TEMPORALITY

Universals and Variation

Maria Bittner

Contents

Figures

Glosses

ENGLISH (Indo-European, Germanic)

gloss and category in this book		Huddleston & Pullum (2002)
PST	past tense (***was***)	preterite tense
PRS	present tense (***is***)	present tense
FUT	future tense (***will*** *be*)	modal auxiliary (mood)
<PST	backshifted past tense (***had*** *been*)	backshifted preterite tense
<PRS	backshifted present tense (***was***)	backshifted present tense
<FUT	backshifted future tense (***would*** *be*)	–
INF	infinitive (***to*** *be*)	infinitive
PRE	prospective aspect ({***is***|***was***} ***going to*** *be*)	idiom
PRF	perfect aspect (***have*** *be****en***)	perfect tense
PRG	progressive aspect (***is*** *be****ing*** *polite*)	progressive aspect

POLISH (Indo-European, Slavic)

gloss and category in this book		Bielec (1998)
\I	imperfective aspect feature (*by-* 'be\I')	imperfective verb
\P	perfective aspect feature (*poby-* 'stay\P')	perfective verb
PRF	perfect aspect inflection (* ~ *poby****wszy***)	past participle
DUR	durative aspect inflection (*będ****ąc*** ~ *)	present participle
PST	past tense (*był****em*** ~ *poby****łem***)	past tense
PRS	present tense (***jest****em* ~ *)	present tense
FUT	future tense (***będ****ę* ~ *po****będ****ę*)	future tense
INF	infinitive (*by****ć*** ~ *poby****ć***)	infinitive
1, 2, 3	1st, 2nd, 3rd person (*był****em****, był****eś****, był*)	first, second, third person
S(G), P(L)	singular, plural number (*był*, *byl****i***)	singular, plural number
M, F, N	masc., fem., neuter gender (*był*, *był****a***, *był****o***)	masc., fem., neuter gender
=SBJ	subjunctive mood clitic (*że=****by****=m był*)	conditional tense

MANDARIN (Sino-Tibetan, Chinese)

gloss and category in this book		Henne *et al.* (1977)
E/	eventive aspect feature	action verb
S/	stative aspect feature	quality verb
DUR	durative aspect particle (*zhe*)	durative aspect
PNC	punctual aspect particle (*le*)	perfective aspect
PRE	pre-state, aspectual modal (*huì ~ yào*)	modal verb
EXP	expect(ed), attitudinal modal (*huì*)	modal verb
DES	desire(d), attitudinal modal (*yào*)	modal verb
$_{\top}$V, V$_{\top}$	topical 3rd person (subject, object)	topic zero (subject, –)
$_{\perp}$V, V$_{\perp}$	background 3rd person (subject, object)	–
M	measure (event v or mass n)	measure (verbal, partitive, …)
CL	classifier (count n)	measure (individual)

KALAALLISUT (Eskimo-Aleut, Inuit)

gloss and category in this book		Bergsland (1955)
SG, PL	singular, plural number	singular, plural number
1, 2	1st, 2nd person	1st, 2nd person
3$_{\top}$, 3$_{\perp}$	topical 3rd, background 3rd person	4th, 3rd person
DEC	declarative, matrix mood inflection	indicative
QUE	interrogative, matrix mood	interrogative
IMP	imperative, matrix mood	imperative
OPT	optative, matrix mood	optative
FCT	factual, dependent mood	causative
HYP	hypothetical, dependent mood	conditional
HAB	habitual, dependent mood	causative habitual
ELA	elaborating, dependent mood	contemporative or participial
-…$_{\top}$	-mood$_{topical.subject}$	mood suppletion
-…$_{\perp}$	-mood$_{background.subject}$	mood suppletion
-…$_{\top\perp}$	-mood$_{topical.subject\ background.object}$	mood suppletion
=RPT	reportative, evidential mood clitic	class 4 enclitic

Acknowledgments

This book is the culmination of some fifteen years of research, so the list of my accumulated intellectual debts is longer than I can acknowledge in detail. But I wish to thank those who stand out in my mind as people to whom this book owes its existence or who had a significant impact on its content.

