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Complementarity of Space and Time in Distance Representations

Second edition

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Jacek Tadeusz Waliński

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This book is dedicated to

Professor Barbara Lewandowska-Tomaszczyk

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Introduction

Resolving enigmas of space, time, and their reciprocal relations have absorbed Western philosophers for over two millennia (Le Poidevin, 2003). Efforts undertaken to this end in philosophy, psychology, and linguistics, as well as other disciplines preoccupied with examination of the human thought have been united in the recently emerged cross-disciplinary enterprise of *cognitive science* (Frankish & Ramsey, 2012). This relatively new field of study was established in the 1970s to unite disparate efforts devoted to understanding the inner workings of the mind, or *cognition*. While psychology is the study of behavior, linguistics is the study of language, and neuroscience is the study of the brain, cognitive science is the study of the *mind*, which not only integrates findings from those disciplines, but additionally employs artificial intelligence models, computational tools, statistical formula, as well as a host of resources from other disciplines to resolve intricacies of conceptual systems.

The entanglement of space and time in the human mind is among most intensely pursued problems in contemporary cognitive science (Núñez & Cooperrider, 2013). Research discussed in this book approaches the problem of relationships between space and time in language using the framework of *corpus-based cognitive linguistics* (Heylen, Tummers & Geeraerts, 2008; Lewandowska-Tomaszczyk & Dziwirek, 2009). This approach to language study relies on explanatory notions adopted by cognitive linguistics (Croft & Cruse, 2004; Evans, 2012), but examines them in such a way that their relevance to a given linguistic phenomenon can be validated empirically with corpus linguistics methodology (McEnery & Hardie, 2012).

This study focuses on a corpus-based examination of relations between space and time in linguistic representations of distance. Selected aspects of distance explored in this book include: *topographical distance*, i.e. geographical distance that separates one point from another in physical space (Tyler & Evans, 2003); *motion-framed distance,*[1] which refers to spatial separation between places in the semantic

[1] The term *motion-framed distance* has been proposed with reference to a unified conceptual TIME-MOTION *frame* discussed by Kövecses (2005, p. 53) and *motion-framed location* discussed by Tutton (2012).

context of *motion events* (Talmy, 2000a; 2000b); and *coextension path distance* understood as denotation of spatial extension of static objects with *fictive motion* (Langacker, 2008a; Talmy, 2000b). The relationship between space and time observable for these kinds of distance in English and Polish language corpora is demonstrated through a series of empirical linguistic studies presented in Chapters 6–8. Additionally, Chapter 9 demonstrates a cognitive schema of *temporal horizon* (Fraisse, 1963; Zimbardo & Boyd, 2008) emergent from the frequency of references to *temporal distance*, i.e. duration between the present moment and a past or future event (Trope & Liberman, 2003).

These empirical linguistic studies of spatial-temporal complementarity of distance representations are based on certain theoretical assumptions discussed in Chapters 1–5. They review previous findings about cognition of space and time, and introduce conceptual frameworks used as guiding principles for the research presented in this book. A fundamental reservation that needs to be made in this context is that language does not reflect physical properties of space and time, but mirrors only what is created in the mind:

> Linguistic analysis cannot reveal the true or physical nature of space and time, for in language they present themselves only as aspects of human experience. The space and time we experience are mentally constructed, inhering in the activity of sentient creatures. (Langacker, 2012, p. 192).

This pertains both to the *basic* level of experience, which stems from our biological capability of experiencing space and time, and the level of *interpreted experience*, at which space and time are products of conscious construal in socio-cultural contexts (Langacker, 2012). This reservation does not deny, however, that space and time are *real* phenomena properly reflected in cognition. If we set a meeting with someone else at a different time and place, we are most likely to meet that person at those, mutually agreed, remote spatial–temporal coordinates. In contrast, meeting the same person in *Heaven* is much more indeterminate, and infinitely harder to pin down through scientific inquiry.

The first chapter introduces the still unresolved puzzle of temporal experience (Le Poidevin, 2007), which reflects the fact that time persistently escapes sensory perception. Subsequent sections of this chapter review observations made to date on the experience of time in different disciplines of cognitive science. Since neither research in psychology (Hancock & Block, 2012) or brain studies (Wittmann, 2013) have distinguished a definitive sensory system responsible for perception and processing of time, it still remains an open question whether we experience time directly, or perhaps indirectly through our perception of succession of events happening in time. Moreover, this chapter presents an ongoing discussion on the reflection of time in linguistic construal, which is grounded on the assumption that despite the present inability to provide a single definite answer what *time* is, differences observed in its linguistic representations are symptomatic of conceptual differences (Langacker, 2012). This presumption guides the research discussed in this volume.

Detachment of temporal conceptualizations from the concept of time *per se* means that time can be conceived in a variety of different ways. Observations of everyday conceptualizations of time across languages and cultures have uncovered a variety of different temporal conceptions based on *spatialization*, *personification*, *reification*, *commoditization*, etc., which seem to be recruited *ad hoc* in different linguistic contexts (Boroditsky, 2011b). These conceptions are reviewed in Chapter 2, which discusses cognitive frameworks relating to the linguistic construal of time, including the *conceptual metaphor* theory (Lakoff & Johnson, 1999) and the *conceptual blending* theory (Fauconnier & Turner, 2002). That chapter also presents two alternative contemporary views on metaphorization of time, which appear to mark two opposite ends of a spectrum of outlooks on temporal conceptualization. While the theory of *objectification* (Szwedek, 2009a) reduces conceptions of time to material entities that are directly perceptible through the senses because of their tangibility, the position of *temporal transience* (Galton, 2011) lays emphasis on time as immaterial dynamic process that can only be captured indirectly through changes of states observable in the world. Moreover, that chapter includes a discussion on the *structure of time* that can be observed in lexical concepts (Evans, 2003), a review of experimental psycholinguistic evidence collected to date for the cognitive validity of metaphorical conceptualizations of time, and a summary of universality vs. diversity in conceptions of time observed across languages and cultures.

Chapter 3 shifts the discussion to conceptions of space. It starts from a question of the nature of space, which was pondered over already in the pre-socratic philosophy (Barnes, 1982). That chapter reviews research demonstrating that we function cognitively in many different *spaces*, which are conceptualized in relation to functions they serve for perceptual-motor interactions (Tversky, 2009). These spaces are constructed mentally with reference to relations relevant to the task at hand, which in turn are used for constructing different *spatial frames of reference* (Levinson, 2003). Moreover, that chapter discusses a general linguistic framework for space descriptions. Since the space of common sense appears to be based on topological understanding of rough relations among spatial objects, its linguistic representation is prone to *schematization* (Talmy, 2000a). Subsequent sections of that chapter focus more specifically on construal of spatial distance, which can involve a variety of different metrics based on travel time, travel effort, or other relevant information, depending on a particular environmental context (Montello, 2009). The final part of that chapter is devoted to the role of time in *spatial situation models* (Rinck, 2005), in which temporal order appears to serve as an organizer for describing multidimensional spatial relations (Levelt, 1989; Tversky, 2004).

It has been found that construal of time draws extensively on spatial terms. Since the 1970s psychologists and linguists have converged on the idea that humans leverage the evolved capacities for spatial reasoning to systematically conceptualize time in terms of space,[2] which appears to be much more tangible to human senses. The entanglement of space and time in cognition is discussed more systematically in Chapter 4, which reviews differences and similarities in experience of space and time that have been observed in cognitive research. This chapter focuses in particular on the opposition between *asymmetric* (e.g. Lakoff & Johnson, 1999) vs. *symmetric* (e.g. Walsh, 2003) views on the relationship between space and time in cognition. Besides, the chapter reviews attempts to fit time into *temporal frames of reference* (Bender, Rothe-Wulf, Hüther & Beller, 2012; Evans, 2013a), and discusses respective roles of space and time in conceptualizations of *objects* and *events* (Langacker, 2008a).

Chapter 5 discusses the methodological background for the corpus-based cognitive research presented in this book. It starts with a brief overview of *cognitive linguistics* as one of the fastest growing contemporary approaches to the study of language and conceptual structure in the interdisciplinary project of cognitive science (Evans, 2012). Next, the discussion moves to *corpus linguistics* (McEnery & Hardie, 2012) as an empirical approach to language research. This chapter introduces a linguistic workbench used throughout studies presented in this book, including English and Polish corpora and wordnets (see *Reference materials* section following *Bibliography* for details). The final section of that chapter discusses the role of corpora in cognitive semantic studies based on the role of *usage* in the cognitive linguistic examination of meaning (Glynn & Fischer, 2010).

[2] As noted by Núñez & Cooperrider, (2013, p. 220), "Time is spatialized when, for example, an English speaker points backwards while saying 'long ago', when one uses a linguistic metaphor such as 'Ski season is approaching', or when a teacher draws a historical timeline running from left to right."

The following chapters in this volume present original empirical linguistic research. Chapter 6 explores a correlation of space and time in *prepositional phrases* (Huddleston & Pullum, 2002) expressing separation between places in *absolute terms*, i.e. denoted in (spatial or temporal) units, e.g. "fifteen miles from London" or "fifteen minutes from London". Chapter 7 demonstrates an important role of *temporality* in expressions of spatial distance in the semantic context of motion events (Talmy, 2000a; 2000b). Chapter 8 shows a tendency for *atemporality* in linguistic expressions of spatial extension of static objects described with *coextension paths* (Talmy, 2000b). Taken together, these three chapters demonstrate that denoting distance in either spatial or temporal terms appears to be modulated by the presence of the semantic element of *motion* (cf. Ramscar, Matlock & Boroditsky, 2010). This indicates that in linguistic representations of distance space and time are complementary to one another and should be viewed from the perspective of a unified conceptual frame of SPACE-TIME-MOTION, in which space and time can stand *metonymically* for each other (cf. Kövecses, 2005).

The relationship between space and time can also be approached from the opposite angle of *spatialization of time*, which in this study refers to defining subjective temporal zones to address a convenience aspect of temporal definitions (Bergson, 1922/1999). This is demonstrated in Chapter 9, which investigates a cognitive schema of *temporal horizon* (Fraisse, 1963; Zimbardo & Boyd, 2008). Research presented in that chapter shows how major zones of the temporal horizon emerge from a systematic examination of the frequency of expressions denoting absolute temporal distance found in conversations of Polish speakers. This study demonstrates that linguistic examination based on demographically annotated corpora of impromptu conversations held in informal personal contexts provides a lens on the temporal cognition unavailable otherwise. The final part of the book is devoted to Conclusions that can be drawn from the cognitive corpus-based linguistic studies presented in this volume. They summarize how in the light of this research the domains of space and time can be viewed as complementary to one another in cognition.

Time and space are not only difficult to examine, but even to think about. Time persistently escapes conscious observation efforts—its perception still remains as elusive as it is fundamental (Wittmann, 2013). Space seems to be more graspable, but its perception is more likely to be a matter of cognitive illusion originating from the primacy of the visual modality, rather than a basic fact (Jackendoff, 2002; see also Szwedek, 2009a). Although the basic construal of spatial–temporal experience is undeniably grounded on biological mechanisms developed in the course of evolution of the human species, it is the cultural development of the human race, including language as one of most vital elements, that determines its complexities. The question how space and time are tangled in cognition is far from being solved. As summarized by Núñez and Cooperrider (2013, p. 207), despite a recent cross-disciplinary surge of research in this area, plenty of questions about the different pieces that make up the mosaic of spatial–temporal relations in the human mind still remain unanswered. It is hoped that this study contributes a valuable piece of linguistic research that can be used to complement that mosaic.

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Chapter 1

Experience of time

> *Obviously, trying to define time is a fool's errand. To define a notion is to find for it an equivalent ideational construct made of some other, usually more primitive, notions . . . Any attempt to define time, therefore, is bound to be ridiculous, since nothing in this world even remotely resembles time.*
>
> Masanao Toda (1978) *The boundaries of the notion of time*

1.1 A puzzle of time experience

The nature of time has been an on-going puzzle for all of philosophy and science, including language and cognition. Essays on the problem of time were written already by presocratic philosophers, including Heraclitus and Parmenides; certain aspects of time were discussed in essays of Pythagoras and Zeno of Elea. Plato discussed time in *Timaeus*, and Aristotle in *Physics* (Barnes, 1982; Tatarkiewicz, 2005).

As noted by Le Poidevin (2011), one of the earliest and most famous systematic discussions on the experience of time is attributed to St. Augustine, who in Book XI of his *Confessions* (398AD/1978) arrived at the conclusion that past and future exist only in memory and anticipation. He asked: what is being described as short or long duration when we say that an interval of an event or time is short or long? It cannot be what is past, since what is non-existent cannot presently have any properties. But neither can it be what is present, for the present has no duration. Augustine's answer to this riddle is that the measure of time takes place in the human mind. Eight hundred years later St. Thomas Aquinas explored the difference between time and *eternity* (timelessness) in the writings of Aristotle from the point of view of neo-Platonic philosophy, concluding that eternity, as the measure of permanent being, is an attribute of God. Material things are subject to change in time and corruption because they recede from permanence (White, 1994). Besides these two studies, in the era of scholasticism[3] little advance was made in the study of time.

Starting from the Renaissance, philosophers, including Descartes, Newton, and Kant, systematically investigated the concepts of *succession*, *duration*, *subjectivity*, *objectivity*, and *consciousness*, which gradually acquired their present meanings and ultimately contributed to development of the concept of time (Roeckelein, 2000, pp. 27–34). Descartes presumed that *time perception* happens inside the human intellect or soul, hence should be regarded as innate ability (Kalkavage, 1994). Cognition of time in the human mind points toward *subjectivity of time perception*. The systematic division between *objective* and *subjective* time was introduced by Newton, who put time in the perspective of a measurable object of study. Newton asserts that *absolute* (objective) time is the only true time, which "by itself and from its own nature flows equably without relation to anything external" (Newton, 1687/1995, p. 6). In contrast, *subjective* time is a measure of duration exemplified by the calendar, which makes it relative to human perception (Harre, 1994; DiSalle, 2006, pp. 20–25; Rynasiewicz, 2012).

The psychological aspect of the concept of time was advanced by Kant, who asserts that we perceive reality not only through physical experience, but mostly with an innate apparatus of *a priori knowledge* that includes perception of time and space (W. Walsh, 1967; see Pinker, 2007a, pp. 157–163 for a review of Kant's views on time and space from a modern cognitive perspective). For Kant the experience of time is a form of inner sensible intuitions required to perceive anything at all. Hence, time as such does not exist in the physical world independently of psyche. Later, 19th- and 20th-century philosophers, including: Henri Bergson (1889/2001; 1922/1999), Edmund Husserl (1917/1991, 1928/1964), and Martin Heidegger (1927/2002) made important contributions to the phenomenology of time. Different outlooks on the experience of time are discussed in ample literature (e.g. Le Poidevin & MacBeath, 1993; Le Poidevin, 2003, 2007, 2011; Dainton, 2010a; Markosian, 2013; and references therein), which presents a wide variety of philosophical views on the perception and consciousness of time.

At the turn of the 20th century the problem of time experience had already been a subject of profound psychological analyses and experimentation (e.g. James, 1890; Mach, 1886). An early dictionary of psychology (Warren, 1934) provides the following systematization of notions related to time in the psychological inquiry: *time* is the measurable aspect of duration; *psychological time* is the subjective impression of the temporal experience of duration; *time perception* is the apprehension of the amount of duration of experiences;

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[3] For a review of biblical references to time, see Roeckelein 2000, pp. 11–20.

temporal perspective is the memory for the relative distance in time. It also distinguishes *time perception* from *perception time*, defining the latter as the time that elapses from the presentation of an object to its recognition by the observer. This chapter presents a concise overview of modern cognitive research on various aspects of temporality in the human mind. It focuses predominantly on those aspects of subjective time experience that appear to be, to some extent, relevant to linguistic representations of distance.

1.2 Time perception and processing

There is abundance of research on the psychology of time because time is one of the most compelling and universal cognitive dimensions of experience. Time is important not merely to psychologists, but throughout all of science and human life. As pointed out by Hancock and Block (2012), the problem of time perception is difficult to pursue because in comparison to other dimensions of experience time is quintessentially non-observable. Ornstein (1969, 1972) summarized the psychological problem of time perception in the following manner:

> There is no process in the external world which directly gives rise to time experience, nor is there anything immediately discernible outside ourselves which can apprehend any special 'time stimuli'. It is therefore not too surprising that psychological research on time as a dimension of consciousness has been so diverse, so incoherent, and so easily forgotten (Ornstein, 1972, p. 96).

