desk* is attached to the noun *printer* as a post-modifier and does not fill a case of the verb *printed*.

*Wilma printed the paper [on [the printer np] pp].* (1)

*Fred printed the paper [on [the printer [on his desk pp] np] pp].* (2)

The exact same semantic relationships expressed by prepositional markers can usually be marked by adverbials. In sentence 3, *at* marks and *the same time* fills the TimeAt case; in the paraphrase in sentence 4, *simultaneously* is in the same relationship with *occurred* and must express the same case.

*The two events occurred [at the same time pp].* (3)

*The two events occurred [simultaneously adv].* (4)

The adverbials' capacity to denote the circumstances of acts in the same way as prepositional phrases leads us to consider adverbials as case markers as well. Adverbial case markers both mark a case and fill it.

## 3 The Cases

The first version of TANKA's case set was constructed from several previously published case lists. We then compiled a comprehensive list of case markers from a thorough search of electronic and conventional dictionaries which identified the prepositional and adverbial case markers. Entries list the cases that each marker can realize along with an example sentence for each usage. The marker list without the example sentences appears in Appendices I and II.

The cases appear in Table 1 in five groups. Definitions of the cases appear in Appendix III along with sentences chosen to reflect typical usage or to illustrate the scope of each case. The PARTICIPANT group consists of cases whose entities are directly involved in the act. The CAUSALITY group includes relationships with entities enabling or opposing the act.

Under SPACE and TIME we group relationships that place the act at an absolute or relative position in space or time. Finally, QUALITY groups the remaining cases that represent various other relationships between a verb and its arguments. In a text, during TANKA's operation we expect a much higher probability of having to choose between cases appearing in the same group than cases appearing in different groups. This expectation was confirmed in the experiment summarized in Barker & Delisle (1996).

<i>PARTICIPANT</i>			
Accompaniment	ACMP	Experiencer	EXPR
Agent	AGT	Instrument	INST
Beneficiary	BENF	Object	OBJ
Exclusion	EXCL	Recipient	RECP
<i>CAUSALITY</i>			
Cause	CAUS	Opposition	OPP
Effect	EFF	Purpose	PURP
<i>SPACE</i>			
Direction	DIR	LocationThrough	LTRU
LocationAt	LAT	LocationTo	LTO
LocationFrom	LFRM	Orientation	ORNT
<i>TIME</i>			
Frequency	FREQ	TimeThrough	TTRU
TimeAt	TAT	TimeTo	TTO
TimeFrom	TFRM		
<i>QUALITY</i>			
Content	CONT	Measure	MEAS
Manner	MANR	Order	ORD
Material	MATR		

Table 1. List of TANKA's cases (with abbreviations)

## 4 Case Assessment

### 4.1 The Case Marker Data

Table 2 shows the number of markers marking each case. The *Preps/Pos* column is the number of prepositional or positional markers marking each case along with the percentage of total prepositional and positional marker→case mappings this number represents. For example, 8 prepositions mark the Accompaniment case; and 8 is 3.3% of all prepositional or positional marker→case mappings in the marker list. The *Adverbs* column is the number of adverbial markers and the *Total* column is the total number of markers for each case. The bottom row of the table shows the total number of marker→case mappings in the marker list.

	<i>Markers</i>					
	<i>Preps/Pos</i>		<i>Adverbs</i>		<i>Total</i>	
Accompaniment	8	3.3%	4	1.6%	12	2.4%
Agent	2	0.8%	0	0.0%	2	0.4%
Beneficiary	4	1.6%	0	0.0%	4	0.8%
Exclusion	19	7.7%	2	0.8%	21	4.2%
Experiencer	2	0.8%	0	0.0%	2	0.4%
Instrument	9	3.7%	1	0.4%	10	2.0%
Object	3	1.2%	0	0.0%	3	0.6%
Recipient	5	2.0%	0	0.0%	5	1.0%
Cause	12	4.9%	0	0.0%	12	2.4%
Effect	3	1.2%	0	0.0%	3	0.6%
Opposition	6	2.4%	2	0.8%	8	1.6%
Purpose	10	4.1%	0	0.0%	10	2.0%
Direction	22	8.9%	51	20.0%	73	14.6%
LocationAt	47	19.1%	53	20.8%	100	20.0%
LocationFrom	3	1.2%	5	2.0%	8	1.6%
LocationThrough	11	4.5%	2	0.8%	13	2.6%
LocationTo	4	1.6%	4	1.6%	8	1.6%
Orientation	1	0.4%	13	5.1%	14	2.8%
Frequency	1	0.4%	47	18.4%	48	9.6%
TimeAt	16	6.5%	39	15.3%	55	11.0%
TimeFrom	4	1.6%	6	2.4%	10	2.0%
TimeThrough	9	3.7%	7	2.7%	16	3.2%
TimeTo	4	1.6%	3	1.2%	7	1.4%
Content	9	3.7%	0	0.0%	9	1.8%
Manner	9	3.7%	5	2.0%	14	2.8%
Material	5	2.0%	0	0.0%	5	1.0%
Measure	11	4.5%	4	1.6%	15	3.0%
Order	7	2.8%	7	2.7%	14	2.8%
	246		255		501	

Table 2. Distribution of the case marker mappings

## 4.2 Interpreting the Case Marker Data

When building the case set, we included a case based on the existence of a single marker marking it. However, if the number of markers marking a case is below average, that case may be unnecessary for analyzing texts; a case with markers numbering above the average may be crude. It may be possible to improve the case set by combining two cases weakly represented by the markers into a more general case; and it may be possible to split well represented cases into several more specific cases.