First and foremost, Hans Kamp has been instrumental on both counts. Since 1997, conversations with Hans and seemingly casual remarks with lasting impact have led me to embark on various lines of inquiry—beginning with dynamic semantics, then temporal discourse reference, and finally presupposition—which ultimately merged into this book. Hans also carefully read the first draft of *Part I* and gave me extensive written comments that led me to restructure and rethink that part entirely.

I am also deeply grateful to Judith Tonhauser and three other (anonymous) reviewers for carefully reading the pre-final book manuscript and writing exceptionally helpful reviews, which led to the final restructuring and revisions. Lisa Matthewson and two other (anonymous) reviewers of the book proposal had important initial impact.

Thanks are also due to the participants in my lecture series and other presentations at the Institute for Computational Linguistics at Stuttgart University (2000–2012)—a yet another debt I owe to Hans Kamp; my 2001–2013 Rutgers courses on dynamic semantics; ESLLI 2006 course on *Temporal Anaphora in Tenseless Languages*; LSA 2009 course on *Crosslinguistic Compositional Semantics*; and other presentations over this period. Conversations with consultants on Kalaallisut, Mandarin Chinese, and my native Polish played a different but equally crucial role.

Last but not least, I thank Susan Rothstein for inviting me, long ago, to write a book for her *Explorations in Semantics* series. Over the subsequent years, both Susan and the entire editorial team at Wiley-Blackwell patiently nurtured the project to its successful completion. I could not have written this book without their staying the course, in spite of many missed deadlines, during the initial gestation period; their enthusiastic encouragement throughout the entire process; and, most importantly, without the expert review process at the key junctures—both the book proposal and the pre-final book manuscript.

Introduction

In any language, speakers have grammatical means to refer to past, present, as well as future times, events, and states. They can speak directly, expressing their own attitudes; or indirectly, attributing words or attitudes to other people. Moreover, they can refer to a particular event or state, or to a habitual pattern. To express these universal types of temporal reference, different languages use different grammatical categories. They may also use the same categories in language-specific ways.

Discourses (1) through (4), in four diverse languages, illustrate both the universal types of temporal reference and the range of variation to be analyzed in this book. The four languages differ in the grammatical *TAM-categories* – TENSE (*T*), ASPECT (*A*), MOOD (*M*) – which they require to form a finite sentence. English is classified as TENSE-based, because a tense inflection or auxiliary (e.g. past -PST, present -PRS, or future FUT) is required to form a finite sentence, whereas grammatical aspect (e.g. perfect *have* v.PRF) is optional. Polish is TENSE-ASPECT-based, because each Polish verb has a grammatical aspect feature (perfective \P or imperfective \I) and to form a finite sentence must be inflected for tense (-PST, -PRS, or -FUT). Tenseless Mandarin is ASPECT-based, because Mandarin verbs likewise have grammatical aspect features (eventive E/ or stative S/). Finally, tenseless Kalaallisut is MOOD-based, because to form a finite sentence a Kalaallisut verb must be inflected for matrix mood (e.g. declarative -DEC). In addition, Kalaallisut has a separate paradigm of dependent moods (e.g. factual -FCT, hypothetical -HYP, habitual -HAB) and a mood-like reportative clitic (=RPT). Only semantically relevant grammatical categories, to be analyzed in this book, are glossed (using abbreviations listed in the Glosses at the front of the book; '*ref.*' abbreviates '*reference*').

(1) TENSE-based temporality: *English* (Indo-European, Germanic)

i. Ann has gone home. *present ref.*
Ann have.PRS go.PRF home

ii. She said (that) her dad was ill. *indirect report*
she say.PST (that) her dad be.<PRS ill

iii. When he sees her, he'll certainly be happy. *non-past ref.*
when he see.PRS her he=FUT certainly be happy

iv. He's always happy when she comes. *habitual ref.*
he=be.PRS always happy when she come.PRS

(2) TENSE-ASPECT-based temporality: *Polish* (Indo-European, Slavic)

i. Ania pojecha-ł-a do domu. *past ref.*
Ann ride.off\P-PST-3SF to home
Ann has gone home.

ii. Mówi-ł-a że jej tata jest chory. *indirect report*
say\I-PST-3SF that her dad be\I.PRS.3SG ill
She said that her dad was ill.

iii. Jak ją zobaczy, na pewno się=ucieszy. *future ref.*
when her see\P.FUT.3SG for sure *se*=rejoice\P.FUT.3SG
When he sees her, he'll be happy, [I]'m sure.

iv. Zawsze się=cieszy jak ona przyjeżdża *habitual ref.*
always *se*=rejoice\I.PRS.3SG when she ride.in\I.PRS.3SG
He's always happy when she comes.