This observation is true for the study of time in general. Gibson (1975) ostensibly resolved the problem of time perception by pointing out that what we perceive are events in time, not time *per se*: "the perception of time is a puzzle of the same sort that the perception of space has been – an insoluble one. There is no such thing as the perception of time, but only the perception of events and locomotions" (Gibson, 1975, p. 295). Lakoff and Johnson (1999, p. 138) used this point of view to define time as a *metonymical phenomenon* relating to recurrence of events (see also Kosecki, 2005; 2007; Peirsman & Geeraerts, 2006; cf. Croft, 2006).

However, Evans (2003, pp. 63–65) argues that our conceptions of time may not relate as much to the awareness of change perceptible in events, but rather to the *subjective experience of duration*. He asserts that the ability to experience duration is a prerequisite for the awareness of change, not vice-versa. He points out the fact that "we actually experience the 'passage' of time whether there has been a change in the world-state or not" (Evans 2003, p. 64). It is evidenced in situations of relative sensory-deprivation, e.g. in windowless, soundproof chambers, or caves deep down the ground, in which subjects are still aware of the passage of time[4] (Rasmussen, 1973/2007).

Time is generally regarded as *linear*, therefore it is discussed in psychological studies either as *protensive*, i.e. perceived cognitively as extending ahead into the future, or as *retrotensive*, i.e. perceived cognitively as extending back into the past (Kastenbaum, 1994). Block (1990) distinguishes three major aspects of psychological time: time as *succession*, which reflects the sequential occurrence of events from which we perceive (or infer) temporal succession and order of events; time as *duration*, which reflects different characteristics of events, since all events persist for certain duration and are separated by time periods that may contain other events; and time as *temporal perspective*, which refers to the experiential and conceptual understanding of the past, the present, and the future, which form a continuous timeline.

Fraisse (1984) distinguishes between *perception of duration*, which involves the psychological present, and *estimation of duration*, which takes place when memory is used either to associate a moment in the past with the present or to link two past events. Psychological studies embracing memory of the past time follow several paths (see Block & Zakay, 2008 for a review). One involves the *chronology of events*, i.e. the memory of the order of occurrence of events. Another deals with *retrospective timing*, i.e. remembering the duration of a past event or activity. Retrospective timing embraces two major processes: one is *location based* and consists of judging how recent events are, the other is *distance based* and involves estimating the amount of time that has elapsed between a past event and the present moment. *Prospective memory* involves time estimation, formulating plans, and remembering to perform a planned action or intention in the future (Block & Zakay, 2006).

Grondin (2008, 2010) notes that time does not have clearly defined categories of experience because sensory modalities involved in the perception of time are not distinct. Fraisse (1978; 1994) maintains that we have no specific time sense as such, but only sensory perception of particular *sequences* and *rhythms*, including *cosmic*, e.g. day and night, change of seasons; *biological*, e.g. heartbeat, respiration, circadian rhythms; and *perceptual*, e.g. in music (see Large, 2008). Kastenbaum (1994) notes

[4] Psychological studies of sensations experienced in sensory deprivation were popular in the 1960s. Research of alterations in temporal experience during isolation from the environmental stimuli was inspired by accounts from people trapped in caves reporting a shortening of duration experience during isolation. Although such studies usually concluded that experienced duration is affected by sensory deprivation relative to normal environmental conditions, all subjects isolated or nearly isolated from external stimuli continued to experience temporal duration. See Rasmussen, 1973/2007 for a review of studies conducted in that period.

that it is highly probable that the passage of time is not sensed by a single, independent function of the human organism, but is derived from multiple feedbacks, as we respond to both internal and external environmental stimuli.

Cognitive frameworks of time perception can be generally classified into dedicated vs. intrinsic models (see Ivry & Schlerf, 2008; Grondin, 2010 for reviews). *Dedicated models* entail some sort of specialized mechanisms used for representing the temporal relationship between events. For example, *internal-clock* hypotheses, which have been proposed for over 50 years (e.g. Treisman, 1963; Gibbon, Church & Meck, 1984), are based on the idea of a central *pacemaker–counter* device. It is assumed to emit pulses, similar to the ticks of a clock, which are accumulated in memory and used for measuring intervals of experienced duration. An alternative line of research posits that the mechanism responsible for estimating temporal duration involves *oscillatory processes* (see Matell & Meck, 2004 for a review). It assumes that the accuracy of temporal judgments depends on the capacity to synchronize the internal rhythm set by neural oscillators situated in the brain with the corresponding level of external rhythms offered by the environment.

On the other hand, *intrinsic models* of time perception promote the idea that there is no central mechanism dedicated to time sensing. Generally, this view assumes that sensory and cognitive processes that are not specifically dedicated to temporal perception act additionally as interval timers. For example, *attentional models of time perception* (Zakay & Block, 1997) assume that both retrospective and prospective timing is influenced by attention allocations in intervals of time: the more attention is focused on a non-temporal task, the less attention will be left over to notice the passage of time. The impact of cognitive load on duration judgments seems to explain why "time flies" when we are engaged in a task at hand (Block, Hancock & Zakay, 2010). However, the present state of research leaves us unsure whether there is one central mechanism or several discrete non-dedicated mechanisms involved in the perception of temporal intervals ranging from seconds to years, and the full lifetime.

Generally, it has been observed that an increase or decrease in vital functions consistently leads to underestimations and overestimations of time intervals. For example, a raised *body temperature* (Wearden & Penton-Voak, 1995) or *pain* (Somov, 2000) is associated with longer duration estimates, i.e. time appears to proceed more slowly than usual. Likewise, acceleration or slowing down of the subjective perception of time passage can be triggered by taking *stimulants* or *narcoleptics* (Meck, 1996). Moreover, a strong association between *affective states* and the experience of time has been found. Our sense of time is easily distorted by our emotions in pleasant or unpleasant contexts: time seems to fly when we are having fun, but drags when being criticized by the boss (Droit-Volet & Meck, 2007). The perception of temporal distance to a future event is shaped by the effort one must invest to realize the event (Jiga-Boy, Clark & Semin, 2010). Even *listening to music* affects the perception of time passage[5] (Bailey & Areni, 2006; Droit-Volet, Bigand, Ramos & Bueno, 2010).

Other studies have demonstrated vast individual differences in time estimation accuracy. For example, *gender* exerts a relatively small but consistent effect on the perception of brief durations. Females were found to underestimate produced brief intervals (in the order of seconds) compared with males, but overall their responses proved to be more accurate than those of their male peers (Hancock & Rausch, 2010). Additionally, our experience of time seems to be affected by *personality* and *lifestyle*. Extraverts have a tendency to overestimate time and to make less accurate time judgments in comparison to introverts (Eysenck, 1959; Rammsayer, 1997).

Although these findings clearly demonstrate that the perception of time is subject to inter- and intra-individual variability, after 125 years of research psychology has not yet distinguished a definitive sensory system responsible for perception and processing of time (Hancock & Block, 2012). Neither has research in neuroscience found the neural basis for the processing of temporal intervals and the experience of duration[6] (Wittmann, 2013).

1.3 Consciousness of subjective time

There is an ongoing phenomenological debate started by William James (1890, Ch. XIV) on the presumed *puzzle of temporal consciousness* (Le Poidevin, 2004; S. Kelly, 2005), which embraces two complementary, yet seemingly paradoxical aspects of *temporal experience*: (a) what is experienced is experienced *now*; (b) the passage of time is often described as a *stream* or a *flow*. Taken together *temporal consciousness*[7] consists of a window of presence in the continuous flow of time related to what is

[5] In experiments conducted by Bailey and Areni (2006), the estimated duration of a given interval was shorter when familiar as opposed to unfamiliar music was played to respondents waiting idly. A subsequent study (Droit-Volet, Bigand, Ramos & Bueno, 2010) found that such an effect occurs regardless of the emotional valence of music presented in a major (happy) or a minor (sad) key.

[6] Perception of time and distortions in time processing are also examined in psychiatry, neuropsychology, and neurobiology. Temporal disorders are observed, for example, in ADHD, social issues, memory disorders, and a wide variety of psychopathologies. See volumes edited by Szeląg & Wittmann (2004) and Wittmann & van Wassenhove (2009) for reviews of neural mechanisms involved in the experience of time.

[7] Studies on time and consciousness contributed to the development of a separate area of research devoted to *chronesthesia*, i.e. awareness of subjective time (Tulving, 2002).

happening right now. A number of conceptual models have been proposed to solve the paradox how it is possible to perceive duration, when our experiences of time are confined to the present moment (see Droege, 2009; Dainton, 2010a).

Findings in cognitive neuroscience and psychophysics indicate that time perception operates at three basic levels termed *temporal windows* (Pöppel, 2009; Wittmann, 2011). A basic building block of temporal experience is defined by the border between simultaneity and succession, since below a certain *temporal threshold*[8] (Fraisse, 1984; Dainton, 2010b) temporal order is not perceived. This elementary unit of temporal experience, labeled *functional moment*, is a snapshot of temporal perception that operates within the range of milliseconds. The lowest threshold of detection is observed in the auditory system, where two short acoustic stimuli, which are only 2–3 ms apart, are detected as non-simultaneous. The visual and the tactile system have thresholds of some tens of milliseconds; inter-modal stimulation results in higher thresholds.

A larger unit of temporal integration is an *experienced moment*, which is assumed to operate within the range of about 3 seconds[9] (Turner & Pöppel, 1983; Pöppel, 2004). A temporal interval exceeding about 3 seconds is experienced as being qualitatively different than shorter duration, e.g. a pause in a conversation exceeding 6 seconds, might be felt as disturbingly long (Wackermann, 2007). In that sense, longer duration leads to a phenomenon based on working memory, which encloses a sequence of experienced moments for the representation of *mental presence* (Wittmann, 2011). Consequently, our momentary experience of *nowness* is likely to be embedded in a temporal field that stretches across time reaching both into the past and into the future (Droege, 2009).

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[8] The question of *perceptual temporal threshold* was originally raised by William James, who asked "What is the minimum amount of duration which we can distinctly feel?" (James, 1890, p. 613). Fraisse (1984) discusses temporal thresholds of *succession* and *duration*. Dainton (2010b) discusses temporal thresholds of *simultaneity*, *succession* and *integration*.

[9] An interesting piece of evidence on about the outer limit of the experienced moment is based on *rhythms in poetry*. In the paper entitled "The Neural Lyre", F. Turner and Pöppel (1983) demonstrate that the fundamental unit of metered poetry, which they call LINE, contains a different number syllables, depending on the tonality of language. However, despite the difference in the number of syllables involved, the LINE takes nearly always 2–4 seconds to recite across a diverse set of analyzed languages, including Ancient Greek, Chinese, English, French, German, Japanese, Latin, and other less systematically measured languages. This largely universal *temporal organization of poetic meter* suggests a correlation between the three-second LINE and the three-second auditory present of the experienced moment, which is likely to be tuned to the timing mechanism that coordinates rhythmic behavior. Turner and Pöppel (1983) hypothesize that possibly poets have an implicit knowledge of the temporal machinery of the human brain and use the temporal platform of 3 seconds as a formal basis for poetic expression.

The experienced moment functions as an implicit aspect of any conscious experience. It is assumed to be created by a cognitive processing mechanism that segments sensory experience into temporal windows, which are subjective mental constructs without physical existence. Experimental evidence for existence of such temporal windows comes from a variety of studies (see Pöppel, 2009; Wittmann, 2011 for reviews from neuroscience). Experienced moments are required for cognitive synthesis of music[10] and spoken language, since these acoustic events can only be understood in temporal relation to the preceding and the following elements (see Wittmann & Pöppel, 2000). Whereas the duration of the functional moment is not perceived, the experienced moment has duration, which is believed to provide a basis for the feeling of the *psychological present*[11] (James, 1890; Fraisse, 1984).

1.4 Compression, protraction, and acceleration of time

Both the perceived and the estimated progression of time are highly subjective. Under conditions of extreme stress people often experience distortions of time, which have been reported by professionals encountering life-threatening conditions in aerospace, military, and fire-fighting operations, etc. (Hancock & Weaver, 2005). From a relatively short temporal perspective, a particular situation can be perceived to pass quickly if *attentional engagement* in the situation is high (Block et al., 2010). On the other hand, from a longer temporal perspective, a large number of changes happening in a short period of time makes people remember that time period as long, which can be explained by a lot of changes leaving a richer memory trace, which increases the remembered duration[12] (Ahn, Liu & Soman, 2009).

In sociology, lengthening and shortening of subjective temporal experience was investigated by Flaherty (1993, 1999), who found that when the density of conscious

[10] Music is only conceivable as consisting of extended moments, melodies, and phrases, which inter-connect individual musical elements. An intuitive example of temporality in music was presented by Dan Lloyd (2010): "As Paul McCartney lands on 'Jude', the 'Hey' is retained though no longer sensed. Likewise, as 'Jude' sounds, we anticipate something to follow ('Don't make it bad', if one knows the song, or something less definite.) To perceive a song requires that its notes be held in awareness in a temporal structure".

[11] The framework of the *psychological present* was first identified by William James (1890, Ch. XV) as the time interval, a few seconds in length, in which we experience the flow of events as being simultaneously available to perceptual or cognitive analysis.

[12] The study by Ahn, Liu and Soman (2009) showed that participants in a presentation estimated a slide show with a lot of changes as shorter than a slide show with only a few slides immediately after the presentation, but after 3 days, when their time judgment was memory-based, the more dynamic presentation with a lot of changes was estimated as longer.

information processing is high, people estimate the progression of time to pass slowly. This phenomenon, which Flaherty terms *protracted duration*, occurs in problematic circumstances that provoke emotional concern and cognitive involvement, e.g. in times of an economic crisis. On the other hand, situations when one can act in a relatively mindless fashion lead to an impression that time has passed quickly, i.e. *temporal compression*. These findings suggest that variation in the experience of time occurs not so much due to individual cognitive differences, but rather because people find themselves in different kinds of circumstances.[13]

A largely related phenomenon that has been studied extensively in psychology concerns *subjective acceleration of time*, i.e. the illusion that time appears to pass more rapidly in later adulthood than when one was younger (Draaisma, 2004). As noted by Janssen, Naka and Friedman (2013) a large number of studies demonstrate that about 70% of the people feel that time is currently passing faster than it did in the past. Different theories have been proposed to explain the apparent acceleration of time's passage. For example, James (1890, p. 625) and Fraisse (1984, p. 29) attributed this phenomenon to a decline in the number of memorable events experienced in later adulthood. Internal clock theories attribute this change to slowing down of an internal pacemaker (Draaisma, 2004, pp. 219–222). Attentional explanations hypothesize that the acceleration of time can be explained by a general decrease in the attentional resources caused by aging (Gruber, Wagner & Block, 2004).

Another explanation of why time seems to accelerate as we advance in age comes from a phenomenon called *forward telescoping*. Studies of memory (Crawley & Pring, 2000) observed that older people have a tendency to date events as being more recent than they actually are. When people learn that they have underestimated the age of an event, they have the impression that time is passing faster than it used to be (Draaisma, 2004, pp. 215–217). The latest studies on aging and the speed of time (Friedman & Janssen, 2010; Janssen et al., 2013) have suggested that the phenomenon of subjective acceleration of time is likely to be caused by *time pressure*. We seem to be susceptible to a general

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[13] Anecdotal accounts of protracted duration and temporal compression can be found in fiction. For example, Bryson (2006, p. 29) provides a description of *protracted duration* from a childhood perspective: "One of the great myths of life is that childhood passes quickly. In fact, because time moves more slowly in Kid World—five times more slowly in a classroom on a hot afternoon, eight times more slowly on any car journey of more than five miles (rising to eighty-six times more slowly when driving across Nebraska or Pennsylvania lengthwise), and so slowly during the last week before birthdays, Christmases, and summer vacations as to be functionally immeasurable—it goes on for decades when measured in adult terms. It is adult life that is over in a twinkling".

impression that we are currently experiencing more time pressure than we experienced in past periods, which results in the feeling that objective time is passing more quickly than in the past.

An increase in time pressure is related to *social acceleration of time*. The profound changes in the last decade of the 20th century related to an unprecedented advances of information and communication technology, have entailed a new perception of time, which Castells (2000) terms *timeless time*. For example, timeless time of the Internet enables us to review several different documents at the same time, makes it possible to be in several places at the same time, or enables us to participate in more than one activity in one place. Gleick (2000, p. 11) grieves over the speed-soaked culture of the modern times characterized by "fast ovens, quick playback, quick freezing, and fast credit". He notes that paradoxically for all the hours, minutes, and even seconds being saved we cannot find time for such basic human activities as eating, sex, and relating to our families.

In a similar vein, Eriksen (2001) discusses *tyranny of the moment* in the information age. An increased speed of life in the *information society* (or *network society* as termed by Castells, 2000) influences the experience of temporal aspects of our daily functioning. The core of Eriksen's argument is that gaps of time normally used for free-floating slow thoughts have been systematically eradicated in the information age. As a result, our attention is so firmly fixed on the present moment, that existence is gradually becoming a continuous chain of events with a dissolving notion of time. This leads to various adverse side effects, including simplification, superficiality, loss of precision, assembly line effects, and general feeling of insecurity in modern societies.