For each case, the value in the *Total Markers* column of Table 2 will determine if the case is overrepresented or underrepresented. Underrepresented cases will be considered potentially

over specific and candidates for combination. Overrepresented cases will be considered potentially over general and candidates for splitting.

Table 3 shows the number of times each case was assigned during case analysis of the *Junior Science Book of Rain, Hail, Sleet & Snow* (Larrick, 1961)<sup>1</sup> and the percentage this number represents among all cases assigned during that analysis. The 965 case instances appeared in 439 clauses in that text. The frequency of occurrence in the test text will be used to support or detract from the marker data: a case weakly represented by markers that occurs frequently in practice merits inclusion in the set. Finally, the case definitions in Appendix III will be consulted when looking for appropriate cases for combination with a potentially over specific case.

	<i>Instances</i>			<i>Instances</i>	
Accompaniment	2	0.2%	LocationThrough	17	1.8%
Agent	251	26.0%	LocationTo	26	2.7%
Beneficiary	1	0.1%	Orientation	1	0.1%
Exclusion	2	0.2%	Frequency	27	2.8%
Experiencer	123	12.7%	TimeAt	30	3.1%
Instrument	7	0.7%	TimeFrom	0	0.0%
Object	239	24.8%	TimeThrough	16	1.7%
Recipient	14	1.5%	TimeTo	0	0.0%
Cause	7	0.7%	Content	9	0.9%
Effect	20	2.1%	Manner	42	4.4%
Opposition	0	0.0%	Material	4	0.4%
Purpose	2	0.2%	Measure	23	2.4%
Direction	25	2.6%	Order	0	0.0%
LocationAt	55	5.7%			
LocationFrom	22	2.3%	<i>total instances</i>	965	

Table 3. Instances of each case in the test text

### A note on the use of the test text

A single text is not sufficient to conclude that a given case appears either commonly or rarely in practice. However, the fact that a case appears frequently even in one text suggests that low marker representation does not imply over specificity for that case. Cases marked by only one or two markers may be very common in texts if those markers appear commonly, as do for example the positional markers.

<sup>1</sup> The cases have been used in the semi-automatic analysis of several texts over many years. The text referred to in table 3 was analyzed in an experiment reported in Barker & Delisle (1996). A discussion of the cases that did not appear at all in the test text also appears in that report.

## A note on combining cases

Three restrictions govern the combination of pairs of cases:

1. *Both cases must be potentially over specific before combination*: combining a potentially over specific case with a potentially over general case will only exacerbate the second case's problem of over generality
2. *Candidate cases for combination must share some semantic property*: the combined case must be an obvious semantic generalization of each of the original cases; cases with completely distinct meanings must not be combined merely for the sake of increasing their marker representation.
3. *The two cases must be in complementary distribution in the language*: case theory requires that no case appear more than once in a given clause; a sentence containing both of the candidates for combination in the same clause is a counterexample that rules out the combination of those two cases.

### 4.3 The Evaluation of TANKA's Cases

**Accompaniment** is potentially over specific. Semantically, the potential partners for combination are Agent, Beneficiary, Experiencer, Instrument, Object and Recipient. However, it is a simple task to compose sentences containing Accompaniment and any one of the six other cases.

*[You AGT] can add [spice OBJ] [to the soup ACMP] [for Betty BENF]  
[with your fingers INST].* (5)

**Agent** is very weakly represented by the markers. However, it was also the most commonly assigned case in the test text and is therefore unlikely to be over specific. Moreover, if Agent were to be combined with another case to form a more general case, it could only be combined with Experiencer—all other cases commonly appear in the same sentence as Agent. Combining it with Experiencer would not significantly raise the marker representation, though the frequency of assignment in the test text would be much higher still. It is also possible that Agent is too general. But given that the definition of Agent is already restricted to sentient entities that intentionally perform acts, it would be difficult to split Agent on semantic grounds.

**Beneficiary** is potentially over specific. The only other potentially over specific case that could be combined with it is Recipient. However, clauses containing both cases are easy to construct.

*I sent a letter of reference [to the human resource manager RECP]  
[for my colleague BENF]* (6)

Such examples show that in some circumstances a combined Recipient-Beneficiary case would need to be assigned to two arguments playing different roles within the same clause. Not only would such an assignment violate case theory's one role per argument rule, it would obscure a significant distinction between two roles in an act.

**Exclusion** is potentially over general based on its somewhat high marker representation. According to the definition of Exclusion, it could be split into two more specific cases: Excluded-NotSubstituted and Excluded-Substituted. However, to date Exclusion has

appeared rarely in texts. If analysis of more texts shows that Exclusion appears frequently in practice, the suggested split should be considered.

**Experiencer** is weakly represented by the markers. Semantically, the only appropriate candidate case for combination that does not commonly appear in sentences together with an Experiencer is Agent. The Agent-Experiencer combination was discussed under Agent and rejected.