(3) ASPECT-based temporality: *Mandarin* (Sino-Tibetan, Chinese)

i. Ann huí.jiā le 。 *non-future ref.*
Ann E/return.home PNC
Ann has gone home.

ii. Tā shuō tā bàba shēng.bìng le 。 *indirect report*
she E/say her dad E/get.ill PNC
She said her dad was ill.

iii. Tā bàba kàn.dào tā, yídìng (huì) hěn gāoxìng。 *future ref.*
her dad E/see.rv her, definitely (EXP) very $_{\top}$S/happy
When he sees her, [he]'ll definitely be happy.

iv. Tā bàba měi-cì kàn.dào tā, dōu hěn gāoxìng。 *habitual ref.*
her dad every-M_{evt} E/see.rv her, DIS very $_{\top}$S/happy
Her dad is always happy when he sees her.

(4) MOOD-based temporality: *Kalaallisut* (Eskimo-Aleut, Inuit)

i-ii. Aani angerlarpoq, ataatanigooq naparsimammat. *non-future ref.*
Aani angirlar-pu-q, ataata-ni=guuq naparsima-mm-at. + *indirect rep.*
Ann go.hm-$DEC_{\top}$-3SG dad-$3SG_{\top}$=RPT ill-$FCT_{\perp}$-$3SG_{\perp}$
Ann has gone home, because, [she] said, her dad was ill.

iii. Ataataata takuguniuk nuannaassaqqaarpoq. *future ref.*
ataata-ata taku-gu-ni-uk nuannaar-ssaqqaar-pu-q
dad-$3SG_{\perp}$.ERG see-$HYP_{\top}$-$3SG_{\top}$-$3SG_{\perp}$ happy-certain.to-$DEC_{\top}$-3SG
When he sees her, he's certain to be happy.

iv. Takukkaangat tamatigut nuannaartarpoq. *habitual ref.*
takug-gaanga-t tamatigut nuannaar-tar-pu-q
show.up-$HAB_{\perp}$-$3SG_{\perp}$ always happy-habit-$DEC_{\top}$-3SG
He's always happy when she comes.

The terms "tense", "aspect", and "mood" are used differently by different researchers. The methodology I use in this book is to choose a prototypical example of each category, analyze the prototype, and then use that analysis to decide, for other items in that language as well as other languages, whether they are similar enough to allow a unified analysis. If the answer is yes, I subsume them under the same category; otherwise, I use a different term. For this reason, the terms I use may differ from those used by other authors. (In the Glosses section, the list of abbreviations for key grammatical categories lists the terms used in this book, aligned with the corresponding terms used in major reference grammars.)

As prototypical examples of grammatical TENSE, I use matrix tense inflections in English (-PST, -PRS) and Polish (-PST, -PRS, -FUT). In English, the analysis I propose extends to the future auxiliary (FUT) and the dependent backshifted tenses (-<PST, -<PRS, -<FUT). In contrast, there is no such category in Mandarin (see e.g. Henne *et al.* 1977; Li and Thompson 1981; Lin 2006; Ren 2008; *contra* e.g. Tsang 1981; Wu 2009) or Kalaallisut (see e.g. Shaer 2003; Bittner 2005; *contra* e.g. Kleinschmidt 1851; Bergsland 1955; Fortescue 1984; Trondhjem 2009).