The shaping of the temporal experience by our functioning in the society results from *time embeddedness*, which was described in the sociology of time by Lewis & Weigert (1981). Because all modern industrialized societies function in accordance with the time of clocks and calendars, all social acts are temporally fitted inside of larger social acts. We assign time available for our individual activity according to schedules, deadlines, and other temporal arrangements set by the social models of functioning (see Zimbardo & Boyd, 2008, pp. 37–41 for a discussion how profoundly the *transition from event to clock time* changed economic relations in society). It seems that in the course of the socio-cultural development, starting with the invention of the clock and constitution of our existence with it (see Fauconnier & Turner, 2002, pp. 195–198; Roeckelein, 2008, pp. 5–7), time has been becoming increasingly linear, measurable, consecutive, predictable, and has recently become rather disturbingly irrelevant.

1.5 Time in linguistic construal

As noted by Langacker (2012, p. 203), because time is hard to describe or even think about, it remains an open question whether we directly experience time or our temporal experience is limited to merely observing the succession of events. Langacker (2012, pp. 191–192) asserts that in order to properly interpret linguistic evidence in relation to time we need to distinguish two different levels of temporal experience. The level of *basic experience* reflects our biological aptitude of organisms potentially capable of experiencing time passage, which can be reasonably presumed to be comparable among all human beings. This "raw" experience of time is related to our background awareness rather than conscious reflection. As a fundamental cognitive aspect of temporality, it functions as an organic medium for apprehension of other entities.

On the other hand, at the level of *interpreted experience* time is the product of cultural elaboration and transfer from generation to generation. This conscious kind of temporal experience is derived from time as an object of conception and analysis. Langacker notes that both individual and culturally constructed conceptions of time are significantly influenced by a variety of socio-cultural frames reflecting ideas and patterns widely held and used in the society (see also Goffman, 1974). Consequently, the interpreted experience of time is complex, multifaceted and highly variable. Langacker (2012, p. 192) adds that since the conception of time includes both basic and interpreted experience, both universal and language-specific properties can be used to investigate the nature and role of time in cognition. It applies in particular to linguistic research of the relationship between time and space as fundamental domains of experience.

Language and time are related in cognition in many reciprocal ways. Language has been developed in time, and linguistic communication takes place in time. Language also serves as a principal means for understanding time, i.e. its structuring, representing, and conceptualizing (e.g. Allwood, 2002; Evans, 2003; Kosecki, 2008; Jaszczolt 2009, 2012; Lewandowska-Tomaszczyk, 2014). Languages afford a wide variety of overt means used for referring to time, including *grammatical markers of time* (tense, aspect, mood and modality), and *lexical markers of time*, such as temporal adverbs and temporal connectives. They are used to refer to the past, present, and future time as well as to convey relative temporal ordering of events. Jaszczolt (2012) emphasizes that languages additionally offer a wide variety of indirect ways of temporal reference. This is achieved with pragmatic devices, which range from the automatic assignment of salient interpretations to overtly tenseless expressions, to relying on the addressee's active, conscious inference of the time relevant to a given situation, which is common to the interlocutors in the particular context.

Of all linguistic devices used to structure time, tense markers traditionally have received probably the greatest attention. *Tense* situates the process described by the verb with respect to the time of the speech act (Comrie, 1985). English has an apparently simple system of absolute tenses, which divides time into present (time more of less simultaneous to the time of the speech act), past (time prior to the time of the speech act), and future (time subsequent to the time of the speech act). Every clause in English encodes time in the form of a tense morpheme attached to the verb, which puts time in a distinguishably prominent position in comparison to any other dimension of experience. Tense markers are found on verbs in the form of *affixes*, e.g. "walk – walked", or *vowel change*, e.g. "sit – sat", which marks them for present or past time, respectively. It is noteworthy that futurity is marked in English tense system not directly by tense markers on verb forms, but rather by *mood* and *modality* (Palmer, 2001), e.g. with *shall* and *will*, or dedicated grammar constructions, e.g. *be* + going to.

There is a substantial variation in the system of tenses used across languages. Polish marks verbs for past, present, and future forms (Fisiak, Lipińska-Grzegorek & Zabrocki, 1987, Ch. 3), but Chinese does not express time by changing the forms of verbs (Comrie, 1985). Instead, the process described by verb is anchored in time with *adverbial expressions* such as *now*, *tomorrow*, *then* etc., which are used more frequently than in English, and through *linguistic* sequencing of events (Allwood, 2002). Some languages do not seem to distinguish tenses at all (see Everett, 2005). Even in a relatively simple system of tenses used in English, the temporal meaning depends to a great extent on conceptualization. The present tense can be used to reference to past events in the so-called *historical present*, e.g. "Yesterday, she comes up to me and asks me to go out", or to reference to *scheduled future*, e.g. "The train leaves in five minutes" (Croft, 1998; Langacker 2008a).

Tense situates events in time with respect to the time of the speech act, but it does not refer to the internal temporal structure of events. This is addressed by aspectual grammatical constructions. *Aspects* can be essentially defined as "different ways of viewing the internal temporal constituency of a situation" (Comrie, 1976, p. 3) Verb aspect denotes an onset, duration, and completion status of event. A *perfective* aspect conveys an outside event perspective, and permits one to view the event as a complete whole. An imperfective aspect makes explicit reference to the internal temporal perspective of the situation, and enables one to view the event to be in a middle stage of completion (Comrie, 1976). Although tense and aspect are different grammatical phenomena they do interact a complementary manner for temporal anchoring of events (Croft, 1998; Ter Meulen, 1995; Radden & Dirven, 2007, Part III; see also Bielak & Pawlak, 2013 for a review from the ELT perspective). Their interface works differently in different languages (Comrie, 1976, Ch. 4).

Temporal representation in language is also closely tied with *mood and modality*, which refers to phenomena that have to do with the concepts of possibility, probability, certainty, and necessity deployed in everyday human thought and talk (Palmer, 2001). Jaszczolt (2009, 2011) looks for a common denominator for time as a subjective mental construction on the one hand, and a metaphysically objective property of the universe on the other in an underlying concept of modality. She starts from the assumption that time can be viewed in two basic manners, which was originally proposed more than a century ago by the philosopher John McTaggart in his famous philosophical essay titled *The Unreality of Time* (1908).

McTaggart (1908; see Le Poidevin, 2003, 2007 for reviews) proposed a fundamental distinction between two ways in which we order events in time, which he called "A-series" and "B-series" of time. The *A-series* is the series of events ordered as running from the past, through the present, to the distant future. An event's position in the A-series is constantly changing: once it ceases to be present, it continues endlessly to recede further into the increasingly remote past. On the other hand, the *B-series* is the series of events ordered by means of two relations: precedence and simultaneity. The locations of events in the B-series do not change: if at one time an event, e.g. *the World War I*, is earlier than another event, e.g. *the World War II*, it is the case at all times that the first World War precedes the second one, despite the fact that from the current perspective they both belong to the past.

McTaggart's distinction allows to distinguish between two kinds of temporal expression: tensed (A-series) expressions and tenseless (B-series) expressions. The *tensed* expressions help to locate events in the A-series. Examples of this kind of expression are: "We will visit the museum tomorrow", "She is arriving at the station right now", "I last met her two weeks ago", etc. The *tenseless* expressions help us to locate events in the B-series, e.g. "The total solar eclipse takes place on *11 August 1999*". As noted by Le Poidevin (2003):

> Most ordinary sentences in English are A-series expressions, in that any verb will typically be tensed, i.e. its inflexion will indicate position in the A-series: 'Enid *is* dancing', 'Eric *wishes* to speak', 'Frank's performance *was* grotesque', 'Hermione *astounded* the spectators', 'Jeff *will be* here shortly.' When philosophers wish to use an expression that is truly *tenseless*, i.e. one that does not indicate position in the A-series, however vaguely, they often have to resort to rather artificial expressions, such as 'The Armistice OCCURS (tenselessly) on 11 November 1918', or 'The Sun BE 8 light-minutes from the earth.' (Le Poidevin, 2003, p. 129)

He adds that although such tenseless expressions sound awkward, they are undoubtedly useful in philosophical discussions (see Smart, 2008 for a current review of the tenseless theory of time).

McTaggart (1908) used the distinction between A-series and B-series of time to argue that there is in fact no such thing as *time* and that the temporal order of reality is a mere illusion. Although his conclusion that time is unreal and all statements which involve its reality are erroneous has been generally rejected, his distinction between the tensed and the tenseless conceptions of time have been widely accepted. It is noteworthy, however, that the distinction between these two series of time originates from a metaphysical discussion (see Markosian, 2013 for a review of the debate it has beeen generating ever since), not from objectively observed facts in the domain of time. In fact, we cannot see what time actually is. Therefore, it is a matter of convention, which is useful only as long as we assume that A- and B-series of time are universally valid representations of time (see Everett, 2005; Sinha, Sinha, Zinken & Sampaio, 2011 for accounts of two different Amazonian tribes, who do not use such a system of temporal reference). Moreover, even in cultures which do use this system of temporal reference, language users do not seem to put a great importance to this particular distinction, as it typically goes unnoticed in our everyday speech and thought.

Jaszczolt's (2009) argumentation for time as epistemic modality stems from the observation that although we all have a concept of time, it does not automatically mean that it acts as the basic building block in the conceptualization of time. For instance, one prevalent way of thinking about time is conceptualizing it as motion that flows from the future, reaches our subjective present, and then flows into the past, which corresponds to the A-series of time. Jaszczolt questions time conceptualized in this subjective manner, or *internal time* as termed in her essay, as being "real" with reference to metaphysical time in which events occur one after another without relation to our subjective perception (B-series), which she terms *real time*.

From this outlook, the internal time is a kind of convenient illusion that our minds create to come to terms with the fact that we normally anticipate changes of states or events, then experience them, and then retain some of them in memory once they passed. But it is merely a partial reflection of metaphysical time that exists without relation to subjective presentism. Jaszczolt suggests that both these seemingly inconsistent series of time belonging to different levels of description are not necessarily incompatible. They interact with each other through what she terms *supervenience* and defines as "dependence in the sense of constitutive characteristics" (Jaszczolt, 2009, p. 2; cf. *temporal supervenience*[14] in Sattig, 2006).

According to Jaszczolt, temporality is inherently modal: real time can be attributed to the sense of metaphysical probability and relativity, while the internal time can be attributed to the sense uncertainty, i.e. *epistemic detachment* (or alternatively *commitment*, Jaszczolt, 2011) of the speaker. Thus, on the underlying level of basic concepts temporality can be viewed as *epistemic modality* , i.e. "a speaker's commitment to the truth of a proposition" (Bybee & Fleischman, 1995, p. 6; see Cann, 1993 for an introduction to truth-conditional semantics), that relates temporal concepts of past, present, and future eventualities to the degree of the probability assumed by the speaker. Jaszczolt argues that the internal time supervenes both on modality by virtue of being epistemic detachment, but also on real time, (or *spacetime*, if we assume Einstein's (1916/1952a) Theory of Relativity), in which alternative histories and predictions about the universe develop.

Levelt (1989) argues that the linguistic representation of time is basically an attempt to translate a flow of events from perceptual experience into words and sentences. For that reason, the order in which events are reported in discourse normally follows their chronological order. However, the default temporal order can be overridden with temporal adverbials, which can be observed in narratives (Ter Meulen, 1995; Zwaan, Madden & Stanfield, 2001). There are also some more idiosyncratic ways of structuring temporal relations in language. For example, reduplication can be used to indicate that a process is extended over time, e.g. "And she ran and ran and ran…", which is often found in children's literature. Vowel lengthening in intonation can be used to indicate a longer than usual duration, e.g. "That was a loooong meeting", which is frequently found in everyday speech (see Allwood, 2002; Lewandowska-Tomaszczyk, 2014 for examples of other linguistic devices used to mark temporality). It is noteworthy that linguistic means used to express temporal relations are both universal as well as specific to the particular language and culture (see Jaszczolt, 2012; Lewandowska-Tomaszczyk, 2014 for reviews).

In a series of publications discussing various aspects of temporality in Cognitive Grammar, Langacker (e.g. 1986, 1987a, 1991, 2008a, 2012) points out that if we want to learn about conception of time from its linguistic manifestations, we first need to sort out the distinction between *processing time*, i.e. time functioning as the

[14] Sattig (2006) argues in favor of logical supervenience of *ordinary time* that entails past, present, and future (i.e. the subjective time) on the physical time as an element of four-dimensional spacetime. "I find it overwhelmingly plausible that all facts about ordinary time logically supervene on facts about spacetime; what goes on in spacetime fully determines what goes on in ordinary time. This is the general thesis of temporal supervenience." (Sattig, 2006, p. 1).

medium of conception, and *conceived time*, i.e. time functioning as the object of conception. He emphasizes that conceived and processing time are difficult to separate. We can reasonably presume that processing of relations occurs simultaneously in multiple dimensions and on different time scales. Each instance of conceptualization is inherently dynamic because it is something that happens through mental processing (neural activity) regardless of properties of the conceptualized entity. Hence, a certain amount of processing time is required even for conceptions of atemporal static configurations.

Time functions in language in two basic ways. Firstly, it serves as the background domain used for profiling temporal aspects of events (see Section 4.7). Secondly, time can be profiled as the foreground domain that is "put onstage" as the focus of attention. Langacker (2012, p. 192) proposes a model that illustrates construal of time in relation to alterations of focal prominence between *subject* and *object* of conception, which is shown in Figure 1.1.

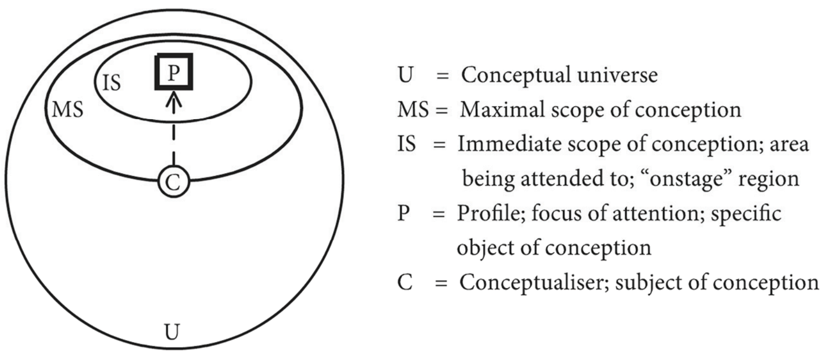

Figure 1.1 Subject and object of conception in apprehension of time

The large circle (**U**) in the model presented in Figure 1.1 represents our conceptual universe, i.e. everything we are capable of conceptualizing, which exceeds the boundaries of the real world as we perceive it. The *subject* of conception is a conceptualizer (**C**), who is situated in the centre of the universe.[15] As shown in the model, conceptualizer apprehends only a portion of the universe. The *maximal scope* (**MS**) comprises everything conceptualizer is generally aware of, and the *immediate scope* (**IS**) is the conceptual area being attended for a particular purpose.

[15] Situating conceptualizer's experiential standpoint in the centre of the universe corresponds to the *anthropocentric* view proposed by Protagoras (Barnes, 1982, pp. 430–432). It is noteworthy that Levinson (2003) considers this outlook as a bias resulting from the traditional European perspective.

Langacker describes it metaphorically as the "onstage region".[16] The specific *object* of conception, i.e. conceptualizer's focus of attention at the particular moment is termed by Langacker as *profile* (**P**). In apprehension of time, the *processing time* is an aspect of conceptualizer's processing activity, whereas the *conceived time* is a facet of the universe that conceptualizer is capable of apprehending. This model functions in an analogous manner in relation to apprehension of space.

As an object of conception, *time* itself functions in several different manners. It is an abstract entity expressed by a mass noun, e.g. *much time, enough time, more time*, etc., but also appears as a bounded entity in complex expressions that designate a specific point in time, e.g. *instant, moment, (at) that time*, etc., or an interval of time, e.g. *period, span of time, length of time*, *during the time of*, etc. All these expressions incorporate the concept of time directly (Langacker, 2012; see also Evans, 2003, 2005 for a discussion on different senses of time). There are also numerous expressions that designate temporal points or intervals indirectly. These include both common nouns like *minute, hour, day, week*, etc. and proper nouns like *Monday, January*, and *1971*. They make reference to time by invoking complex conceptual frameworks derived from the clock and calendar as devices used to measure time and distinguish temporal locations (Evans, 2003, pp. 127–128; Fauconnier & Turner, 2008). Generally, apprehension of time takes place through mediation of other concepts that are more tangible to human senses, which is discussed in the following chapter.