**Instrument** is potentially over specific based on its somewhat low marker representation. The only other potentially over specific case that does not appear commonly with Instrument is Experiencer. However, Experiencer and Instrument have such different semantics that combining them would produce a semantically heterogeneous case.

**Object** is unlikely to be over specific despite its weak marker representation. Like Agent, Object accounted for roughly a quarter of the cases appearing in the test text. Combining Object with another case—even if one were available—would further dilute the information expressed by Object. In fact, Object might already be too general and splitting into more specific cases might be appropriate. Given the homogeneity of its definition and the small number of markers, it is not obvious how Object could be split into more specific cases. One possibility would be to keep different Object cases for different semantic classes of verbs. For example, there could be one Object case for verbs that physically modify their objects, another Object case for verbs that move their objects, etc. However, such a division of the Object case would require a semantic classification of all the English verbs and a mapping from these classifications to the different Object cases. These tasks present difficult knowledge engineering problems. Moreover, the effectiveness of the split would depend on the appropriateness of the verb classifications to a particular domain.

**Recipient** is potentially over specific. Since the Recipient is an entity affected by the act in some way, cases for combination should involve entities also affected by the act. The candidates are Beneficiary and Object. Recipient always appears with Object and therefore cannot be combined with it. The Recipient-Beneficiary combination was discussed under Beneficiary and rejected.

**Cause** is potentially over specific. It could be combined with Agent by ignoring the notion of intent in Agent's definition. However, the definition of Cause covers the role of enablement allowing it to appear in sentences with an Agent:

*[We AGT] acted [on his advice CAUS].* (7)

Combining Cause and Agent would require a new case to cover examples like sentence 7 to account for *on his advice*. This case would be more narrow in coverage than the original Cause.

**Effect** and **Purpose** are potentially over specific based on their weak marker representation. Semantically, these two could only combine with each other. Purpose differs from Effect in that Purpose is the intended though not necessarily occurring result whereas Effect is the occurring though not necessarily intended result. The combined case could be defined as a possible situation resulting from an act—intended or not; realized or not. Whether this more general case would capture useful knowledge from text would be dependent on the application.

**Opposition** is potentially over specific but expresses a unique role that shares no semantics with any other case—with the possible exception of Exclusion. However, sentence 8 includes instances of both Exclusion and Opposition together.

*They went [without me EXCL] [despite my pleas OPP].* (8)

**Direction** is potentially over general. Splitting this case into more specific directions (such as up, down, right, etc.) would probably result in at least six new cases which would almost certainly be too specific. Moreover, a given act only has a single direction, so the new cases would be in complementary distribution in the language, making them good candidates for combining back into a single Direction case.

**LocationAt** is very well represented by the markers, reflecting one of the most common uses of the prepositions: expressing spatial relationships. There are several possibilities for replacing LocationAt with more specific cases. For example, LocationAt could be replaced with LocationAt, LocationInside and LocationOutside. For applications needing subtle distinctions between various Location cases the application itself would probably dictate how LocationAt should be split.

**LocationFrom, LocationThrough, LocationTo** and **Orientation** are all potentially over specific. Semantically, the only candidates for combination with any of these are the spatial cases. Direction and LocationAt are already potentially over general. So these four cases could only be combined with each other. Sentence 9 shows all four cases being used in the same clause.

*My car rolled [backwards ORNT] [from its parking space LFRM]  
[through the lot LTRU] [to the china shop LTO].* (9)

**Frequency** is potentially over general resulting from the productivity of frequency adverbs. Almost any time unit can be made into an adverb marking Frequency: *day*→*daily*, *month*→*monthly*, *sixty years*→*sexagintennially*. There are no good semantic criteria for splitting Frequency into more specific cases.

**TimeAt** is well represented by the markers, reflecting another common use of the prepositions: expressing temporal relationships. Like its spatial counterpart LocationAt, TimeAt could be split in many ways. One possibility would be to split TimeAt into TimeAbsolute and TimeRelative as distinguished in sentences 10 and 11.

*The guests arrived [at eleven o'clock TABS].* (10)

*Barney arrived [after the speeches TREL].* (11)

**TimeFrom, TimeThrough** and **TimeTo** are all potentially over specific. Semantically, the only candidates for combination with any of these are the temporal cases. Frequency and TimeAt are already potentially over general so these three cases could only be combined with each other. Sentence 12 shows all three cases being used in the same clause.

*I will be traveling [for four days TTRU] [from Friday TFRM] [to Monday TTO].* (12)

**Content** and **Material** are potentially over specific. These two cases could only be combined with each other. The resulting case would be somewhat heterogeneous. Furthermore, example sentences containing both Content and Material are possible.

*I made the container [out of hard plastic MATR] [for very hot liquids CONT].* (13)

**Manner** is potentially over specific based on the number of markers reported in Table 2. However, the marker list only contains adverbs marking cases other than or in addition to

Manner. All other adverbs (an open category) are assumed to mark Manner. So Manner is potentially over general, if anything. There are many possibilities for splitting Manner but doing so would not rid the case set of one over general “grab bag” case. Any finite case set allowing an open list of markers will have at least one default case. Admittedly, Manner is our grab bag.

**Measure** is slightly underrepresented by the markers. However, Measure is semantically unique making possible combinations with any other case contrived. The fact that there are as many as 15 markers for Measure and it appeared 23 times in the test text suggests that it is not so specific as to be useless in practice.