As prototypical examples of grammatical ASPECT, I use Polish grammatical aspect features (imperfective \I, perfective \P) and English aspectual auxiliaries (perfect *have* v.PRF, progressive be v.PRG). I propose that they represent two types of grammatical aspect, ARGUMENT-FILLING and RECENTERING, respectively. I further propose that Mandarin, too, has grammatical aspect features (stative S/, eventive E/), which likewise instantiate argument-filling aspect. In addition, Mandarin and Polish have recentering aspect – to wit, Mandarin aspect markers (e.g. punctual PNC, durative DUR) and Polish aspect inflections (-PRF, -DUR). In contrast, Kalaallisut has no grammatical aspect of any type. Instead, it has many derivational suffixes that introduce new eventualities — for example, state-forming *-sima* 'have (consequent state)', *-ssa* 'be expect(ed), desire(d)', *-ssaqqaar* 'be certain to', *-nngit* 'be not', etc.; punctual event-forming *-lir* 'begin', *-junnaar* 'stop', etc.; process-forming *-qattaar* 'v again and again', *-tir* 'v in stages', *-riartur* 'go away to v', etc.; habit-forming *-tar* 'v habitually', *-tuaannar* 'v always', *-gajug* 'v often', *-llattaar* 'v sometimes', etc.; see e.g. Kleinschmidt 1851; Schultz-Lorentzen 1927; Bergsland 1955; Bittner 2005, 2007, 2011; Bittner and Trondhjem 2008).

As prototypical examples of grammatical MOOD, I use Kalaallisut matrix mood inflections for illocutionary force (declarative -DEC, interrogative -QUE, optative -OPT, imperative -IMP). They instantiate argument-filling mood, parallel to argument-filling aspect and tense. In Kalaallisut, dependent mood inflections (factual -FCT, hypothetical -HYP, habitual -HAB, elaborating -ELA) likewise instantiate argument-filling mood. In contrast, the reportative evidential clitic (=RPT) instantiates recentering mood, parallel to recentering aspect.

Building on Jelinek (1984), I further propose that some languages have argument-filling grammatical PERSON *(P)*. In our language sample, examples include subject inflections in Polish (e.g. 3SF, 3SG in (2)) and subject, object, and possessor inflections in Kalaallisut (e.g. topical $3SG_{\top}$, background $3SG_{\bot}$ in (4)). They also include Mandarin subject, object, and possessor features, which can lexically fill arguments of verbs and nouns, resulting in so-called "zero anaphora" (e.g. topical subject ${}_{\top}(\cdot)$ of ${}_{\top}$S/happy in (3)).

The unifying generalization is that argument-filling *TAMP*-categories saturate arguments of predicates. For verbal predicates, the argument structure depends on the language. Argument-filling tense saturates the time argument ("reference time"), if there is such among the language-specific arguments of the verb; argument-filling aspect saturates the eventuality argument; argument-filling mood saturates the world argument ("world of evaluation"); and argument-filling person saturates the subject or object argument. In contrast, recentering *TAMP*-categories presuppose an argument slot that is already filled and change the prominence of the input referent. In general, argument-filling *TAMP*-categories form grammatical paradigms of obligatory items in complementary distribution, because the argument slot they fill must be filled and can only be filled once. In contrast, recentering *TAMP*-categories are grammatically optional and may co-occur, since changes in prominence (e.g. demotion) can be recursive.

As discourses (1) through (4) illustrate, translation equivalents may have different sentence boundaries and not exactly the same meaning. Nevertheless, a competent speaker of languages *A* and *B* can judge whether a discourse in language *A* qualifies as a translation equivalent of a discourse in language *B*. Intuitively, the meaning is then "essentially the same" or "as close as one can get." A central goal for a formally explicit cross-linguistic theory of semantics is to explicate this intuition. For example, how do we represent the meanings of translation equivalents in diverse languages, such as discourses (1) through (4)? Another central goal is to develop a theory of semantic composition that can derive such meaning representations from diverse morphosyntactic forms.

Some semanticists, including this author, would add two more desiderata. One is that, as far as possible, compositional rules should be general and universal. This is essential to capture semantic generalizations, both within and across languages. Secondly, as far as possible, the theory should be based on overt categories, since it then builds on a foundation that is free of controversy and makes predictions that are easy to test. Empty categories – i.e. inaudible elements required to make the rules work – weaken the theory, because they introduce controversy and make it difficult to submit the theory to empirical test. So if one must posit any, the fewer and the more marginal they are, the better.