[16] Langacker describes an expression's *scope* as the array of conceptual content using a perceptual analogy of a viewer watching a theatrical play: "Consider a person seated in the audience watching a play. With respect to this familiar viewing arrangement, a number of constructs might be characterized: (i) the *viewer*, who has the perceptual experience; (ii) the *perceptual relationship* between the viewer and what he perceives; (iii) the *full perceptual range*, subsuming everything that falls within his visual field (the stage, surrounding portions of the theatre, part of the audience); (iv) the *general locus of viewing attention*, namely the stage; and (v) within that area, the *specific focus of attention* (usually one of the actors)." (Langacker, 1993, p. 330).

Chapter 2

Conceptions of time

This, in fact, is the power of the imagination, which, combining the memory of gold with that of the mountain, can compose the idea of a golden mountain.

Umberto Eco (1980) *The Name of the Rose*

2.1 Indirect apprehension of time

An outlook on the nature and status of time depends to a great extent on whether we refer to subjective physiological/neurological *experience of time,* which was discussed in the previous chapter, or psychological/linguistic *conceptions of time,*[17] in which the temporal experience is turned into temporal concepts construed by conscious structuring and analysis in socio-cultural contexts (Langacker, 2012). Irrespective whether we approach the linguistically expressed conceptions of time as derived from *subjectively real experience* (Evans, 2003) or a *metonymically abstracted perception of recurring events* (Lakoff & Johnson, 1999), they are not discussed on their own terms, but depend on elaborate mechanisms of conceptual representation frequently engaging metaphors.

Metaphor was discussed already by Aristotle in *Poetics* (335BC/1995a) as a sign of language mastery. However, Aristotle regarded metaphor as an ornamental linguistic device, more appropriate for poetry than for scientific discourse. Because of Aristotle's relegation of metaphor to stylistics, practically until the late 19th century, the study of metaphor was largely restricted to literary research, which focused on the interpretation of particular texts. In 1897 French philologist Michel Bréal published *Essai de Sémantique*, which sparked a new interest in metaphor

[17] Núñez and Cooperrider (2013, p. 220) describe the difference between *perception* and *conceptions* of time using the following analogy: "Time perception… must be distinguished from time 'conceptualization', in the same way that thermoperception must be distinguished from the everyday conceptualization of temperature."

among linguists and philosophers. In his essay Bréal argued that metaphor is more than a mere linguistic ornament, and put it in the position of a ubiquitous linguistic feature, which he regarded as a principal device employed in linguistic expressions of change.

Subsequently, the topic of metaphorical expression was taken up by Ivor Richards (1936), who introduced the standard terminology of metaphor: the term used metaphorically is *vehicle*, the topic to which it is applied is *tenor*, and the interpretation of the metaphor depends on a common *ground*. Another influential American philosopher Max Black also rejected Aristotle's view as too simplistic. Black (1962, 1979/1993) articulated an influential alternative outlook that posits metaphorical understanding as a communicative phenomenon that operates at the deep level of conceptual structure. According to his *interaction view* (Black, 1962), metaphors are understood by perceiving the topic concept in terms of the vehicle concept to produce a ground that combines their conceptual attributes and transcends their literal denotations. Black argues that metaphor conveys a special kind of meaning resulting from the interaction of the constituent terms, which: (a) is new, or creative, not inferable from the standard lexicon; (b) is not paraphrasable, at least not completely; (c) brings about conceptual innovations and therefore generates new knowledge and insight (Black, 1979/1993, p. 23).

Black's ideas were opposed by Donald Davidson (1978), whose argumentation was centered around the statement that "metaphors mean what the words, in their most literal interpretation, mean, and nothing more" (Davidson, 1978, p. 32). For Davidson, if the cognitive content of a metaphor cannot be put into words, then, by definition, it is not a content, but something else. Thus, Davidson sees metaphors in the role of pragmatic devices that draw our attention to certain features of the reality that we may or may not have been aware of previously, but rejects the claim that they have the potential to generate a new cognitive content. The discussion on the conceptual nature of metaphor has been continued ever since (see Hills, 2012 for a review from a philosophical perspective). What is relevant to this study, it has frequently referred to metaphorical conceptions of time.

An observation that the linguistic representation of time systematically relies on metaphorical conceptualization appeared at the beginning of the 20th century in McTaggart's (1908) essay on the *unreality of time*. McTaggart (1908, p. 470) notes that "it is very usual to present Time under the metaphor of a spatial movement". Moreover, he points out that the movement of time is typically pictured from future to past (future events are approaching us), but the movement of the self in time is pictured from past to future (we approach future events). However, McTaggart discusses this observation sparsely in a single footnote. Conceptual constraints of metaphorical expressions of time in spatial terms were discussed by Merleau-Ponty (1945/1962) and Smart[18] (1949), who both argued that the idea of time flowing like a *river* is an illusion. In the 1970s the ongoing discussion on metaphorical conceptions of time has expanded from philosophy to cognitive science, and embraced insights from linguistics, psychology, neuroscience, anthropology, sociology, and other fields of research.

2.2 Early cognitive studies on spatialization of time

Investigation of the relationship between space and time has a long tradition of studies in developmental psychology. Jean Piaget, who examined time (Piaget, 1946/1969), space (Piaget & Inhelder, 1948/1956), motion and speed (Piaget, 1946/1970), and geometry (Piaget, Inhelder & Szeminska, 1948/1960) in the child's mind, arrived at the conclusion that at early stages of cognitive development they form an inseparable entity and emerge as separate concepts of space, time, motion, and velocity as we grow up. Systematic investigations of the relationship between time and space in language and cognition were undertaken on a larger scale in the 1970s. In 1973 Herbert Clark presented a study in cognitive developmental psychology reporting a series of observations that children produce spatial terms earlier than their temporal counterparts. Following these observations, Clark argues that time is learned by analogy to the cognitively prior perceptual model of physical space. As put by Clark (1973, p. 57), "In general, therefore, spatial expressions should appear before time expressions, and in particular, each term that can be used both spatially and temporally should be acquired in its spatial sense first." Accordingly, he put forward a hypothesis of *metaphorical acquisition of temporal meaning*, which posits that the human concept of time is actually a spatial metaphor.

Other studies conducted in that period (e.g. Bennett, 1975; Miller & Johnson-Laird, 1976; Traugott, 1975, 1978) identified some universal patterns characteristic of the language used to describe time in spatial terms. Traugott (1978) questioned universality of temporal descriptions in terms of *moving-ego* and *moving-time* conceptual models. Instead, she proposed a distinction between *dynamic* temporal

[18] John Jamieson Carswell Smart was a pioneer of *physicalism* – a set of theories holding that consciousness, sensation and thought do not float free of physicality, but can – and eventually will – be located in a scientific material worldview. In his papers "The River of Time" (1949) and "Spatialising Time" (1955) Smart invokes Einstein's theory of relativity to argue that our notion of time passing has conceptual limitations, hence is likely to be an illusion.

expressions, which describe time in terms of motion, and *static* temporal expressions, which use ego's front-back orientation to express temporal concepts (cf. TIME ORIENTATION metaphor in Lakoff and Johnson, 1999, p. 140). To explain the difference between moving-ego and moving-time conceptualizations in the static model Traugott suggested using two different timelines: one based on the *tensed* view of time, and the other based on the *tenseless* view of time, as distinguished by McTaggart (1908).

According to Traugott's (1978) proposal, in the tensed timeline time is *deictic,*[19] i.e. described as [+/-Proximal] to the point of *now*, whereas in the tenseless timeline it is subject to ordering of events with respect to one another. Traugott proposed to distinguish between the tensed and tenseless timelines by identifying whose *front* is being referred to: on the tensed timeline, *front* refers to the speaker's front-back orientation; on the tenseless timeline, *front* should be interpreted as referring to time's front-back orientation. Moreover, Traugott (1978) notes that because time is conceptualized as linear, the spatial terms used to express temporal relations are typically *uni-dimensional* rather than *multi-dimensional*. Thus, temporal sequencing is discussed using *directionally ordered*, rather than *symmetric* words. We normally use words such as *before/after*, *ahead/behind*, and *up/down* to refer to time, but not *left/right*.[20]

Miller and Johnson-Laird (1976, p. 401) explained the tendency to discuss temporal relations along the *front/back axis* by attributing it to the primacy of the front side as: (a) containing the main perceptual apparatus; (b) lying in the direction of motion; (c) being typically oriented toward the observer. However, they

[19] The term *deixis* is derived from the Greek word *deiktikos*, which stands for a pointing finger. The function of deictic expressions is to point at their referents (Rauh, 1983, p. 10). The *deictic origin* (or *deictic centre*) is the point (e.g. *I, here, now*) from which we refer to other things. Words are *deictic* if their semantic meaning is fixed, but their denotational meaning depends on time and/or place. The most pervasive aspect of *temporal deixis* is tense (Rauh, 1983, pp. 229–276; Comrie, 1985, pp. 13–18). Conceptions of time relative to different temporal reference points are discussed by Fillmore in his "Lectures on deixis" (1971/1997, pp. 28–36).

[20] Bonato, Zorzi and Umiltà (2012) review empirical evidence for the possibility that humans represent the subjective time flow on a spatially oriented *mental time line* that flows from left to right. Traces indicating that in some contexts time can be conceptualized as located sideways do exist in language. For example, we can *put time aside*, e.g. "We need to purposefully put time aside to spend with it, listen to it" (British National Corpus). The Rolling Stones sing that "Time is on my side" (A song written by Norman Meade, Verve: VK 10307, B-side, released October 3, 1963). There is an ongoing discussion on idioms reflecting conceptual structures and mind's interpretive strategies, which includes non-compositional (e.g. Cruse, 1986; Keysar & Bly, 1999) and compositional views (e.g. Kövecses, 1986; Gibbs, 1992). See Gibbs (2007) for a review.

emphasized that "although the language of time borrows heavily from the language of space, the psychology of time is very different from the psychology of space" (Miller & Johnson-Laird, 1976, p. 457).

Furthermore, the above-mentioned studies noticed that expressions of time in spatial terms function across numerous languages and cultures. As summarized by Lyons (1977, p. 718), "the spatialization of time is so obvious and so pervasive a phenomenon in the grammatical and lexical structure of so many of the world's languages that it has been frequently noted, even by scholars who would not think themselves as subscribing to the hypothesis of localism". Subsequent observations that conceptions of time appear to be consistently structured in spatial terms were made in the 1980s in studies that defined the basic tenets of cognitive linguistics (e.g. Lakoff & Johnson, 1980; Jackendoff, 1983; Lakoff, 1987; Langacker, 1987a).

2.3 Time in conceptual metaphors

Among various models proposed to specify how a combination of different concepts yields metaphoric meaning, the most influential has been the *conceptual metaphor framework* advanced[21] by the linguist George Lakoff and the philosopher Mark Johnson (Lakoff & Johnson, 1980, 1999; Lakoff, 1993). In their groundbreaking book *Metaphors We Live By* (1980), Lakoff and Johnson rejected the Aristotelian view of metaphor as a mere stylistic ornament used for esthetic purposes, and posited it as a rudimentary process of the human thought. They defined the essence of metaphor as "understanding and experiencing one kind of thing in terms of another" (Lakoff & Johnson, 1980, p. 5). According to their proposal, the creation and understanding of metaphorical language is mediated by correspondences that structure mental representations of concepts:

> Many aspects of our experience cannot be clearly delineated in terms of the naturally emergent dimensions of our experience. This is typically the case for human emotions, abstract concepts, mental activity, time, work, human institutions, social practices, etc. … Though most of these can be *experienced* directly, none of them can be fully comprehended on their own terms. Instead, we must understand them in terms of other entities and experiences, typically other *kinds* of entities and experiences. (Lakoff & Johnson, 1980, p. 177).

[21] Lakoff and Johnson (1980) refer to the work of Michael Reddy (1979/1993) on the *conduit metaphor* as an inspiration for their theory. In a later publication Lakoff (1993, p. 204) acknowledges Reddy's contribution as follows: "Reddy showed . . . that the locus of metaphor is thought, not language, that metaphor is a major and indispensable part of our ordinary, conventional way of conceptualizing the world, and that our everyday behavior reflects our metaphorical understating of experience".

Thus, metaphors are not primarily a matter of language, but rather of cognition. The theory is grounded in the following assumptions: (a) metaphor is a property of concepts, not words; (b) the basic function of metaphor is to enable us to understand certain concepts; (c) metaphor is not necessarily based on similarity between concepts; (d) metaphor is used pervasively and unconsciously by ordinary people, not just poets; (e) metaphor serves as a basic mechanism in human thought and reasoning (Lakoff & Johnson, 1980; see Kövecses, 2010, pp. ix–xiii for a recapitulation).

Over the years, the theory has been systematically updated and developed. A more comprehensive version has been promoted under the label of *Contemporary Theory of Metaphor* (CTM) (Lakoff, 1993). A subsequent iteration (Lakoff & Johnson, 1999) put a stronger emphasis on fundamental grounding of conceptual metaphors in embodied experience and taken into consideration, among other developments, Grady's (1997) theory of primary metaphors and Fauconnier and Turner's (1998) theory of conceptual blending. The latest proposal of *Neural Theory of Metaphor* (Lakoff, 2008) models metaphors as neural mappings with reference to *Neural Theory of Language* (see Feldman, 2006 for an introduction), still putting a strong emphasis on connections between embodiment and metaphor.

The *conceptual metaphor* can be defined in a nutshell as a *conceptual mapping*, i.e. a set of correspondences between two conceptual domains, in which a previously stored conceptual representation of one cognitive model is used to provide a structured understanding of another. The conceptual domain from which we draw metaphorical expressions to understand another conceptual domain is termed within this framework as the *source domain*, while the conceptual domain that is understood this way is the *target domain* (cf. the *vehicle* and the *tenor* of the metaphor in Richards, 1936). The source domain is less abstract, i.e. more accessible to perception, than the target domain. Only a part of the source is mapped onto the target, and only a part of the target is involved in the mapping because one concept cannot be the same as another.

A basic feature of conceptual metaphors emphasized by Lakoff and Johnson (1980, 1999) is their *asymmetrical directionality*. It assumes that the metaphorical extension is motivated by a cognitive cross-domain mapping between abstract and concrete domains. It is asymmetrical in the sense that "A" is conceptualized in terms of "B", but "B" is not conceptualized in terms of "A". For example, *weather* can be used to describe economic and political conditions metaphorically, but discussing weather in terms of politics seems to be both linguistically and conceptually preposterous (Grady, 2007).

The target conceptual domain shapes the conception of its *axiological content* (see Krzeszowski, 1990, 1997), relations, and patterns of inference of the source domain. In the outcome, a conceptual metaphorical mapping creates a gestalt, i.e. a coherent knowledge structure, which is easier to grasp and allows for using the inferential structure of relatively concrete domains to reason about relatively abstract domains. The use of a particular model of mappings can be attributed to cognitive *embodiment*, i.e. experience inherently linked to bodily motor functions and perception[22] (see Gibbs, 2006; Kardela, 2006a; Rohrer, 2007; Wilson & Foglia, 2011 for reviews from slightly different perspectives).

Lakoff and Turner (1989) in their book on poetic uses of metaphors make a distinction between *conventionalized metaphors* (cf. *dead metaphor* in Lakoff & Johnson, 1980, pp. 54–55; Pawelec, 2006) and *novel metaphorical mappings*. They assert that conventionalized metaphors are not unique figurative linguistic constructions of individuals, but "are rather part of the way members of a culture have of conceptualizing their experience"[23] (Lakoff & Turner, 1989, p. 9). The *conventionality of a metaphor* is a gradable dimension, which varies along two parameters. A metaphor is *conventionalized* "to the extent that it is automatic, effortless, and generally established as a mode of thought among members of a linguistic community" (Lakoff & Turner, 1989, p. 55). The other parameter is *conceptual indispensability*, which concerns the degree to which a concept is virtually unthinkable without metaphorical extension.

An example of such a concept is time. As already mentioned, time is not conceptualized on its own terms but, at least in a significant part, is conceptualized metaphorically and metonymically. Among flagship examples used in this context is the observation that time is systematically expressed across languages and cultures in terms of the concrete domain of motion in space. Following the assumption that events can be perceived and manipulated in cognition in ways in which time *per se* cannot (cf. Gibson, 1975), Lakoff and Johnson define time by

[22] Lakoff and Johnson (1980, 1999) propose that the link between the two domains of experience involved in conceptual metaphors may include sensorimotor experience, perceptual structural similarity, and possibly other cognitive, biological, or cultural motivations.