**Order** is also slightly underrepresented by the markers. There is no support from the test text to counter the marker data. The only case that would form a natural combination with Order would be LocationAt, which is already potentially over general.

## 5 *Conclusions*

The stated purpose of this report was to enlist the positional, prepositional and adverbial case markers as support for the inclusion of cases in TANKA’s case set. Since the case system was built using the markers as an initial justification for the cases, this effort to validate the cases may seem post hoc. However, the case system was built with just one criterion for inclusion of a case in the set: that it be marked by at least one marker. The degree to which each case was represented by the markers was never considered.

The analysis uncovered only one pair of cases to combine: Effect and Purpose. These two cases were both weakly represented by the markers, they both refer to some possible outcome of an act and no sentence could be found containing both cases. An application with no need to distinguish intended outcome from unintended or realized outcome from unrealized might be better served by a single Effect-Purpose case.

Several possibilities exist for refining general LocationAt and TimeAt cases. For applications sensitive to the subtleties of spatial or temporal phenomena, splitting one or both of these cases might be useful.

The main result from this exercise is that, with few exceptions, cases could not be split or combined with others without violating the restrictions listed in section 4.2. This result shows that there is support from the markers for each of the cases in our set. The appropriateness of the cases for semi-automatic knowledge acquisition remains to be established by applying the case set in the analysis of a large body of text.

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## Appendix I - The Prepositional and Positional Case Markers

<i>aboard</i>	LAT	<i>beside</i>	LAT	<i>in</i>	LAT	<i>outside</i>	LAT	<i>under</i>	LAT
<i>about</i>	CONT	<i>besides</i>	EXCL		LTO	<i>outside_of</i>	EXCL		MANR
	LTRU	<i>between</i>	LAT		TAT	<i>over</i>	DIR		DIR
	LAT		ACMP		TTRU		LAT		MEAS
<i>above</i>	LAT		TAT		CONT		CAUS		ACMP
	DIR	<i>beyond</i>	TTRU		MATR		LTRU	<i>underneath</i>	LAT
<i>across</i>	LAT		LAT		MEAS		INST		DIR
	DIR		MEAS		DIR	<i>past</i>	TTRU		ORD
<i>after</i>	ORD		ORD		FREQ		TAT	<i>unlike</i>	EXCL
	TAT		TTRU		MANR		LAT	<i>until</i>	TTO
	LAT	<i>but</i>	EXCL		PURP		MEAS	<i>unto</i>	RECP
<i>against</i>	OPP	<i>by</i>	AGT		EFF		LTRU		MEAS
	DIR		EXPR	<i>in_front_of</i>	LAT		DIR		PURP
	LAT		CAUS	<i>in_lieu_of</i>	EXCL	<i>pending</i>	TTRU		ACMP
	PURP		MANR	<i>in_spite_of</i>	OPP	<i>piobj</i>	RECP		BENF
<i>ahead_of</i>	LAT		MEAS	<i>inside</i>	LAT		BENF	<i>up</i>	DIR
	ORD		INST		DIR	<i>pobj</i>	OBJ		LTRU
<i>along</i>	LAT		MANR	<i>instead_of</i>	EXCL	<i>respecting</i>	CONT		LAT
	LTRU		LAT	<i>into</i>	TTO	<i>round</i>	LAT	<i>upon</i>	TAT
<i>alongside</i>	LAT		TAT		LTO		LTRU		LAT
<i>amid</i>	LAT		LTRU	<i>in_the_midst_of</i>	DIR	<i>save</i>	EXCL		PURP
<i>amidst</i>	LAT	<i>by_means_of</i>	MANR		LAT	<i>saving</i>	EXCL		CAUS
<i>among</i>	LAT	<i>concerning</i>	CONT		TAT	<i>since</i>	TFRM		INST
	ACMP	<i>considering</i>	OPP		EXCL	<i>psubj</i>	AGT	<i>up_to</i>	TAT
<i>amongst</i>	LAT	<i>despite</i>	OPP		MANR		EXPR	<i>versus</i>	OPP
	ACMP	<i>down</i>	DIR		LAT		INST	<i>via</i>	INST
<i>apart_from</i>	EXCL		LAT		TAT		CAUS		LTRU
<i>around</i>	LTRU	<i>during</i>	TAT		LAT	<i>through</i>	OBJ	<i>with</i>	MATR
<i>as</i>	MANR		TTRU		EXCL		LTRU		ACMP
<i>as_of</i>	TFRM	<i>except</i>	EXCL	<i>notwithstanding</i>	OPP		DIR		TFRM
<i>aside_from</i>	EXCL	<i>except_for</i>	EXCL	<i>of</i>	MATR		INST		MANR
<i>at</i>	DIR	<i>excepting</i>	EXCL		CAUS		TTRU		INST
	LAT	<i>for</i>	LTO		OBJ		CAUS		CONT
	TAT		DIR	<i>off</i>	LAT		EXCL		RECP
	MANR		CONT		LFRM	<i>throughout</i>	LTRU		CAUS
	CONT		TTRU	<i>on</i>	CONT		TTRU		EFF
	MEAS		BENF		LAT	<i>till</i>	TTO	<i>with_respect_to</i>	CONT
	CAUS		PURP		TAT	<i>to</i>	TTO	<i>within</i>	MEAS
<i>atop</i>	LAT		MEAS		PURP		LTO		LAT
<i>bar</i>	EXCL		CAUS		CAUS		DIR		DIR
<i>barring</i>	EXCL		RECP		INST		RECP	<i>without</i>	EXCL
<i>before</i>	ORD		TAT		ORNT		MEAS		LAT
	TAT		PURP	<i>onto</i>	DIR		PURP		
	LAT	<i>from</i>	LFRM		LAT		EFF		
<i>behind</i>	LAT		TFRM	<i>opposite</i>	LAT		ACMP		
	ACMP		MATR		TAT		BENF		
<i>below</i>	LAT		CAUS	<i>out_of</i>	LFRM		LAT		
	DIR				LAT		PURP		
	MEAS				DIR		DIR		
	ORD				CAUS	<i>towards</i>	LAT		
<i>beneath</i>	LAT				MATR		PURP		
	ORD				INST		DIR		
							TAT		