Note, however, that this desideratum does not ban unmarked categories. In natural languages, an unmarked default member of a grammatical paradigm is often in contrast to morphologically marked members. In such cases, the unmarked

default form is audible and the absence of any marker is semantically significant for any competent speaker, who knows the paradigm. Similarly, in languages that allow cross-categorial uses of certain categories (e.g. English *and, or*, *even*), the audible sisters in any syntactic structure determine the variant of the lexical entry to be used in this local environment. Thus, for unmarked categories, I see no problem with using an inaudible element (e.g. zero lexical operator) to fill the place of an expected grammatical marker or to adjust the syntactic category and/or the meaning so that they fit in the local syntactic environment.

In research on temporal and other types of discourse reference, most formal semanticists have so far pursued four strategies. One is to simply ignore linguistic types other than English and present English-based theories – i.e. theories based on English and similar languages (say, French) – as theories of "natural language" (see e.g. Kamp 1981a, b; Moens and Steedman 1988; Roberts 1989; Kamp and Reyle 1993; Lascarides and Asher 1993; Stone 1997; de Swart 1998; Rothstein 2004; Lambalgen and Hamm 2005; Brasoveanu 2007; Kamp *et al.* 2011). By accident or design, this strategy served us well in the infancy of formal semantics. Indeed, it may have been the right strategy for that initial period. If one tries to tackle too many problems at once, one can be overwhelmed and end up making no progress at all. Avoiding this trap, English-based formal semantics has been very successful in analyzing semantic phenomena of English – including nominal, temporal, and modal discourse reference (in addition to the above, see e.g. Reichenbach 1947; Heim 1982; Partee 1984; Hinrichs 1986; Webber 1988; Parsons 1990; Muskens 1995, 1996). But judging by the widespread use of the term "natural language" as a synonym for "English," many formal semanticists do not yet realize that English-based theories are too parochial to apply to other linguistic types, such as Mandarin (3), Kalallisut (4), or even Polish (2). Still, even widespread use of Anglo-centric terminology cannot change the fact that a theory based *on* English is a theory *of* English or, at best, of that linguistic type.

Compounding the confusion, many semanticists analyze other languages in terms of English-based semantic categories. For example, nominal discourse reference has been analyzed in terms of "(in)definiteness," whether or not the language has articles (see e.g. Fortescue 1984; Krifka 1992; Chierchia 1998; Lyons 1999). Similarly, temporal discourse reference has been analyzed in terms of English-based aspectual classes (e.g. "accomplishments", "achievements", etc.) and "reference times," whether or not the language has progressive aspect or grammatical tense. For tenseless languages, the fact that temporal discourse reference is precise is regarded as evidence for "reference time," so researchers try to determine this time in the absence of tense (see e.g. Smith 1991/7; Wu 2003; Xiao and McEnery 2004; Lin 2006; Matthewson 2006; Ren 2008; Trondhjem 2009).

In the process, grammatical terms denoting English or Polish categories (e.g. English *(in)definite* noun phrase; English *progressive* and *perfect* aspects; Polish *(im)perfective* aspect; etc.) have been extended to assorted categories in

other languages, based on superficial similarities (e.g. Comrie 1976, 1985; Henne *et al.* 1977; Li and Thompson 1981; Fortescue 1984; Trondhjem 2008, 2009) or translated diagnostic tests (e.g. Smith 1991/7; Matthewson 2006; Wu 2009; Altshuler 2010). One can, of course, choose an arbitrary language *L* and analyze other languages in terms of semantic categories of *L*, since any language can be translated into *L*. The question is what an analysis of this sort can teach us about the original linguistic system as opposed to its translation. It is also not clear how to test such a theory with monolingual native speakers. Last but not least, this strategy has led to massive terminological confusion. Grammatical terms with clear prototypical meaning (see e.g. Agrell 1908 on *(im)perfective* aspect; Christophersen 1939 on *(in)definiteness*; Dowty 1979 on *progressive* and *perfect* aspects) have been extended to such a wide variety of categories that it is no longer clear what the extended terms are supposed to mean, let alone how to develop a unified theory (see Tonhauser 2008 on this methodological problem).