[23] The idea that we learn metaphors directly by conceptualizing experience is criticized by Pinker (2007a, Ch. 5) who provocatively encapsulates his disapproval in the following statement: "No one has to be smitten with a seatmate on a cross-country bus trip to appreciate that love is a journey, or see a pair of debaters pull out pistols to sense that arguments are like war" (Ibid. p. 251). But, of course, Pinker must be aware that the conceptual metaphor theory assumes that people conceptualize only *some aspects* of love as a journey, and only *some aspects* of love can be understood in terms of journeys.

metonymy: “In the world, there are iterative events against which other events are compared (…) Successive iterations of a type of event stand for *intervals of time*” (Lakoff & Johnson, 1999, p. 138).

The following basic properties of time can be distinguished in this context: (a) Time is *directional* and *irreversible* because events are directional and irreversible; (b) Time is *continuous* because we experience events as continuous; (c) Time is *segmentable* because periodic events have beginnings and ends; (d) Time is *measurable* because iterations of events can be counted (Lakoff & Johnson, 1999, p. 138; cf. Galton, 2011 for an alternative specification of the properties of time).

Accordingly, our experience of time is always relative to our experience of events: events are located in time relative to other events, duration of events is measured relative to other events, and so forth. The metonymical conceptualization of time is reflected not only in language but also in other cultural artifacts related to time, such as: sundials, hourglasses, clocks, calendars, time lines, and graphs mirroring the way we think about time (Lakoff & Johnson, 1999, pp. 155–156). Such physical objects serve as *material anchors* in conceptualization of time (Hutchins, 2005; De Smedt & De Cruz, 2011). For example, the clock, especially the circular face of the analogue clock with the hands moving around in the course of the day, shapes the conceptualization of time as *cyclical* (see Roeckelein, 2008, pp. 5–7; Williams, 2004 for a discussion on the *constitutive role of the clock* in conceptualization of time).

Lakoff and Johnson (1999, p. 52) assert that time is conceptualized by unconscious cognitive mechanisms through perceptual and motor experience in the concrete domain of space as the TIME IS MOTION metaphor in two major variants: *motion of objects* and *motion along a path*. The metaphorical conceptualization of time along the *front/back axis* results in MOVING TIME and MOVING OBSERVER metaphors.[24] With the MOVING TIME metaphor (Lakoff & Johnson, 1999, pp. 141–144), we conceive of ourselves as stationary, with events approaching us from the future, passing us, and then receding into the past, e.g. *the coming weeks*, *the deadline is approaching*. With the MOVING OBSERVER metaphor (Lakoff & Johnson, 1999, pp. 145–148), time is conceived of as a stationary landscape, along which we are moving, encountering events as we proceed. We move along the timeline into

[24] Apart from *Moving Time* and *Moving Observer* (Lakoff & Johnson, 1999), there are several alternative nomenclatures used in the context of metaphorical mappings of time along the *front/back axis*. Earlier works (e.g. Clark, 1973) refer to *Moving Time* and *Moving Ego* metaphors. Other researchers (e.g. Boroditsky, 2000; Gentner, 2001) discuss *Time-moving* and *Ego-moving* metaphors. Although the difference is minor, it still results in certain terminological havoc.

the future, so future events are ahead of us, e.g. "We are approaching the deadline", and past events are behind us, e.g. "Leave your childhood behind".

In the MOVING TIME model events are conceived as facing towards the past as they approach us, thus an event that is before another is located in the past. Hence, paradoxically, events which occurred before the present are behind us. These two different assignments of *front/back* to the timeline have been discussed in ample literature on conceptions of time (e.g. Lakoff & Turner, 1989; Evans, 2003; Radden, 2004). Lakoff and Johnson (1999, pp. 148–149) note that the MOVING TIME and MOVING OBSERVER metaphors are strictly speaking inconsistent with each other. However, these conceptualizations can be viewed as minimally differing variants based on *figure-ground reversal* of the more general TIME IS MOTION metaphor. Metaphors commonly come in *duals* based on figure-ground reversal. Lakoff and Johnson (1999, pp. 194–201; see also Lakoff, 1993, pp. 225–228) view the phenomenon of metaphorical *duality*[25] as a general attribute of EVENT-STRUCTURE concepts, such as state, action, and cause (see Lakoff & Johnson, 1999, Ch. 11).

Moore (2000, 2006) points out that there is a third, largely overlooked type of *time as motion* metaphor that relates two times to each other independently of ego's perspective. Instead of using a deictic reference to ego, it locates a particular time relative to another time. In that metaphor, time is depicted as being in an unchanging relationship of sequence in which the intervals between times do not change, which corresponds to the *tenseless* view of time (see McTaggart, 1908; Smart, 2008). From this perspective, New Year always follows Christmas but never gets closer to it. Consequently, Moore (2006) proposes dividing the MOVING TIME metaphor into two metaphorical variants: EGO-CENTERED MOVING TIME, which is *perspective specific*, and SEQUENCE IS RELATIVE POSITION ON A PATH, which is *perspective neutral*.

[25] Lakoff & Turner (1989, Ch.1) point out an alternative conception of time, which they discuss as the TIME IS A PURSUER metaphor. In the poem "To His Coy Mistress" written by Andrew Marvell (1681/1999) time is depicted as a motive force that impels us forward from behind: "*But at my back I always hear / Time's winged chariot hurrying near; / And yonder all before us lie Deserts of vast eternity.*" Additional examples come from Google search: "Wimbledon champion Novak Djokovic forced 30-year-old Roger Federer to accept that time has caught up with him" (Daily Mail Online, Sep 10, 2011); "Goodbye, my dear mother, time hurries me along, I am going to the Opera" – Maurice Dupin in a letter to his mother, George Sand (1991, p. 154). Polish speakers frequently use the set phrase "Czas goni nieubłaganie" [Lit. *Time pursues relentlessly*] that encapsulates this concept. This conception also occurs as a dual involving the TIME IS AN OBJECT OF PURSUIT variant, and may be attributed to *personification of time*.

Núñez and Sweetser (2006) propose a parallel, arguably more accurate taxonomy of spatial metaphorical mappings of time, which focuses on reference points rather than the identity of moving entities. They emphasize that *futurity* (reference to times *later than now*) must not be confused with *posteriority* (reference to one time as being *later in a sequence* than another), since not every instance of "later than" is an instance of "later than now." Similarly, *past* (reference to times *earlier than now*) must not be confused with *anteriority* (reference to one time as *earlier in a sequence* than another).

The key point in this taxonomy is that future and past are inherently *deictic semantic categories*. To be able to calculate the time reference one has to know the position of ego (i.e. when the relevant speaker's present is). Núñez and Sweetser (2006) propose to use the terms *Ego-Time-Reference-Point* (Ego-RP) and *Time-Reference-Point* (Time-RP) for this categorical distinction to clearly distinguish between *what is moving* (ego or time) and *what is the landmark relative to which motion is construed* (ego or time). They note that front–back orientation can be established for either a *moving* or a *static landmark* (see also Zinken, 2010). An accompanying study (Núñez, Motz & Teuscher, 2006) demonstrated experimental evidence for the psychological reality of the Ego-RP versus Time-RP distinction.

Yet another common conceptualization of time occurs in a separate variant of the MOVING TIME metaphor labeled TIME–SUBSTANCE VARIATION (Lakoff & Johnson, 1999, p. 144). In this variant the movement is conceptualized in terms of a moving substance. Since a substance can be measured, we conceptualize the duration of time in terms of the amount of substance, e.g. *a lot of time*, *a little time*, *no time at all*. In this metaphor the passage of time is conceptualized in terms of a common linear moving substance, often as a *river*.[26] The present is the part of the river that is passing us, the future is the part of the river that is flowing toward us,

[26] Merleau-Ponty (1945/1962, pp. 477–478) pointed out limitations of the metaphorical conceptualization of time as a river that flows independent of and precedent to our relation to it, since we cannot "observe" time as it goes by: "Time presupposes a view of time. It is, therefore, not like a river, not a flowing substance. The fact that the metaphor based on this comparison has persisted from the time of Heraclitus to our own day is explained by our surreptitiously putting into the river a witness of its course". Smart (1949) argues that time conceptualized as a river is an illusion because if time flowed or passed, it would require a super-time to flow or pass in. He asks how fast time passes: "I am advancing through time at how many seconds per—? We might begin, and then we should have to stop. What could possibly fill the blank?" (Smart, 1949, p. 485). It was replied by Prior (1958, p. 244) in the following way: "Surely the answer to this question is obvious. I am now exactly a year older than I was a year ago… the rate of this change is one time-unit per time-unit". This discussion still has not reached a conclusive settlement (see Skow, 2010 for a review).

and the past is the part of the river that has already flown past our location. Consequently, we frequently speak of *the flow of time*.

Apart from the above-discussed conceptual metaphors of time derived from *motion-framed perspective* (see Kövecses, 2005, p. 53), Lakoff and Johnson (1999, p. 140) distinguish a set of conceptual mappings of past, present, and future in worldwide cultures, which they call the TIME ORIENTATION metaphor. It reflects our basic cross-domain mapping that uses a spatial configuration with an observer localized at the center mapped to the present moment. In most cultures the time in front of the observer is the future, and the time behind the observed is the past, e.g. "The worst is *behind* us now", and "We are looking *ahead* to the future" (see Núñez & Sweetser, 2006 for account of *Aymara* culture, which uses the reverse assignment). Lakoff and Johnson (1999, p. 140) emphasize that the metaphorical model of TIME ORIENTATION relies on the *static view of time* based on the observer's orientation and does not specify any movement of time/in time (see also Radden, 2004). Kövecses (2005, pp. 51–53) subscribes to this distinction in the context of metaphorical universality. He notes that people around the world conceptualize time in terms of space both as something *static* and as something *dynamic*.

Moreover, metaphorical conceptions of time frequently entail *personification* (Lakoff & Johnson, 1980, Ch. 7; Kövecses, 2010, pp. 55–56). Lakoff and Turner (1989, pp. 35–43 & 73–79) discuss a common conceptualization of time based on the TIME IS A CHANGER metaphor (also in more specific variants of: DESTROYER, DEVOURER, HEALER, REAPER, THIEF), where time is conceptualized as an entity largely independent of events it influences. It enables us to use knowledge about ourselves to comprehend temporal aspects of reality. Kövecses (2010, p. 55) assumes that time is conceptualized using these particular agents because of the relation to other metaphors embracing concepts of time indirectly, such as *life* and *death*. Accordingly, time is conceptualized as a thief that steals that the precious possession of life, and as a reaper that kills people.

Another prevalent conceptualization of time embraces metaphors TIME IS A RESOURCE and TIME IS MONEY (Lakoff & Johnson, 1980, pp. 7–9; 1999, pp. 161–164; Evans, 2003, Ch. 14). It imposes an outlook in which we use time in manners similar to how we use money and valuable resources in general, hence time can be spent, given, traded, borrowed, lost, wasted, etc. This metaphor, however, belongs to the category of *socio-cultural constructs*, rather than phenomenologically universal aspects of human cognition, since it appears in some languages and societies, but not others (see Evans, 2003, p. 177). As put by Lakoff and Johnson:

> Time in our culture is a valuable commodity . . . Because of the way that the concept of work has developed in modern Western culture, where work is typically associated with the time it takes and time is precisely quantified, it has become customary to pay people by the hour, week, or year . . . This isn't a necessary way for human beings to conceptualize time; it is tied to our culture. There are cultures where time is none of these things. (Lakoff & Johnson, 1980, pp. 8–9).

For example, this temporal metaphor does not function in the languages of non-industrialized cultures, such as *Inari Saami*, an indigenous language spoken in Northern Finland (Idström, 2010), or *Pirahã*, an indigenous language of a hunter-gatherer Amazonian tribe in Brazil (Everett, 2005). Instead, those cultures tend to associate the concept of time with changes observable in nature.

Moreover, other metaphors involve the concept of time indirectly. For example, metaphors LIFE IS A JOURNEY, A LIFETIME IS A DAY (Lakoff & Johnson, 1980; 1999, pp. 59–64) and DEATH IS A DEPARTURE, DEATH IS GOING TO A FINAL DESTINATION (Lakoff & Johnson, 1980; Lakoff & Turner, 1989, pp. 1–34) refer to the concept of time in the sense of *instance*, where time is conceptualized as a particular event, activity, process or state, rather than an interval or moment (see Evans, 2003, Ch. 9).

In their original proposal Lakoff and Johnson (1980) distinguished ontological, structural, and orientational metaphors (see Kövecses, 2010, pp. 37–40 for a recapitulation; Szwedek, 2007 for a criticism). *Orientational metaphors* relate concepts to each other in spatial terms, e.g. HAPPY IS UP / SAD IS DOWN, as in "Cheer up" or "I feel down". Such conceptualizations are assumed to be grounded in our physical experience, since an erect posture is typically associated with positive emotional states, and sadness with a sagging posture. *Structural metaphors* have a clearly defined target domain, which structures conceptualization of the source domain in more sharply defined terms. *Ontological metaphors* do not have a well-defined target domain. They reflect systematic correlates within our experience in more general terms of objects, substances, and containers, without specifying exactly what kind of object, substance, or container is meant.[27]

[27] Lakoff and Turner (1989, pp. 80–83) added a distinction between *specific- vs. generic-level metaphors* and redefined the *ontological* category in terms of the *Great Chain of Being*, which is a folk model of nature that specifies physical and behavioral attributes of humans, animals, plants, complex artifacts, and basic natural objects (Lakoff & Turner, 1989, pp. 167–168; see also Krzeszowski, 1997, p. 67 for a reduction to four levels). For example, people are often talked about as animals, e.g. mules or lions; plants, e.g. roses or cacti; machines, e.g. rockets or bulldozers; and objects, e.g. stones. Szwedek (2011) proposes another typology of metaphors: *metonymy-based*, *concrete-to-abstract*, and *abstract-to-abstract* with reference to a distinction between material and non-material entities used in metaphorical conceptualizations.

An example of the ontological metaphor used in conceptualizations of time is the TIME IS A CONTAINER metaphor. It employs the CONTAINER image schema (Lakoff, 1987, pp. 272–273; Dewell, 2005), and typically appears in the context of extended events and actions correlated with bounded time spans (Lakoff & Johnson, 1980, p. 29–31, 59; 1999, p. 153). Accordingly, we can be *in time* or *out of time*, e.g. "*In* the year 2013", "He'll be back *within* ten minutes", "They blitzed four goals *inside* 14 minutes", "We're right *out of* time". The TIME IS A CONTAINER metaphor is also reflected in expressions referring to the ability to *fill time* (Kövecses, 2006, p. 166). Szwedek (2009a) notes that such conceptualizations fall into a more general schema of the *in-out* orientation (cf. Lakoff, 1987, pp. 271–272). Moreover, metaphors such as LIFE IS A JOURNEY, DEATH IS DEPARTURE can be viewed as specific instantiations of the SOURCE-PATH-GOAL image schema (Lakoff, 1987; Lakoff & Johnson, 1999, p. 32–34; Hampe, 2005), in which time is conceptualized as a trajector moving along a path, e.g. "There is a long way ahead of us to finish this work" means "A lot of time shall pass before we finish this work".

The relation between specific metaphors and more generic image schemas corresponds to a distinction between *complex* and *primary metaphors* introduced by Grady (1997). Grady argues that complex metaphors are made up of primary metaphors, which develop through *conflation*, i.e. the experiential association of discrete conceptual domains in cognition. They arise naturally from basic recurring units of human experience, which Grady terms *primary scenes*. For example, complex metaphors referring to the concept of journey, such as LOVE / A BUSINESS / A TASK IS A JOURNEY can be accounted for in more general terms of the PURPOSES ARE DESTINATIONS metaphor, which explains why the sentence "We are going nowhere" can be used just as well for discussing an unsuccessful business venture, a marital crisis, and frustration with the task at hand.

A primary metaphor that seems to be particularly relevant to conceptions of time is the CHANGE IS MOTION metaphor (Lakoff, 1993; Grady, 1997, p. 107). Since time is inherently associated with change, it is conceptualized as motion in different variants discussed above. However, as pointed out by Galton (2011), it appears that it is the *change* aspect of motion, rather than motion as such, that acts as the conceptual source in metaphorical representations of time. In other words, because of its fundamental association with change, motion appears to correspond in a natural way to the transient nature of time.[28]

[28] In von Wright's (1969) temporal logic events are composed of motion and change. See Kozanecka-Dymek (2012) for a brief review of various kinds of temporal logic.

Grady's (1997) theory of primary metaphors brings a stronger generalizing power to the conceptual metaphor theory and locates the cognitive roots of metaphor in the conflation of concepts arising from the basic experience. Additionally, primary metaphors are much easier to link with research in psychology and the brain sciences. Grady (2005) views them as basic *inputs* in Conceptual Integration Networks (Fauconnier & Turner, 1998, 2002; see Section 2.4). The theory of conceptual metaphors has been accepted by a large number of cognitive scientists as a key process of conceptualizing reality the social, cultural, and psychological domain. The idea that metaphor is conceptual in nature has been supported with diverse linguistic and nonlinguistic evidence (Górska, 2009). However, because of its essential schism from previous traditions in linguistics and semantics, the conceptual metaphor framework has also come under considerable criticism.