## Appendix II - The Adverbial Case Markers

<i>above</i>	LAT	<i>continually</i>	FREQ	<i>frequently</i>	FREQ	<i>nowhere</i>	LTO	<i>sideways</i>	ORNT
<i>abroad</i>	LAT	<i>continuously</i>	FREQ	<i>globally</i>	LAT	<i>obliquely</i>	ORNT	<i>sidewise</i>	ORNT
<i>aerially</i>	INST	<i>currently</i>	TAT	<i>halfhourly</i>	FREQ	<i>occasionally</i>	FREQ	<i>sometime</i>	TAT
<i>afterwards</i>	TAT	<i>daily</i>	FREQ	<i>hence</i>	LFRM	<i>off</i>	TTO	<i>sometimes</i>	FREQ
<i>again</i>	FREQ	<i>decadally</i>	FREQ		TFRM		LAT	<i>somewhere</i>	LAT
<i>ago</i>	TAT	<i>distantly</i>	LAT	<i>henceforth</i>	TFRM	<i>often</i>	FREQ		LTO
<i>ahead</i>	DIR	<i>diurnally</i>	TAT	<i>henceforward</i>	TFRM	<i>on</i>	DIR		LFRM
	TAT	<i>domestically</i>	LAT	<i>here</i>	LAT		LAT	<i>someplace</i>	LAT
<i>along</i>	DIR	<i>down</i>	MEAS		DIR	<i>once</i>	FREQ		LTO
	ACMP		DIR	<i>hereafter</i>	TFRM	<i>out</i>	DIR		LFRM
<i>also</i>	ACMP	<i>downhill</i>	MANR	<i>hereinafter</i>	LAT		LAT	<i>soon</i>	TAT
<i>already</i>	TAT		DIR	<i>hereunder</i>	LAT	<i>outdoors</i>	LAT	<i>southeasterly</i>	DIR
<i>always</i>	FREQ		LAT	<i>hitherto</i>	TTO		DIR	<i>southeastwardly</i>	DIR
<i>angularly</i>	ORNT	<i>downrange</i>	LAT	<i>hourly</i>	FREQ	<i>outside</i>	DIR	<i>southerly</i>	DIR
<i>annually</i>	FREQ		DIR	<i>how</i>	MANR		LAT	<i>southwesterly</i>	DIR
<i>anywhere</i>	LAT	<i>downstairs</i>	LAT	<i>immediately</i>	TAT	<i>outward</i>	DIR	<i>southwestwardly</i>	DIR
	LTO		DIR	<i>incessantly</i>	FREQ		ORNT	<i>temporarily</i>	TTRU
<i>apart</i>	LAT	<i>downstream</i>	LAT	<i>indoors</i>	LAT	<i>outwards</i>	DIR	<i>terrestrially</i>	LAT
	MEAS		DIR	<i>inside</i>	DIR		ORNT	<i>then</i>	TAT
<i>aperiodically</i>	FREQ	<i>downtown</i>	LAT		LAT	<i>overhead</i>	LAT	<i>thence</i>	LFRM
<i>around</i>	DIR	<i>downward</i>	DIR	<i>instantly</i>	TAT		DIR		TFRM
	LAT		ORNT	<i>instead</i>	EXCL	<i>partly</i>	MEAS	<i>there</i>	DIR
<i>aside</i>	DIR	<i>downwards</i>	DIR	<i>inward</i>	DIR	<i>periodically</i>	FREQ		LAT
<i>astray</i>	LAT		ORNT	<i>inwards</i>	DIR	<i>permanently</i>	FREQ	<i>thereafter</i>	TFRM
<i>away</i>	DIR	<i>early</i>	TAT	<i>irregularly</i>	FREQ		TTRU	<i>therein</i>	LAT
<i>axially</i>	LAT	<i>easterly</i>	DIR	<i>just</i>	TAT	<i>perpetually</i>	FREQ	<i>today</i>	TAT
<i>backward</i>	DIR	<i>eastwardly</i>	DIR	<i>last</i>	ORD		TTRU	<i>together</i>	ACMP
	TTO	<i>either</i>	EXCL	<i>lastly</i>	ORD	<i>presently</i>	TAT	<i>tomorrow</i>	TAT
<i>backwards</i>	DIR	<i>elsewhere</i>	LAT	<i>late</i>	TAT	<i>previously</i>	TAT	<i>tonight</i>	TAT
	ORNT	<i>entirely</i>	MEAS	<i>left</i>	DIR	<i>primarily</i>	ORD	<i>too</i>	ACMP
<i>before</i>	TAT	<i>epochally</i>	FREQ	<i>locally</i>	LAT	<i>publicly</i>	LAT	<i>triennially</i>	FREQ
<i>beforehand</i>	TAT	<i>equatorially</i>	LAT	<i>long</i>	TTRU	<i>quadrennially</i>	FREQ	<i>triweekly</i>	FREQ
<i>behind</i>	LAT		LTRU	<i>midweekly</i>	TAT	<i>quarterly</i>	FREQ	<i>up</i>	DIR
<i>belatedly</i>	TAT	<i>erectly</i>	ORNT	<i>millennially</i>	FREQ	<i>rarely</i>	FREQ		ORNT
<i>below</i>	LAT	<i>eternally</i>	TTRU	<i>momentarily</i>	TAT	<i>recently</i>	TAT	<i>uphill</i>	MANR
	DIR	<i>eventually</i>	TAT		TTRU	<i>regularly</i>	FREQ		DIR
<i>bicentennially</i>	FREQ	<i>ever</i>	TAT	<i>monthly</i>	FREQ	<i>remotely</i>	LAT		LAT
<i>biennially</i>	FREQ	<i>everywhere</i>	LAT	<i>never</i>	FREQ	<i>right</i>	MANR	<i>upstairs</i>	LAT
<i>bimonthly</i>	FREQ	<i>externally</i>	LAT	<i>nevertheless</i>	OPP		DIR	<i>upward</i>	DIR
<i>biweekly</i>	FREQ	<i>far</i>	LAT	<i>next</i>	ORD	<i>round</i>	DIR		ORNT
<i>biyearly</i>	FREQ	<i>federally</i>	LAT		TAT		LAT	<i>upwards</i>	DIR
<i>briefly</i>	TTRU	<i>finally</i>	TAT	<i>nightly</i>	FREQ	<i>second</i>	ORD		ORNT
	TAT	<i>first</i>	ORD	<i>nocturnally</i>	TAT	<i>secondly</i>	ORD	<i>usually</i>	FREQ
<i>by</i>	LAT		TAT	<i>nonetheless</i>	OPP	<i>seldom</i>	FREQ	<i>weekly</i>	FREQ
<i>centennially</i>	FREQ	<i>formerly</i>	TAT	<i>northeasterly</i>	DIR	<i>semiannually</i>	FREQ	<i>westerly</i>	DIR
<i>centrally</i>	LAT	<i>forth</i>	LFRM	<i>northeastwardly</i>	DIR	<i>semiweekly</i>	FREQ	<i>westwardly</i>	DIR
<i>coastally</i>	LAT	<i>fortnightly</i>	FREQ	<i>northerly</i>	DIR	<i>septennially</i>	FREQ	<i>yearly</i>	FREQ
	LTRU	<i>forward</i>	LAT	<i>northwesterly</i>	DIR	<i>sexennially</i>	FREQ	<i>yesterday</i>	TAT
<i>collinearly</i>	LAT		DIR	<i>northwestwardly</i>	DIR	<i>short</i>	LAT	<i>yet</i>	TAT
<i>constantly</i>	FREQ		TAT		TAT	<i>shortly</i>	TAT	<i>yon</i>	DIR
<i>contiguously</i>	LAT	<i>forwards</i>	DIR	<i>nowadays</i>	TAT		MANR	<i>yonder</i>	LAT