The third strategy, pursued in most cross-linguistic research in formal semantics, is to assume that the syntactic input to compositional semantic rules are not variable overt forms like (1)–(4), but abstract "Logical Forms" (*LF*), which in the relevant respects are more uniform (see e.g. Huang 1982; Bittner 1994a, b, 1999; Baker and Travis 1997; Schlenker 2004; Lin 2006; Matthewson 2006; Altshuler 2010). After 13 years of pursuing this strategy myself, I have come to the conclusion that it offers no hope of a satisfactory theory of natural language semantics. *LF*-based theories syntactically assimilate all languages either to English or to a purely abstract, supposedly universal, template that no language realizes overtly. Both alternatives are unsatisfying: Anglo-centric theories are only good for English, whereas purely abstract theories require one to accept the premise that all languages obfuscate the input to semantic composition. Moreover, because of their heavy use of empty categories, *LF*-based theories are hard to test empirically. Indeed, at present, they are impossible to test on discourses such as (1)–(4), because they make no predictions beyond the first sentence and are not explicit enough to determine the admissible *LF*s.

The fourth option is to give up the idea that universal semantic phenomena call for a unified cross-linguistic account. For example, in his pioneering work on tenseless temporality, Bohnemeyer (2002) presents detailed and convincing evidence that Yukatek Mayan has no grammatical tense but still expresses temporal discourse reference as precisely as English. He then proposes that temporal anaphora in tenseless Yukatek is based on pragmatic Gricean principles that, according to English-based theories, play no role in tensed languages such as English or French (see also Bohnemeyer 2009). This proposal is not formally implemented, so it is a program rather than a testable theory. As a program, I do not find it attractive. The obvious difference between tensed and tenseless languages is that the former do, and the latter do not, have grammatical tense paradigms. Instead, Bohnemeyer posits language-specific pragmatics without adequate evi-

dence to motivate this less obvious approach. In the absence of such evidence, I prefer to maintain the standard view that pragmatic principles are universal, although they may interact with language-specific items, such as grammatical tenses (see e.g. Grice 1975; Stalnaker 1978; van der Sandt 1992; Roberts 1998; Beaver 2001). Unlike Bohnemeyer, I also believe that universal temporal phenomena (e.g. universal types of discourse reference exemplified in (1) through (4)) call for a unified theory, which should apply to tensed and tenseless languages alike (e.g. tensed (1) and (2) as well as tenseless (3) and (4)).

So in this book, I pursue a fifth strategy. If semantic theory is to apply to diverse languages uniformly, without undue Anglo-centrism and without positing pseudo-universal *LF*s or language-specific pragmatics, then it must take the overt form of each language at face value and interpret it directly, as is. To explicate natural language meanings, including cross-linguistic translation equivalences, we need a universal semantic representation language. This must be a formal logic that, given the overt form of a discourse in any language, can represent its meaning transparently enough to enable us to derive its logical representation, from the given overt form, by means of universal directly compositional rules.

This break with tradition does not mean that we have to start over from scratch. In fact, there already exist typed dynamic logics that are compatible with direct semantic composition by universal type-driven rules. Muskens (1995, 1996), Stone and Hardt (1999), and Brasoveanu (2007) propose directly compositional analyses of nominal, temporal, and modal discourse reference in English (a.k.a. "natural language"). In Bittner (2007, 2011), I propose directly compositional analyses of nominal, temporal, and modal discourse reference in Kalaallisut. In this book, I propose to integrate these English-based and Kalaallisut-based approaches and, in the process, develop a universal directly compositional theory that applies to Polish and Mandarin as well.

In general, a typed logic allows direct type-driven composition in a framework where syntactic and semantic rules operate in tandem and can thus inform and constrain each other. A dynamic logic formally explicates changing states of information (INFO-STATES) in discourse, which makes it possible to explicate discourse anaphora. The antecedent updates the input info-state by introducing a discourse referent (DREF) for an individual, time, eventuality, world, or the like. In the resulting info-state the anaphor refers to that dref (see e.g. Karttunen 1976; Kamp 1981a, b; Heim 1982; Roberts 1989; Dekker 1994; van den Berg 1995, 1996; Stone 1997; AnderBois *et al.* 2010). A typed dynamic logic makes discourse anaphora available for direct type-driven composition. This additional compositional power makes it possible to derive equivalent semantic representations from diverse morphosyntactic forms. In particular, differences in morphosyntactic hierarchy – including differences in word boundaries, sentence boundaries, and constituent structure – can be bridged by discourse anaphora, be-

cause this primarily depends on linear order (the antecedent must precede the anaphor) and does not require either sisterhood or c-command.