2.3.1 Criticisms of conceptual metaphors

A major conceptual challenge against the investigation of figurative meaning in metaphors comes from David Davidson, who opposed Max Black's (1962, 1979/1993) view that metaphor conveys a special kind of meaning resulting from the interaction of the constituent terms (see Section 2.1). In his paper *What Metaphors Mean* (1978), Davidson argues that metaphors do not mean anything in the sense of conveying cognitive content: "metaphors mean what the words, in their most literal interpretation, mean, and nothing more" (p. 32). He views them instead as pragmatic devices that draw our attention to certain features of the world that we may or may not have been aware of previously.

Davidson denies the idea that metaphors can provide new or unexpected insights by observing that metaphorical concepts and language are essentially unconstrained: "When we try to say what a metaphor 'means' we soon realize there is no end to what we want to mention."[29] (Davidson, 1978, p. 46). Thus, metaphors invite us to infer whatever appropriate message we see, which means that the range

[29] Wittgenstein in his "Lectures on Religious Belief" (1938/2003, pp. 70–71) discusses a similar idea of "non-cognitivism" in emotive functions of religious language. He presents an example of a man, who before going to China with no intention of coming back, bids farewell to his friend with the words: "We might see one another after death." Confronted with this sentence one may ask what it means. Does it express a certain attitude? Perhaps, fondness of the friend? According to Wittgenstein, because we cannot substitute anything particular for these words, the answer is: "It says what it says. Why should you be able to substitute anything else?" See also a discussion on the indeterminacy of meaning in Quine (1960/2013, p. 29) illustrated with a potential infinity of possible translations of "Gavagai".

of possible metaphorical correspondences is limited only by our imagination. This idea has been summarized by Grady (2007, p. 196) as follows: "If one person states that 'Life is a kiwi fruit', another will be clever enough to point out the shared features which make these two entities comparable and which provide the ground for the metaphorical mapping of one onto the other". One must bear in mind, however, that Davidson's conceptions of language and cognition stemmed form formal semantics and were articulated before the advent of cognitive linguistic frameworks of metaphor proposed by Reddy (1979) and Lakoff and Johnson (1980).

Noam Chomsky (1997) when asked about his opinion on the role of information-age metaphors in understanding the human condition and getting closer to the truth of things, answered: "Well, metaphors are metaphors. If they're a stimulus to the imagination, fine. Let your imagination be stimulated. But one should not confuse metaphors and imaginative leaps with understanding; they may be a help to understanding, but then we await the understanding to make judgments…".

Another challenge to the conceptual metaphor theory arises from the "abstraction" position (see Lakoff & Johnson, 1980, pp. 106–110), which assumes that meanings identified as metaphorical are actually literal. Jackendoff and Aaron (1991) point out that numerous expressions identified as metaphors may be viewed instead as reflections of literal beliefs and thematic parallels, i.e. abstract categories whose language refers primarily to concrete and spatial experience, but whose content is much more general and abstract (see *Thematic Relations Hypothesis* in Jackendoff, 1983, pp. 188–192; Jackendoff, 2007, Ch. 6 for more up-to-date particulars). Jackendoff (2002, p. 358) argues that although conceptions of time and space are thematically parallel, the presumed primacy of spatial relations as the metaphoric grounding of temporal relations may be illusory.[30] He points out that spatial relations may seem primary due to their association with visual modality, cognitive motor functions, and evolutionary priority. He notes that it is

[30] We do not know for sure whether processing metaphorical temporal/motion language makes use of spatial representations. Keysar, Shen, Glucksberg & Horton (2000) devised a set of experiments involving a reading-time measure to evaluate a fundamental assumption of Conceptual Metaphor Theory that people routinely use conceptual mappings to understand conventional expressions in ordinary language. They found no evidence that readers use conceptual mappings to understand conventional temporal expressions, which indicates that people need not rely on conceptual mappings for conventional expressions, although such mappings may be used to understand novel metaphors. On the other hand, a study by Langston (2002) demonstrated that violating highly conventionalized *orientational metaphors* slows reading. Psycholinguistic and psychophysical studies investigating the spatial–temporal relationship from various perspectives are discussed in Sections 2.7 and 4.4.

epistemologically equally plausible to assume that space and time are organized by a common set of parameters that are simply more transparent in spatial than in temporal language.

Murphy (1996, 1997) proposes an alternative view of s*tructural similarity*, which posits that elements and relations in the two domains of metaphor are motivated by a common set of terms because those domains share inherent similarities. In contrast to the conceptual metaphor theory, which views metaphorical mappings as links between concrete source domains and abstract target domains, the structural similarity proposal considers both domains as equally basic. Murphy assumes that metaphorical language arises when people notice structural parallels between two domains, such as those of space and time. He argues that people can think of time without thinking of space, but they generally use space to reason about time because these two domains are largely similar. From this outlook, metaphor comprehension involves the activation of an abstract schema shared in both domains rather than the activation of source domain concepts.

Engberg-Pedersen (1999) points out that the conceptual metaphor theory leaves many questions unanswered, for example, it is not clear what constitutes a domain, in what way one domain is opposed to another domain, and what precisely should be regarded as concrete and what as abstract. Using data from signed languages and visual perception she attributes the distinction between time as abstract and space as concrete to the basic difference between static objects and inherently dynamic events observable in space and time. She argues that because time and space are intertwined in cognition at different levels, they should not be analyzed as separate domains.

Glucksberg and McGlone (1999) discuss the lack of empirical support for the assumption that comprehension of figurative language is mediated by unconscious metaphoric correspondences that structure understanding of abstract concepts (cf. Boroditsky, 2000). They propose an alternative *minimalist* account of metaphor in which comprehension is conceived as a search for an *attributive category* that is exemplified by the source domain. Moreover, McGlone (2001, p. 95) accuses the conceptual metaphor theory of circularity: “How do we know that people think of theories in terms of buildings? Because people often talk about theories using building-related expressions. Why do people often talk about theories using building-related expressions? Because people think about theories in terms of buildings.” Glucksberg (2001) argues that metaphors are best explained as *class inclusion* assertions, for example in “My lawyer is a shark,” *shark* becomes the name of a class of layers with predatory qualities. This view, however, cannot account for orientational metaphors derived from experiential correlation, such as HAPPY IS UP.

Another line of criticism accuses some conceptual metaphors of being cases of analogy or simile, rather than real metaphors. It posits that processing metaphors involves reasoning generally related the use of analogy (Gentner & Jeziorski, 1993; Gentner, Bowdle, Wolff & Boronat, 2001). According to the *structure-mapping* proposal (see Wolff & Gentner, 2011 for a review) the processing of metaphor (like the processing of analogy) includes both highlighting commonalities and projecting inferences. An initial processing stage involves symmetrical processes that arrive at a structural alignment of similarities between the two representations. This is followed by directional projection of inferences from the source to the target in a later phase. According to this proposal, comprehension of metaphoric expressions evolves as a function of their conventionality and linguistic form (see *the career of metaphor* hypothesis in Bowdle & Gentner 2005). A completely new expression requires different kinds of inferential work than when it becomes familiar. This model broadens the notion of analogy to make it cover any form of alignment between structures.

Pinker (2007a, Ch. 5) supports the idea that numerous metaphorical conceptual representations can be explained on the grounds of analogy. He assumes that spatial representations are used for conceptualizing time because tools of spatial inference can be applied to different kinds of abstract concepts, including possessions, states, and causes: "generally, we can use the mental mechanisms for space to deal with *any* continuous variable, from health to intelligence to gross domestic product" (Pinker, 2007a, pp. 252–253). Since time can be assumed to be a dimension like space, spatial metaphors are useful to think about time to the extent that space and time share certain parallel properties.

Szwedek (2007) asserts that the distinction between ontological, structural, and orientational metaphors is faulty. He argues that for orientation and structure to exist, it is necessary to *objectify* the concept by assigning it some physical status, thus all metaphors are fundamentally ontological. Szwedek (2011) proposes an alternative typology of metaphors: metonymy-based, concrete-to-abstract, and abstract-to-abstract with reference to a distinction between material and non-material entities used in metaphorical conceptualizations. Szwedek's (2009a) position on the metaphorical conceptualization of time is discussed separately in Section 2.5.

Certainly, the conceptual metaphor framework has gained enormous popularity, but at the same time it has attracted sharp criticisms, particularly from psychologists. McGlone (2007) reviews the empirical evidence for and against the explanatory value of conceptual metaphors. He concludes his assessment by stating that despite its "important atmospheric influence", the conceptual metaphor framework has not fared well as an account of figurative language understanding. Ruiz de Mendoza Ibáñez and Pérez Hernández (2011) point out that the development of the framework over the years have generally addressed many of the initial problems in a satisfactory way, although there is still room for improvement.

2.4 Time in conceptual blending

A need of a more elaborate explanation of metaphorical conceptualizations of time has been postulated by Fauconnier and Turner (2008), who since 1994 have been proposing that metaphor constitutes a subset of a higher-order conceptual process employed for linguistic and non-linguistic construction of meaning, which they labeled *conceptual integration* (also *conceptual blending*). *Conceptual Integration Theory* (Fauconnier & Turner, 1998; 2002; see M. Turner, 2007 for a review) is a cognitive framework that embraces a vast array of cognitive operations, including analogy, categorization, counterfactual reasoning, metaphor, metonymy, and comprehension of grammatical constructions (see Fauconnier & Sweetser, 1996; Coulson, 2001; Dancygier & Sweetser, 2005).

A basic concept used in the framework of conceptual integration is *mental space* (Fauconnier, 1994, 2007; Fauconnier & Sweetser, 1996). It was originally devised to answer questions about cognitive organization of incompatible information about a single object in discrete representations (Fauconnier, 1994). Subsequently, it proved to be useful for explanation of various semantic and pragmatic phenomena (see Fauconnier, 2007 for a review).

Fauconnier defines mental spaces as "partial structures that proliferate when we think and talk, allowing a fine-grained partitioning of our discourse and knowledge structures" (Fauconnier, 1997, p. 11) or more generally as "very partial assemblies constructed as we think and talk for purposes of local understanding and action" (Fauconnier, 2007, p. 351). Coulson and Oakley (2000) describe the mental space as a temporary container that stores information relevant to a particular conceptual structure as a perceived, imagined, or remembered scenario, which does not need to refer to objects in the real world. Grady (2007, p. 199) provides a more comprehensive definition of the mental space as "a coherent bundle of information activated in the mind at a particular time, representing an understanding of a scenario, real or imagined". Kövecses (2010, p. 267) notes that a mental space is always more restricted than a metaphorical conceptual domain, hence more specific.

Conceptual integration embraces a set of compositional processes that partition referential representations from mental spaces in the process of creative construction of meaning. Conceptual integration is assumed to project elements from one mental space onto another, fuse separate mental spaces into one, and build up new spaces from existing ones in mental operations. In the conceptual integration framework linguistic units (as well as pragmatic and cultural structures) are viewed as having the potential to generate meaning, rather than only mirror a fixed set of possible interpretations (Fauconnier & Turner, 2002).

Although different mental spaces can contain disparate information about the same elements, each individual space contains a representation that is logically coherent. For example, the sentence "When I was young I was fat and lacking confidence" (found in the BNC) prompts the reader to construct two mental spaces, one for the time when the sentence is uttered, and one for the past time when the speaker was fat and lacking confidence. Partitioning the information into two mental spaces allows the reader to understand that the speaker was fat and lacking confidence as a child, but that it no longer has to be the case when the sentence is uttered. When the elements and relations of a mental space become conceptualized as a consistent package, the mental space is *framed* and we call that organization a *frame* (Fauconnier & Turner, 2002, p. 102; Fauconnier, 2007; cf. Fillmore, 1976, 1982/2007).

However, processing sentences such as "When I was young I was like a stick insect" (also found in the BNC) involves a more complex process. Since it is impossible for humans to actually look like a stick insect (even if only for the overall size) understating such statements occurs through *blending*. This cognitive process occurs through a network of mappings, which in this particular case involves at least two *input spaces*: one includes *child*, the other *stick insect*. They are *compressed* together in a newly created *blended space* as a conceptualization of a very tall and thin child, which is a matter of imagination. It must be emphasized that in this case the child domain and the insect domain do not correspond to the *source domain* and the *target domain* distinguished in the conceptual metaphor because the speaker does not map properties of the insect domain onto his childhood appearance domain. Instead, the speaker conceptually blends the inputs into an image of a tall and skinny child. In a similar manner, time can be discussed as: "a luxury [that some companies cannot afford]" or "a window [through which we spy the world]" (examples found in the BNC).[31] Fauconnier (1997, p. 55) emphasizes that "in every case of examining potential interpretations of an isolated sentence, it is necessary to construct implicitly a discourse in which to interpret it".

In the typology of conceptual blends proposed by Fauconnier and Turner (1998, 2002) metaphors are viewed as a special case of conceptual mappings defined by an asymmetry in the degree to which two input domains provide the conceptual frames structuring a conceptual blend. Fauconnier and Lakoff (2010) discuss the relationship between research programs developed for metaphor and blending as mutually reinforcing and intertwined, rather than directly competitive. They point out that both the conceptual metaphor theory and the conceptual integration theory fit within a more general framework of the *neural theory of language* promoted by Feldman (2006) and Lakoff (2008). Particular differences between these cognitive frameworks have been discussed in numerous publications (e.g. Grady, Coulson & Oakley, 1999; Coulson & Matlock, 2001; Grady, 2007; Kövecses, 2010, Ch. 17 & 19). Conceptual blending was initially postulated as a theory of on-line meaning construction. A more recent proposal of G*eneralized Integration Networks* (Fauconnier, 2009) distinguishes highly conventionalized blends, which function in language, cognition, and culture, as lexicalized expressions entrenched in the conceptual system.

Another central notion discussed in the conceptual blending theory is *conceptual integration network* (Fauconnier & Turner, 1998; 2002, pp. 40–44; M. Turner, 2007). It is an array of mental spaces involved in the process of conceptual integration, which includes minimally four mental spaces (rather than two conceptual domains *source* and *target* distinguished in *metaphorical mappings*). Conceptual blends involve at least two *input spaces*, which include information from discrete cognitive domains. These *inputs* constitute a material that is partially projected by *cross-space mapping* onto a third space, the *blended space*. It is important to note that only selected elements and relations from the inputs are projected onto the blend. Apart from the input spaces and the blended space Fauconnier and Turner's model involves one additional space, which is labeled *generic space*. It contains abstract conceptual structure shared by all spaces involved in the blending, which provides a common ground for the conceptualization to unfold. A schematic model of a minimal conceptual integration network that includes two inputs, the generic space, and the blend is presented in Figure 2.1.

[31] See Fauconnier and Turner (2000) for a review of various examples of conceptual blends observed in disparate fields.

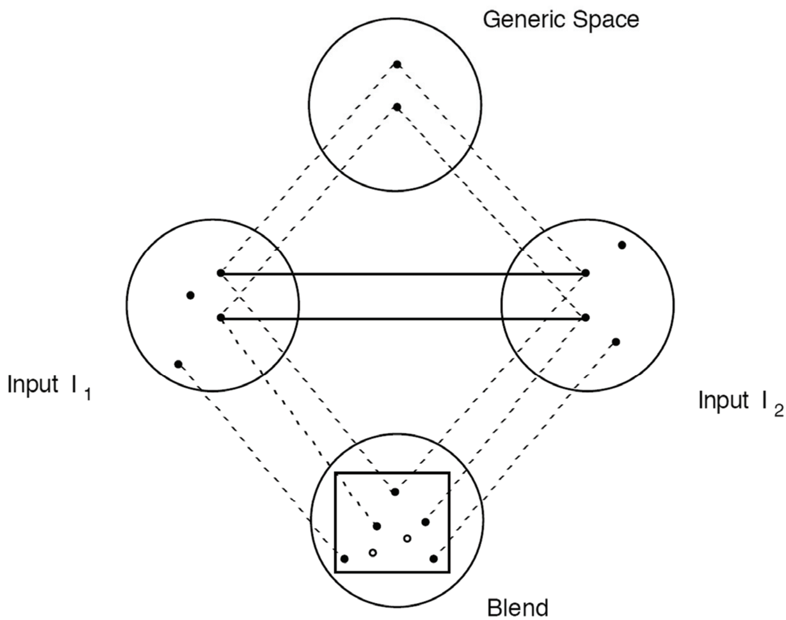

Figure 2.1 Schematic model of a minimal conceptual integration network

In the above diagram, the circles represent mental spaces. The solid lines indicate the matching and cross-space mapping between the input spaces. The dotted lines indicate connections between input spaces and the generic and blended space. The square inside the blended space circle marks *emergent structure.* As noted by M. Turner (2007, p. 379), "while this static way of diagramming aspects of the process is convenient, such a diagram is always a snapshot of an imaginative and complicated development that can involve deactivating previous connections, reframing previous spaces, and other actions".