### ***Appendix III - The Case Glossary***

This appendix describes the meaning and coverage of each case. Each description is followed by one or more example sentences chosen to reflect typical usage or to illustrate the scope of each case.

#### **PARTICIPANT**

##### *Accompaniment (ACMP)*

The Accompaniment case represents one or more entities accompanying another participant (usually the Agent, Experiencer or Object) involved in the act. Sentences 14, 15 and 16 show accompaniment of Agent, Experiencer and Object respectively.

*[I<sub>AGT</sub>] eat supper with [my family<sub>ACMP</sub>].* (14)

*[I<sub>EXPR</sub>] live with [my family<sub>ACMP</sub>].* (15)

*I eat [my peas<sub>OBJ</sub>] with [honey<sub>ACMP</sub>].* (16)

##### *Agent (AGT)*

The Agent case represents the initiator or performer of an act. An Agent is typically a sentient being or some entity treated as sentient to some degree within the domain. This case differs subtly from the Experiencer case in that the Agent intentionally performs or actively participates in the action. The Agent is expressed by the syntactic subject of the verb or as the object of the preposition *by* in passive clauses.

*[The database manager<sub>subj</sub>] retrieved the records.* (17)

Sentence 16 shows an Agent, *The database manager*. Although database managers are not usually thought of as sentient, in the domain of Computer Science they often perform complex tasks. In the absence of a truly sentient initiator, other entities (such as database managers) can be Agents. In sentence 18 the Agent would be *The analyst* with *the database manager* filling the role of Instrument.