In this book, Part I (Semantic Universals) develops these ideas into a testable formally explicit theory. Chapter 1 introduces the universal framework of *Categorial Grammar* (CG), with universal rules of function application and composition (see e.g. Steedman 1996, 2000; Baldridge 2002; Steedman and Baldridge 2011). These type-driven rules are compatible with any typed logic, including typed dynamic logics from English-based work. Unfortunately, English-based logics fail the desideratum of transparent relation to discourse. They fail already in English and, more spectacularly, in Kalaallisut. To address this problem, Chapters 2–7 gradually build a universal typed logic, called *Update with Centering* (UC), which does satisfy this and the other desiderata discussed above.

The universal system of UC is developed in six stages, step-by-step motivating and defining various components. In Chapter 2, evidence from languages with and without argument-filling grammatical person categories (Kalaallisut and Mandarin v. English) is used to motivate and define a *Simple Update with Centering* (UC_0), which can represent pronominal anaphora to salient individuals. In UC_0, drefs are ranked individuals on two prominence tiers. The TOP TIER represents the center of attention; the BOTTOM TIER, the periphery. Anaphors refer to ranked individuals by specifying their prominence tier and rank on that tier (see Bittner 2001a, b, 2011, 2013). It is argued that grammaticalized argument-filling third person categories (e.g. Kalaallisut inflections and Mandarin features) are TOP-LEVEL ANAPHORS – i.e. they refer to the top-ranked individual, on the top or bottom tier. Third person anaphors that are not grammaticalized are less restricted. For example, syntactic third person pronouns in English are SHALLOW ANAPHORS – i.e. they can refer not only to top-ranked, but also to second-ranked (i.e. just demoted) individuals, on the top or bottom tier.

In Chapters 3 and 4, evidence from grammatical tense and aspect categories (in English, Polish, and Mandarin) is used to extend UC_0 with times and eventualities. The latter are sorted into events and states. A universal algebra of dref entities is motivated and defined, building on sub-algebras proposed by Bach (1986) and Moens and Steedman (1988). We also structure the domains of individuals, times, events, and states, by mereological orders, building on Kamp (1979), Link (1983), and Bach (1986). We define two variants of the resulting *Update with Temporal Centering*, one without and one with mereological orders (UC_τ and $UC_{\tau+}$). It is argued that argument-filling grammatical tense and aspect categories are restricted to TOP-LEVEL REFERENCE. That is, the time (or eventuality) filled in by such a tense (or aspect) category has top-ranked status in the output info-state. In addition, it is usually anchored to a top-ranked antecedent eventuality and, in the case of tense, possibly also a top-ranked antecedent time.

In Chapter 5, $UC_{\tau+}$ is extended with drefs for sets, building on van den Berg (1995, 1996), Bittner (2007), and Brasoveanu (2007). This expansion ($UC_{\tau||}$)

is motivated by evidence from nominal and temporal quantifiers and their interaction with anaphora in English. Other languages have other quantificational structures, but these do not require any additional logical tools (see Part II). Cross-linguistically, quantifiers involve top-level distributive reference to domain sets and scope sets of dref entities of the relevant semantic type (e.g. individuals for *most boys*; time intervals for *most days*; states for *usually*).

Chapter 6 zooms in on discourse reference to a subset of events – namely, speech acts. Building on Lewis (1972), Murray (2010), and AnderBois *et al.* (2010), we factor in modal discourse reference to represent anaphoric interactions between argument-filling mood inflections and recentering reportative clitics in mood-based Kalaallisut. The resulting system is called *Update with Illocutionary Centering* ($UC_{\varepsilon\omega\|}$). It is argued that argument-filling grammatical moods, like other argument-filling grammatical categories, are restricted to top-level discourse reference. That is, the referent world has top-ranked status in the output info-state. In addition, it is usually anchored to a top-ranked modal antecedent (world or set of worlds) or to a top-ranked eventuality (e.g. the currently central speech act).

Completing Part I, Chapter 7 examines cross-linguistic evidence from nominal, temporal, and modal discourse reference in (in)direct speech and attitude reports. This evidence is used to combine $UC_{\tau\|}$ and $UC_{\varepsilon\omega\|}$ into a universal logical system, called *Update with Centering* (UC), which can represent all of the above types of discourse reference. An empirically testable hypothesis is that we can build and interpret sample discourses in any language by means of the universal combinatory rules of CG and the universal logical representation system of UC. This directly compositional framework is called CG.UC.