A prominent feature of the conceptual blending is creation of new, emergent meaning, since a blend created in the integration network "develops *emergent structure* that is not in the inputs" (Fauconnier & Turner, 1998; 2002, p. 42). The emergent structure is generated in three steps: (a) composition of projections from the inputs; (b) completion based on independently recruited frames and scenarios; and (c) elaboration (Fauconnier & Turner, 1998, p. 144; Fauconnier & Turner, 2002, pp. 42–44; M. Turner, 2007). *Composition* involves projecting elements from one (or more) input spaces onto another space, which integrates a particular element with a frame. The emergent structure arises from contextual attribution of a relation from one space to an element in another. *Completion* involves binding an additional familiar structure to the blended space, typically by matching background knowledge from the long-term memory with inputs in the blend as the discourse unfolds. *Elaboration* is related to completion, and involves a dynamic conceptualization of a particular scenario represented in the blend, for example, with a *mental simulation* (see Bergen, 2012).

Fauconnier and Turner (2008, p. 56) argue that the association between space and time in terms of simple mappings between spatial and temporal domains should be revisited in order to account for those features of temporal conceptualization that are inconsistent with spatial representations. They demonstrate how conceptual blending enriches conventional metaphorical models of temporal conceptions by presenting a case study of the TIME AS SPACE concept. A *generalized integration network* (see Fauconnier, 2009) developed for this concept is presented in Figure 2.2. It demonstrates that the TIME AS SPACE concept can be viewed as an elaborate integration network construed in terms of multiple metaphorical mappings between various input spaces, and sub-blends.

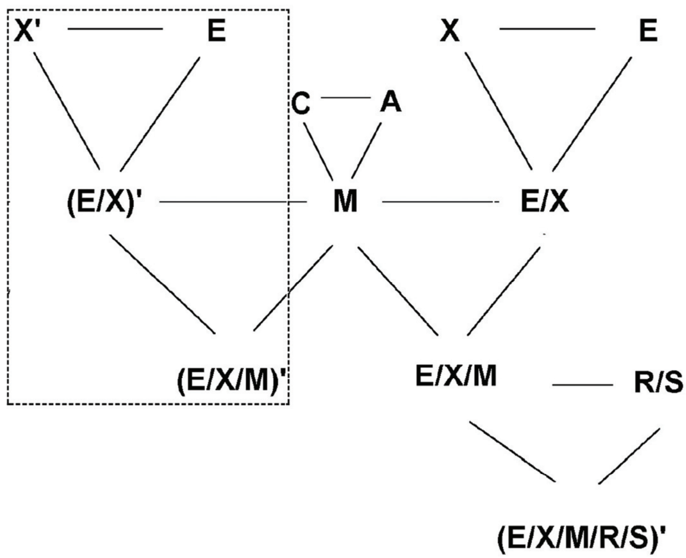

Figure 2.2 Generalized Integration Network for the concept of Time as Space

The model presented in Figure 2.2, includes conceptualizations of *events* (**E**) related to the objective and subjective experience of traveling, as well as conceptualizations of *motion through physical space* (**X**) related to the objective and subjective experience of traversing complete paths. They are blended in the emergent structure (**E/X**), where the traveler of input **X** is fused with the experiencer of input **E**. Within this blend, an event amounts to motion between two points, by which it acquires the property of extension. In the **E/X** conceptualization of time as motion, time is not construed in the objective physical sense but as subjectively experienced by humans, which reflects the fact that the experience of a single event may vary between different individuals.

Additionally, the model accounts for the socially and technologically constructed notion of *universal time* (**M**), which arises from blending of naturally occurring temporal cycles, including *cyclic day* (**C**), as well as natural and technical (e.g. the sun moving across the sky or hands moving on the clock face) *mechanisms of time measure* (**A**). As a result, the blending yields emergent structure of events happening in time that can be measured in temporal units, i.e. equal intervals of time, such as seconds, minutes, hours, days, weeks, months, and years.

Fauconnier and Turner discuss it more extensively in their earlier book *The Way We Think* (2002, pp. 195–198), where they emphasize the importance of *timepiece blend* as a key concept in our understanding of time:

> It is an extremely impressive cultural achievement with incalculable consequences for human life and knowledge to have developed these successive compressions of the Cyclic Day and the Periodic Physical Event. The deep conception of time that emerges is so compelling that we take it to be a part of the fabric of time itself. We find it intuitively obvious that time is divided into equal intervals that repeat day after day, year after year. (Fauconnier and Turner, 2002, p. 198).

De Smedt and De Cruz (2011) explore the role of material culture as an extension of internal time representations through anthropological and archeological case studies. They point out that calendars complement and extend internal time representations because they enable humans to predict cyclically occurring events more accurately than what is possible with episodic memory alone. They argue that the invention of first calendars was among the factors that significantly improved foraging success of the human race during the Upper Paleolithic by allowing to predict animal migration events, which enabled people to make preparations and arrangements in advance.

Hutchins (2005) discusses *material anchors* for conceptual blends. He provides examples of other cognitive artifacts whose spatial configuration aids reasoning about temporal relations, including a Japanese hand calendar used to find the day of the week that corresponds to a given date, and a medieval compass rose used to compute the time of high tide in a port. Williams (2004) emphasizes a *constitutive role of the clock* in conceptualizations of time, rather than being merely a device used for expressing times of a day.

In the **E/X/M** part of the network discussed so far, the conception of time in the generalized integration network is assumed to emerge from blending of events (**E**), construed in terms of experienced motion (**X**), and universal time (**M**). In that blended space local events (**E/X**) become universal events (**E/X/M**), when a particular local event is contained in a *universal temporal unit* projected from **M**, which can be specified by the clock and calendar. Thus, in the emergent structure of the blend, any universal event (**E/X/M)** can be expressed in temporal units. Because it can be measured in a way apparently analogous to spatial measurement, it potentially can be conceptualized as a measure analogous to a universal spatial length expressed in yards, meters, etc. Fauconnier and Turner elaborate on it further in an endnote:

> To say that something is a meter long is to fuse the local with the universal. In the space of physical space, before you had the universal yardstick, let's say, all you could do is compare: this is longer than that. Once you have a universal yardstick, now everything has a length. There is now a universal stuff (of course, this is an emergent concept) just as there are universal events. The meter is made out of universal stuff conceptually, just as the hour is a universal event. Get rid of 5 pounds, take 10 minutes out of your lecture, how many square feet in your house? etc. (Fauconnier & Turner, 2008, p. 66).

Because the generalized integration network construes the TIME AS SPACE concept in two major variants of MOVING TIME and MOVING OBSERVER – a minimally differing *dual* based on FIGURE-GROUND reversal (see Lakoff & Johnson, 1999, pp. 148–149), local events can be construed temporally according to these conceptions, which is marked in the above model respectively as (**E/X)** and (**E/X**)**'**. When they are integrated with the mental space of universal time (**M**), they become universal events construed either as the *experiencer moving in time blend* (**E/X/M**) or the *time moving past a stationary experiencer blend* (**E/X/M**)**'**. They emerge alternatively, depending on the topological variant preserved in the blend.

Moreover, since the concept of time is grounded in cognitive experience, the emergent structure can occur in one of two variants that correspond respectively to *subjective time* (as individually experienced), and *objective time* (as measured by clock). When the emergent structure of the blend focuses on the subjective dimension, time is conceptualized in terms of subjective experience (**E̲/X/M**). As a result, the experience of time is construed differently for different experiencers, which can be observed in *protracted duration* and *temporal compression* (see Flaherty, 1999). On the other hand, when the emergent structure of the blend focuses on the objective dimension, time is conceptualized in terms of the universal clock time (**E/X/<u>M</u>**). In this case, the experience of time is construed as having universal and invariant duration for all experiencers. Because conceptual structures from the inputs are projected into blends selectively, the objective and subjective dimensions of time can function in emergent structures of the entire network.

Moreover, this subjective/objective dimension of time experience can occur for a particular event in a single experiencer, which is illustrated by Fauconnier and Turner (2008) with the following example:

> "*Time goes by really slowly. At the same time, it goes by really fast.*" (CNN, said by a man waiting for word on an American named "Michael" missing in the bomb detonations in London in July 2005.)

A possible interpretation of this sentence reads that "time is going by too slowly because Michael is not showing up, but time is going by too fast because the likelihood that Michael is dead increases with every passing minute." (Fauconnier & Turner, 2008, p. 61).

Furthermore, the concept of time in the TIME AS SPACE generalized integration network can be blended with physical space (**S**). Because of that, time can "fly", "race", "drag", or "come to a complete halt". By incorporation of recollections from memory ® events can be "close", "distant", or "far apart". In result, "we get a new integration **E/X/M/R/S**, which puts a metric on memory that uses the notion of time that is emergent in the **E/X/M** networks" (Fauconnier & Turner, 2008, p. 62).

Such an elaborate model allows for incorporation of other frames, such as *racing* that functions in conceptions TIME IS A PURSUER and TIME IS AN OBJECT OF PURSUIT (cf. Lakoff & Turner, 1989, Ch. 1). Moreover, it explains the construal of time as a flowing or flying object (cf. TIME–SUBSTANCE VARIATION in Lakoff & Johnson, 1999, p. 144). As emphasized by Fauconnier and Turner (2008), in such cases the concept of time emerges from a complex system of mappings between numerous mental spaces, which incorporates the paradoxical inconsistency between subjective experience of time and objective reality of scheduled events. The authors of Conceptual Integration Theory emphasize that the above-discussed Generalized Integration Network for the TIME AS SPACE concept is partial and largely schematic since "conceptual work is never-ending, and we can continue to bring more spaces and even networks into play with the elaborate integration network **E/X/M**" (Fauconnier & Turner, 2008, p. 61).

As pointed out by Forceville (2004), the idea of combining elements of the old to create something new has been explored earlier, for example, by the surrealists, in the collage technique of art creation, or the montage of Russian filmmakers of the

1920s. However, Fauconnier and Turner argue that blending is used in everyday thinking of ordinary people, not only activities typically undertaken by artists in creative activities. Moreover, they have developed a convincing model, which allows for analyzing a range of different phenomena in different disciplines according to the same schemata. The model demonstrates that the conceptual correspondence between time and physical space is not something that can be postulated as a vital constituent of human understanding based on straightforward mappings between two domains taken as primitives (cf. Lakoff & Johnson, 1980). From the conceptual blending outlook, the notion of time should be viewed as a multidimensional concept emerging from a conceptual network involving numerous mental spaces, multiple projections, and hyper-blends.

2.4.1 Criticisms of conceptual blending

The blending theory has not attracted much criticism, but neither has it been intensely debated. Objections raised in a number of papers focused predominantly on *ad hoc*, improvisational procedures employed for dealing with specific instances. Gibbs (2000) points out that blending is too generic because of its descriptive scope. He notes that conceptual blending has been used to explain everything from perceptual experience to participation in rituals (e.g. Fauconnier & Turner, 2000). Moreover, Gibbs (2000) argues that conceptual blending is not a single theory but rather a general framework, which attempts to account for everything and in result explains nothing much in particular. He suggests that researchers in conceptual blending should look for more explicit statements of the grounding principles, and more detailed specifications of the principles that underlie blending analyses.

In a short critical piece, Harder (2003) points out the difficulty of determining parameters for a distinction between already existing mental spaces and new ones established in the process of conceptual integration. He proposes that a new space is required when two mental spaces include contrasting information. He also notes that certain examples analyzed within the blending framework maybe accounted for by simpler processes of grammar. Ritchie (2004) argues that the assumption of four independent cognitive spaces distinguished in the model of conceptual integration leads to unnecessary ambiguity, and works against derivation of testable hypotheses. He demonstrates that some examples used by Fauconnier and Turner (2002) can be interpreted without referencing to four separate mental spaces.

P. Brandt (2005) criticizes conceptual integration theory for its indetermination of the interpretive processes used for generating emergent structures. Instead of the traditional blending model, L. Brandt and P. Brandt (2005) propose a network of six mental spaces designed to derive the critical meaning of utterances. Although their proposal is not fully compatible with the model proposed by Fauconnier and Turner (1998, 2002), some aspects of this alternative can be regarded as a constructive contribution to conceptual integration theory (see Coulson & Oakley, 2005).

A more comprehensive critical analysis of the conceptual blending theory has been presented recently by Glebkin (2013), who accuses the authors of the framework of being too prone to overgeneralizations. He points out that almost all examples analyzed by Fauconnier and Turner (1998, 2002) are connected with the *form* of conceptual operations, but not with their *essence*. For instance, the format of the imaginary *Debate with Kant* example (see Fauconnier & Turner, 2002, pp. 59–62), in which a contemporary philosopher exchanges arguments with imaginary Kant during a seminar is a sort of pedagogical trick. It transforms an abstract philosophical debate into a kind of performance, but the emergence of the blend has no impact on the essence of the problem discussed in the debate. Glebkin concludes that in such cases blending functions as a convenient means of popularizing abstract ideas to the general audience, rather than as a basic instrument for the emergence of new conceptual knowledge.

Secondly, Glebkin points out that the authors of the blending theory neglected to conduct diachronic analyses of the socio-cultural development for the expressions discussed in their examples. For example, the expression to “dig one’s own grave”, which is used, for example, in the sense of a potential financial failure, is analyzed by Fauconnier and Turner (2002, pp. 131–134) as a double-scope network that combines different abstract schemas (cf. Geeraerts, 2009). However, Glebkin notes that it appeared in English and Russian (and most likely other languages, too) only after the first decades of the 20th century in connection with real war atrocities reflected in language. Its emergence, therefore, should not attributed to abstract schemas, as suggested by Fauconnier and Turner, but rather to actual shifts in socio-cultural reality.

Moreover, Glebkin (2013) points out that Fauconnier and Turner fail to provide any experimental data to support their assertions that blends emerge through three-stage process of conceptual operations involving composition, completion, and elaboration in blends. Generally, he does not deny the potential of the blending theory in modern cognitive linguistics, and cognitive science in general, but hopes for a more comprehensive analysis of the theory’s underpinnings, methodology, and heuristic potential in the future.

2.5 Alternative views on metaphorical conceptualization of time

Apart from the blending theory, alternative schemes of metaphorical conceptions of time have been proposed within the conceptual metaphor framework. Aleksander Szwedek (2002, 2007, 2008, 2009a) proposes an alternative theory of metaphor. He views conceptualization of abstract concepts in terms of concrete entities as *objectification.*[32] Since time is frequently confused with events occurring in time, as space is with objects located in space, it seems that we tend to conceptualize both time and space in terms of material entities, which are directly accessible to our senses. In his argumentation Szwedek refers to Kotarbiński's (1929/1990a, Ch. 1) philosophical theory of *reism*,[33] which emphasizes a fundamental role of objects in cognition. Reism assumes that evens taking place in time should be reduced to objects undergoing changes of states:

> And here are other true sentences about "events": "The eruption of Vesuvius destroyed Pompeii and Herculaneum", […], etc., etc. We answer that only externally are those sentences about events. In fact, we have here only substitute phrases of such expressions as: […] "Vesuvius erupted so that it destroyed Pompeii and Herculaneum", and so on. All so-called names of events disappeared […]. Confessing this we can in a few words express our view and say that no object is an event, because only illusorily (never in reality) can we utter a true sentence about an event. […] Since therefore, to say "N exists" – is only to say "A certain object is N", therefore, in other words, we can express our view in the sentence: "Events do not exist". Thus evaporates the whole category of objects which would be events (Kotarbiński, 1929/1990a, pp. 70–71, as translatated and quoted by Szwedek, 2009a).

Consistently with this position, Szwedek (2009a) questions metaphorical schemas viewing time as space, motion and other non-physical objects. He argues that

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[32] Szwedek (2009a) notes that in his theory the term *objectification* is used in its common Oxford English Dictionary sense: "The action of objectifying, or condition of being objectified; an instance of this, an external thing in which an idea, principle, etc. is expressed concretely".