*[The analyst<sub>subj</sub>] retrieved the records with the database manager.* (18)

##### *Beneficiary (BENF)*

The Beneficiary case represents the entity that benefits from the situation resulting from the act. The situation may be to the Beneficiary's advantage or disadvantage, and it may be intentional or accidental. Typically the Beneficiary is an animate being or an organization. It may correspond to the syntactic indirect object of the verb if the indirect object is not the Recipient of the object of the act.

*I wrote [the girl<sub>iobj</sub>] [a reference letter<sub>dobj</sub>] [to prospective employers<sub>pp</sub>].* (19)

*I wrote [the girl<sub>iobj</sub>] [a reference letter [to prospective employers<sub>pp</sub>] <sub>dobj</sub>].* (20)

*This year's rains produced a bumper crop [for the farmer<sub>pp</sub>].* (21)

Sentence 19 shows the indirect object (*the girl*) filling the Beneficiary case with *prospective employers* filling the Recipient case. In sentence 20 there is no verb argument to fill the Recipient case. Nonetheless, since the writing was done to the advantage (or disadvantage) of the girl, Beneficiary is again an appropriate case.

Sentence 21 illustrates the fact that the filler of the Beneficiary case need not be the *intended* beneficiary of the act. Clearly, rains did not intend to produce a bumper crop for the farmer's benefit.

#### *Exclusion (EXCL)*

The Exclusion case represents an entity not included in a group or not accompanying another entity or entities. It can also represent the entity that substitutes for another whose involvement in the act is expected, or whose lack of involvement is significant.

*All were pleased [except him<sub>pp</sub>].* (22)

*John went [instead of Mary<sub>pp</sub>].* (23)

#### *Experiencer (EXPR)*

The Experiencer case represents the entity experiencing a state or a sensation. Unlike an Agent, an Experiencer does not intentionally perform or actively participate in the action. The Experiencer is typically a sentient being or some entity treated as sentient. It corresponds to the syntactic subject of the verb.

*[Fred<sub>subj</sub>] is sleeping.* (24)

#### *Instrument (INST)*

The Instrument case represents an entity that is applied or employed to accomplish an act. The Instrument for acts of transfer is often the medium of the transfer.

*He broke the window [with a brick<sub>pp</sub>].* (25)

*The system administrator notified the users [via email<sub>pp</sub>].* (26)

In sentence 25 *a brick* is the entity applied to accomplish the act of breaking the window. In sentence 26 *email* is the medium of transfer of notifying the users.

#### *Object (OBJ)*

The entity directly acted upon by the verb's action fills the Object case. The Object case often corresponds to the syntactic direct object of the verb.

*Jim printed [the file<sub>dobj</sub>].* (27)

*[The window<sub>subj</sub>] broke.* (28)

*They stripped him [of his pride<sub>pp</sub>].* (29)

Sentence 27 has the syntactic direct object (*the file*) filling the Object case. Sentence 28 shows the less common situation of the syntactic subject (*the window*) filling this case. Sentence 29 is an example of the rare occasion where the Object case is marked by the

preposition *of*. *His pride* is the entity that has been stripped while *him* is the (abstract) location from which it was stripped.

### *Recipient (RECP)*

The Recipient case represents the entity that directly receives the object of an act. The Recipient must be distinguished from the closely related Beneficiary case. Whereas the Beneficiary benefits from the realization of an act, the Recipient takes possession of the act's object. Recipient frequently appears with acts describing dative relationships and often corresponds to the syntactic indirect object of the verb.

*I sent [the prospective employers<sub>iobj</sub>] a reference letter for her.* (30)

*I wrote [the girl<sub>iobj</sub>] [a reference letter<sub>dobj</sub>] [to prospective employers<sub>pp</sub>].* (31)

In sentence 30 the indirect object of the verb fills the Recipient case. In sentence 31 the indirect object fills the Beneficiary case while the Recipient case is marked by the preposition *to* (see the definition of Beneficiary above).

In sentences that contain both cases, Beneficiary is more often marked by the preposition *for* while Recipient is more often marked by the preposition *to*.

## CAUSALITY

### *Cause (CAUS)*

The Cause of an act is the situation or event that makes it take place. The Cause case may also represent an environment that allows an act to be performed or a state to exist.

*He died [of thirst<sub>pp</sub>].* (32)

*We acted [on his advice<sub>pp</sub>].* (33)

### *Effect (EFF)*

The Effect case represents a state that is the outcome of an act or the result of a situation.

*The battle will end [in death<sub>pp</sub>].* (34)

### *Opposition (OPP)*

The Opposition case represents an entity that contrasts with or opposes the act but is insufficient to prevent it from happening.

*[Despite my warning<sub>pp</sub>] they persisted.* (35)

In sentence 35, *my warning* opposes their persistence but does not prevent it.

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<sup>2</sup> We consider this instance of the Object case rare but not merely idiomatic. The existence of similar examples using different verbs supports the decision to treat the preposition “of” as a valid case marker for the Object case: “They deprived him [of his rights<sub>pp</sub>]”; “They partake [of the bread<sub>pp</sub>]”.

### *Purpose (PURP)*

The Purpose case represents the situation intended to result from the act's execution. This case implies initiation of the act by a sentient being. Purpose differs from Effect in that Purpose is the intended though not necessarily occurring result whereas Effect is the occurring though not necessarily intended result.