Throughout Part I, the focus is on cross-linguistic evidence and bottom-line representations in the current sub-system of UC. In Part II (Temporal Variation), the focus shifts to language-specific temporal systems and directly compositional analysis. The temporal systems of TENSE-based English, TENSE-ASPECT-based Polish, ASPECT-based Mandarin, and MOOD-based Kalaallisut are analyzed in turn (Chapters 8–11). In general, in an *X(-Y)*-based system, *X* (and *Y*) are argument-filling grammatical *TAM*-categories are temporal discourse reference is primarily based on *X* (and *Y*). For each system, we analyze reference to past, present, and future eventualities, indirect speech and attitude reports, as well as temporal quantification. Finally, we present a CG.UC fragment to illustrate how the universal rules of CG build discourses like (1)–(4) and translate them into UC. This small but diverse sample confirms that tensed languages have PARALLEL systems of discourse anaphora (see e.g. Partee 1973; Kamp 1981b; Stone 1997; Brasoveanu 2007) In contrast, tenseless languages have INTEGRATED systems.

That is, in tensed English (Chapter 8) and Polish (Chapter 9), temporal anaphora (to times and sets of times) is parallel to other types of discourse anaphora: nominal (to individuals and sets of individuals), aspectual (to eventualities and sets of eventualities), and modal (to worlds and sets of worlds). In a typical

sentence, the subject introduces an individual as a conversational topic, tense introduces a time, and the verbal predicate comments on the topical individual at the topic time. English and Polish instantiate two varieties of parallel anaphoric systems. English has argument-filling indexical tenses and no other argument-filling *TAM*-category. Polish has argument-filling relative tenses, parallel to argument-filling subject inflections and aspect features.

In contrast to tensed languages, which first introduce a time and then an eventuality as part of the comment about that time, tenseless languages, represented by Mandarin (Chapter 10) and Kalaallisut (Chapter 11), refer directly to eventualities. A typical sentence begins with a topic-setting constituent (or cluster), which introduces a state as a conversational topic and require the verbal predicate to comment. The verb may, for example, assert that the topic state is a central part of the verb's state. This mereological relation entails that the topic state is temporally included in the verb's state, but it also entails other types of relations – e.g. spatial inclusion, the same central individual, as well as realization in the same world. Thus, in an integrated anaphoric system, temporal relations are inseparable from other types of relations between eventualities – mereological, spatial, causal, modal, individual-related, etc. Tenseless Mandarin and Kalaallisut instantiate two varieties of integrated anaphoric systems. Mandarin has argument-filling aspect features, which introduce verbal eventualities and relate them to the topic state. Optional argument-filling person features relate to the same topic state. Kalaallisut has argument-filling moods, which assert that the top-ranked eventuality of the verb is verifiable, in the top-ranked world, from the perspective of the topic state or the currently central speech act.

Throughout the book, each language is analyzed in terms of its own grammatical and semantic categories. English-specific categories – crucial for English, but irrelevant for other languages – include: finite verb phrase, (in)definite noun phrase, indexical tense, progressive aspect, and Vendlerian aspectual classes. Polish, Mandarin, and Kalaallisut, are likewise analyzed in terms of their own categories. This methodology is not new, of course. It was applied with great success by Bloomfield, Sapir, and other pioneers of American linguistics, who left us a treasure trove of research on native American languages. Some of the best reference grammars for our sample languages also exemplify this methodology (see e.g. Chao 1968 and Henne *et al.* 1977, on Mandarin; Kleinschmidt 1851 and Bergsland 1955, on Kalaallisut). What is new here is an attempt to integrate this methodology, which views each language as a linguistic system in its own right and seeks to identify its distinctive categories, with the methodology of formal semantics, whose central quest are semantic universals. Having learned a great deal from both, I believe that the first line of inquiry is an essential prerequisite as well as the ultimate test for the latter. Grammatical categories are parochial and so are lexical meanings. What is universal are the syntactic and se-

mantic primitives that all languages use, in their own distinctive ways, to build their parochial categories and parochial lexical meanings.