*The drug was invented [for pain relief pp].* (36)

### **SPACE**

*Direction (DIR), LocationFrom (LFRM), LocationThrough (LTRU), LocationTo (LTO)*

The spatial cases Direction, LocationFrom, LocationTo and LocationThrough represent positions in some (possibly non-physical) space. To distinguish between them consider an act of motion to be an arrow in three-dimensional space. The tail of the arrow represents the starting point of the action (LFRM). The head represents the destination of the action (LTO). The direction of the arrow corresponds to the act's bearing in space (DIR). The shaft joining the tail to the head corresponds to the space through which the act passes or extends (LTRU).

*I traveled [southeast adv] [through New York state pp] [from Ogdensburg pp] [to Lake Placid pp].* (37)

*Look [inside yourself pp] for the answer.* (38)

*They stripped [him dobj] of his pride.* (39)

*She lived [through many trials and tribulations pp].* (40)

*His life is going [nowhere adv].* (41)

Sentence 37 shows all four cases together. It has *southeast* filling the Direction case, *New York state* filling the LocationThrough case, *Ogdensburg* filling the LocationFrom case and *Lake Placid* filling the LocationTo case.

The next four examples illustrate abstract (non-physical) uses of Direction (*yourself*), LocationFrom (*him*), LocationThrough (*many trials and tribulations*) and the LocationTo case (*nowhere*).

### *LocationAt (LAT)*

The LocationAt case represents the space in or at which an act or event occurs. This case typically only applies to non-motion acts that occur statically in space, or to specific points along the path of a motion act. There is no restriction on the physical extent of a point that fills the LocationAt case. As with other locative cases, LocationAt may be interpreted abstractly (non-physically), and either absolutely or relative to another location.

*We stopped [at a restaurant pp] on our way home.* (42)

*The memory was hidden [in his subconscious pp].* (43)

In sentence 42, *a restaurant* is a specific point along the path of motion. Sentence 43 illustrates an abstract usage of the LocationAt case.

### *Orientation (ORNT)*

The Orientation case represents an object's bearing in terms of, or its rotation about, the three-dimensional axes on whose origin the object is centred. Less strictly, Orientation may represent the position of parts of an object with respect to each other.

*The carton lay [on its side pp].* (44)

*The statue stood [erect adv] despite the heavy winds.* (45)

### **TIME**

#### *Frequency (FREQ)*

The Frequency case represents the rate at which an act recurs.

*Buses arrive [in five minute intervals pp].* (46)

*He washes his car [daily adv].* (47)

The two example sentences show the Frequency case being marked first by a preposition and then by an adverb.

#### *TimeAt (TAT)*

The TimeAt case represents the time at which an act or event takes place or a state exists. It is the temporal analog of the spatial LocationAt case. There is no restriction on the extent of the time unit filling the TimeAt case—the filler need not refer to a measurable instant in time. It may also be a nominalized event (one expressed by a noun phrase) indicating when the act took place.

*He traveled extensively [last year adv].* (48)

*He made his fortune [during his visit to Europe pp].* (49)

The case filler in sentence 48 is a time unit with measurable extent.

In 49 the nominalized event *his visit to Europe* indicates the time when the action (making his fortune) occurred.

#### *TimeFrom (TFRM)*

TimeFrom is the case that represents the time of the beginning of an act or event. It may also represent the moment at which a state began to exist or will begin to exist.

*He has been blind [since the war pp].* (50)

*I will be at home [from Tuesday pp] to Saturday.* (51)

In sentence 50 *the war* marks the time at which the state began. He has been blind from the war until now.

In 51, the moment at which the state of being at home will commence is in the future (*Tuesday*). As the from...to sequence suggests, TimeFrom is often paired with TimeTo.

### *TimeThrough (TTRU)*

The TimeThrough case represents the duration of an act, an event or a state of existence. In contrast to TimeAt, the filler of this case must have extent.

*The meeting lasted [for four hours pp].* (52)

### *TimeTo (TTO)*

The TimeTo case represents the time at which an act or event of duration ended or will end. It may also represent the moment at which a state ceased to exist or will cease to exist.

*We worked from nine [to five pp].* (53)

*I will be at home [until Tuesday pp].* (54)

## **QUALITY**

### *Content (CONT)*

The Content case represents the subject of any type of communication or consideration. This case may also represent the physical filling of a container.

*He wrote [about birds pp].* (55)

*I am concerned [about the economy pp].* (56)

*He filled the container [with milk pp].* (57)

### *Manner (MANR)*

The Manner case represents a way in which an act is performed. This case accounts for many common relationships between a verb and its arguments that describe qualitative characteristics of the act or state. MANR is often used in the absence of a more suitable case and can thus be considered a default. This is particularly true for adverbial markers.

*She works [with style pp].* (58)

*He sings [beautifully adv].* (59)

### *Material (MATR)*

The Material case represents the physical substance composing an object involved in an act.

*We build houses [with brick adv].* (60)

### *Measure (MEAS)*

The Measure case represents some quantitative property describing the extent of an act or the amount, number or value (including economic worth) of an entity involved in the act. An instance of Measure implies a scale of measurement.

*The horse won [by three lengths pp].* (61)

*I bought the car [for five hundred dollars pp].* (62)

*Order (ORD)*

The Order case represents the relative position of an entity within a sequence, or within another structured arrangement of entities.

*He filed the Baker file [before the Abel file pp].* (63)