[33] Kotarbiński (1990b) himself characterized *reism* in the following manner: "Sentences may contain words that are not names, e.g. verbs or conjunctions, etc. The point is, however, to eliminate names other than the names of objects. Let me hasten with an example of a *reistic* interpretation of sentences. 'Prudence inheres in wisdom' simply means: 'Every man who is possessed of wisdom is prudent.' 'Bonds of brotherhood related Orestes to Electra' simply means: 'Orestes was Electra's brother.' A *reist* by no means demands that the use of sentences with abstract expressions like the names of qualities or relations be completely abandoned. Quite the contrary, the necessity of applying them is fully recognized just because their presence may often reduce the length of the statement. The only thing he insists upon is to try to be able to do without names which are not the names of things."

instead of the TIME AS SPACE metaphor we should consider the TIME AS AN OBJECT (IN SPACE) metaphor, and instead of the TIME AS MOTION metaphor we should consider the TIME AS AN OBJECT (IN MOTION) metaphor. He points out that reducing conceptualizations of time to a single interpretation of the TIME AS AN OBJECT metaphor, enables us to eliminate the inconsistency between the *moving-time* and *moving-ego* conceptualizations. Moreover, Szwedek (2009a) notes that the *moving-time* variant allows for viewing time as a CONTAINER (see Lakoff & Johnson, 1999, p. 153; Kövecses, 2006, p. 166) through which we pass, and every container is an object in the first place. Szwedek underpins the theory of *objectification* with the Great Chain Of Being (Lakoff & Turner, 1989, pp. 167–168; adapted by Krzeszowski, 1997, p. 67), as well as neurological and linguistic evidence.

Szwedek (2011) proposes a sharp distinction between concrete entities as material, and abstract entities as non-material (see also Krzeszowski, 1997, p. 24), which provides grounds for distinguishing a new typology of metaphors, embracing: metonymy-based, concrete-to-abstract, and abstract-to-abstract metaphors. Since all other domains depend on the physical object[34] that is accessible to our senses, Szwedek (2011) regards the OBJECT schema as the *ultimate source domain*, which is not subject to any further metaphorization. It provides grounds for metaphorical conceptualization to all other conceptual domains, including time and space.

A contrasting position on metaphorical representations of time has been proposed by Antony Galton (2011), who argues that the spatialization of time through metaphor can never do justice to the nature of time as a basic feature of the human experience. Because of disanalogies between key attributes of space and time, it is impossible to use spatial metaphors to represent the nature of time. Galton observes that all temporal metaphors take some kind of change as their source, which means that they depend on the fundamental feature of *temporal transience*.

Galton (2011) notes that transience is difficult to characterize in a formal way without lapsing into circularity. He describes transience as fleetingness, i.e. the idea that we only experience a time at the time we are experiencing it. Any given moment only occurs once, at that very moment of time, and any given time is only

[34] Discussing universality and variation of metaphor in culture Kövecses (2005, Ch. 8) notes that although metaphor is primarily a conceptual phenomenon, in some cases it can also turn into a more or less tangible thing or process in the social–physical reality. This is illustrated in a grasping study of the ARGUMENT IS WAR metaphor (Krzeszowski, 2002), which demonstrates how a legal argument first made in writing can develop over time into actual physical fighting between two families claiming ownership of a castle, as described in the Polish national epic “Pan Tadeusz”.

present when it is that time. We say “What’s done is done” because it is impossible for us to revisit the past. It is also reflected in phrases such as “Here today, gone tomorrow”, “You only live once”, “Time and tide wait for no man”. Galton argues that without this particular attribute, time would be just another static dimension like those of space, and we would have a universe in which there is no change, just different qualities at different spatiotemporal locations. Leonard Talmy (personal communication, April 23, 2013) supports a clear distinction of this particular feature of time, which he calls *temporal progression*.

However, transience is *not* an attribute of space. Space can only acquire this attribute through correlation with time by means of motion. Since motion includes a *change of position*, it is the *change* aspect of motion rather than the *position* part that correlates with the temporal transience in metaphorical representations of time. Galton (2011, p. 695) notes that since “space can only acquire the attribute of transience through correlation with time by means of motion, no purely spatial metaphor can capture the transience of time”. Accordingly, because of its transient nature, time cannot be captured by metaphors that do not make use of the transient aspect of time. Time is such a fundamental and inseparable feature of our experience that it resists explanations in terms of anything else (see also Toda, 1978).

It seems that the above-discussed models mark two opposite ends of a spectrum of views on conceptualization of time. Szwedek’s theory of objectification attempts to reduce conceptions of time to material entities that can be captured *directly* through the senses because of their tangibility. On the other hand, Galton’s position of temporal transience lays emphasis on time as immaterial dynamic process that relentlessly escapes sensory perception, therefore can only be *captured indirectly* through changes of states observable in time. Taking into consideration that across cultures and languages time is conceptualized in a wide variety of ways, including various types of *personification* (see Lakoff & Johnson, 1980, Ch. 7; Kövecses, 2010, pp. 55–56; Lakoff & Turner, 1989, pp. 35–43 & 73–79), *animate and inanimate forms of nature* (see Everett, 2005; Idström, 2010), and culturally created artifacts such as *money* (see Lakoff & Johnson, 1980, pp. 7–9; 1999, pp. 161–164; Evans, 2003, Ch. 14), it is impossible to provide a single definite answer on how time is conceptualized in cognition. A tremendous body of research on metaphorical conceptions of time reviewed briefly in this chapter indicates that as we think and talk about temporality our conceptions are construed in different ways depending on the purpose of local context and situated action.

2.6 Senses of time reflected in lexical concepts

Metaphorical conceptions of time demonstrate that conceptualizations of time do not depend on the concept of time itself. Linguistic expressions of time not only invoke complex conceptual frameworks derived from a variety of different sources, but also reflect different senses of temporal conceptualizations. Evans (2003, 2005) has re-examined the concept of time within the conceptual metaphor theory. He employed Grady's (1997) *primary metaphor* approach to demonstrate that the lexeme *time* is in fact polysemous and relates to a "set of temporal lexical concepts, each with a distinct set of background frames/domains of experience" (Evans, 2003, pp. 67–68). Evans argues that time should not be viewed as a single, relatively primitive concept that constitutes the *primary target* in metaphoric mappings, but rather as a range of distinct lexical concepts structured in terms of possibly heterogeneous meanings. Using four different lines of evidence to support this assumption: distinct meanings, metaphoric mapping gaps, patterns of concept elaboration, and grammatical distinctions, Evans (2003, 2005) discusses a range of distinct *senses of time* that can be associated with the lexical item *time*.

According to Evans, the fundamental sense for time is (1) *Duration Sense*, defined as "an interval bounded by two 'boundary' events, i.e., the beginning and ending of the interval" (2003, p. 108), e.g. "The relationship lasted a long/short *time*"; "It was some/a short/a long *time* ago that they met". In these examples, time references an interval that is co-extensive with a particular state or process. The Duration Sense serves as the conceptual basis, or as termed by Evans following Langacker (1987a, p. 157; 2008a) the *sanctioning sense*, from which the other senses are derived.

In (2) *Moment Sense* (Evans, 2003, Ch. 8), which is illustrated by such sentences as "The *time* for a decision has arrived/come"; "What *time* is it?" the lexeme *time* evokes a "conceptualization of a discrete or punctual point or moment without reference to its duration" (p. 123). Evans (2003, pp. 126–128) adds that there is significant historical evidence that the Moment Sense was derived from the Duration Sense. At an early stage in the development of English salient intervals were lexicalized as the forms *tide* and *time*. In Old English the lexical form *time* had a conventional reading of an *hour*[35] or a *year*, and *tide* was the

[35] Evans (2003, Ch. 8.3; 2005, p. 49) notes that in the highly conventional expression *What time is it?* we can still observe the original earlier meaning of *hour* associated with time. Some European languages still employ in this context the lexeme referencing to hour, e.g. French: *Quelle heure est-il?*; German: *Um wieviel Uhr ist es?*; Polish: *Która jest godzina*?, rather than forms: *le temps*, *die Zeit*, and *czas*, respectively.

form of *time*. Although archaic by now, it is still used to detonate the interval separating high and low water.[36]

Another distinct lexical concept of time that relates to fundamental aspects of our cognitive architecture includes (3) *Instance Sense*, where time is conceptualized as an instance of a particular event, activity, process or state, rather than an interval or moment embedded within an interval, e.g. "This *time*, it was a bit more serious because I got a registered letter"; "He did it 50 *times* in a row". The fourth basic sense of time distinguished by Evans (2003, Ch. 9–10), namely (4) *Event Sense* prompts for a reading in which a specific event is referenced, e.g. "The young woman's *time* [=labour] approached"; "His *time* [=death] has come/arrived". Evans (2005) notes that the Instance Sense and the Event Sense can be subsumed under the Moment Sense. One plausible motivation for the development of the Moment, Instance, and Event senses relates to the phenomenon of *time embeddedness* (Lewis & Weigert, 1981). Since all social acts are temporally fitted inside of larger social acts, events are embedded within other events, and salient intervals are subsumed in other intervals (see Evans, 2003, Ch. 8.3; 2005 for a broader discussion on the derivation of the Moment Sense).

Apart from the above-listed senses relating to fundamental aspects of our cognitive apprehension of time, Evans (2003, Ch. 11–14) discusses senses of time that appear to be derived from the socio-cultural transfer. They include (5) *Matrix Sense*, in which time is conceptualized as an entity that it is not constrained by the interval holding between individual events. The Matrix Sense prompts for an entity which rather than being an attribute of other events and entities is conceived as independent, e.g. "*Time* flows/runs/goes on forever"; "Those mountains have stood for all *time*"; "Nothing can outlast *time*".

Moreover, further reification of time (see also Szwedek, 2009a) results in the (6) *Agentive Sense,* which relates to time as an entity which is conceived not just as serving to manifest change, but as one which actually brings about and hence causes change. In this sense time has the ability to affect us and our environment: it can heal, innovate, steal, devour, inflict scars, etc., e.g. "*Time* is the great physician"; "*Time* transformed her"; "*Time* has left its scars"; "Only *time* will tell" (see also Lakoff & Turner, 1989, pp. 35–43 and 73–79). Furthermore, time occurs in (7) *Measurement-system Sense*, e.g. "Eastern Standard *Time* is five hours behind

[36] As noted in Oxford English Dictionary (2009), the earliest appearance of *tide* in the now archaic sense of *time* can be found in *Beowulf*, c. 700AD. By the 16th century *tide* lost its earlier meaning of *time*, but retained the meaning of period between high and low sea-water, e.g. *tide of the sea*.

Greenwich Mean *Time*"; and (8) *Commodity Sense*, in which time is conceived as inherently valuable entity that can be spent, traded, acquired, possessed, etc., as in "She's invested a lot of *time* in that relationship" or "The psychiatrist charges a lot for her *time*" (see also Lakoff & Johnson, 1980, pp. 8–9; 1999, pp. 161–164; Kövecses, 2005, pp. 132–143). A general conclusion from Evan's analysis is that time has a structure, which enables us to segment temporal experience according to perceptual, conceptual and external sensory dimensions in cognition.

However, Marchetti (2009) argues that semantic analyses of lexical temporal concepts cannot escape circularity. He points out that Evans (2003) starts from the notion of duration as the sanctioning sense for the lexical concepts of time, but then discusses duration as an interval, which is derived from succession, and succession is derived from duration. These lexical concepts are so tightly entangled that is impossible to tell which one of them generates the others. Because of that, semantic analyses of temporal meanings of words are just mere illusions of getting closer to the experiential level of time. Marchetti (2009) proposes that studies on time should instead employ the framework of *attentional semantics*, in which temporal concepts can be associated with a certain level of "expenditure of the nervous energy supplied by the organ of attention for the temporal task" (Marchetti, 2009, p. 32). Unfortunately, he does not include any specific examples of application of his proposal in practice.

2.7 Cognitive validity of spatial conceptualizations of time

As discussed above, both the conceptual metaphor and the conceptual blending frameworks assume that we employ spatial concepts to understand the nature of time. However, as noted by Kövecses (2010, pp. 40–42), saying that we simply "understand" time metaphorically can be objected by those scholars who are interested in real-time processes of understanding involved in cognition (see Gibbs, 2008 for a review). Therefore, it is important to distinguish understanding linguistic metaphors in the sense of *offline understanding* of language, which happens when we *construe* or conceive of time in terms of physical domains (or concepts) by means of long-term memory or as a result of a historical-cultural process, from *online understanding*, which involves short-term cognitive process of comprehending something in real time, at the time of speaking or otherwise interpreting.

Sequencing events in time from spatial perspective was examined by McGlone and Harding (1998), who conducted experiments based on disambiguation of temporal statements. Participants were first asked to answer a series of questions that expressed temporal relations between days of the week in the either ego-moving, e.g. *We passed the deadline two days ago*, or the time-moving, e.g. *The deadline passed two days ago*, metaphors. For each question they were asked to indicate the day of the week that a given event had occurred or was going to occur. At the end of each series the participants were asked to perform this task for the following ambiguous question: "Next Wednesday's meeting has been moved forward two days. What day is the meeting, now that it has been rescheduled?". The sentence is ambiguous because the "moved forward" phrase can be interpreted from either ego-moving or time-moving perspective to yield different answers. The study demonstrated that participants conditioned in the ego-moving variant tended to answer that the meeting was rescheduled for Friday, whereas participants conditioned in the time-moving variant tended to answer that the meeting was rescheduled for Monday.

In experiments conducted by Boroditsky (2000) participants were primed with spatial scenarios consisting of a picture and a sentence description that used either the ego-moving or the object-moving spatial schemas. Then, they interpreted an ambiguous temporal statement similar to the one used by McGlone and Harding (1998) about *next Wednesday's meeting being moved forward two days*. Testing showed that participants primed in the object-moving perspective preferred the time-moving interpretation (meeting thought to be on Monday), and vice versa (meeting on Friday).

These findings were investigated further in subsequent studies (Gentner, 2001; Gentner, Imai & Boroditsky, 2002), which measured response times for processing temporal expressions presented either consistently or inconsistently with the ego-moving or the time-moving variants. In one experiment, passengers at an airport, not aware of being in a psychological study, were asked first a priming question phrased in the either ego-moving, e.g. "Is Boston ahead or behind us in time?" or the time-moving, e.g. "Is it earlier or later in Boston than it is here?" forms. When the participants were subsequently asked the target question: "So should I turn my watch forward or back?", which was consistent with the ego-moving form, response times of those who were primed consistently were shorter than of those who were primed inconsistently. (The response times for the target question were measured by the experimenter with a stopwatch disguised as a wristwatch.) Extra time involved in answering inconsistently primed questions indicates cognitive switching between distinct temporal schemas, which increases processing time.

Participants in another study (Boroditsky & Ramscar, 2002, Study 1) were first asked to study a drawing of an office chair with a rope attached. Half of them were asked to imagine that they were pulling the chair towards them with the rope. The other half were asked to imagine pulling themselves forward along the rope while sitting in the chair. After such priming, they were asked the same ambiguous question about *next Wednesday's meeting being moved forward two days*. Again, those who imagined pulling the chair toward them tended to answer that the meeting had been moved to Monday, which is consistent with the metaphorical variant that time is an object moving toward us. Those who imagined pulling themselves along the rope tended to answer that the meeting had been rescheduled for Friday, consistently with the other variant of metaphorical conception of time.

In another experiment (Boroditsky & Ramscar, 2002, Study 4) the experimenters took the logic a step further to show that an actual experience of motion, not just words, can change people's interpretations of ambiguous temporal statements. They asked the question about *next Wednesday's meeting* to passengers riding on a train. Overall, more passengers responded that the meeting was moved to Friday, which coincides with the metaphorical movement of ego through the temporal landscape. However, the experimenters noticed that the situation is subtler than that:

> We were interested in whether actual motion (simply sitting on a moving train) is sufficient to influence how people think about time, or whether actively thinking about one's journey is necessary in addition to the actual spatial motion. To investigate this, we analyzed whether the responses of the people on the train varied according to whether they had answered our ambiguous question at the beginning, middle, or the end of their journey. People are most likely to be involved in thinking about their journey when they have just boarded the train and when they are getting close to their destination. In the middle of their journey, people tend to relax, read, talk on cell phones, and other mentally disengage from being on the train (Boroditsky & Ramscar, 2002, p. 188).

The experiment demonstrated that the passengers more frequently took the moving ego perspective at the beginning and the end of their train ride; fewer took that perspective in the middle of the journey. It indicates that our thinking about time is tied to our thinking about spatial motion, but not necessarily to the experience of motion itself.

Other experiments (Matlock, Ramscar & Boroditsky, 2005) demonstrated that temporal reasoning can be influenced by reading sentences and drawing spatial descriptions including fictive motion expressions. The tendency to conceptually "move" along fictive motion was observed to be sensitive to the number of points depicted along the path (Exp. 2) and the direction of the path (toward or away) expressed by fictive motion sentences (Exp. 3). The results suggest that fictive motion evokes structures involved in understanding literal motion, and that these literal aspects of fictive motion influence temporal reasoning.

A more recent study (Sullivan & Barth, 2012) demonstrated that temporal judgments are affected more effectively by spatial primes involving imagined motor actions, rather than equivalent passive motions. In the experiments participants imagined either active or passive motor conditions. The active conditions involved imagining a self-powered motor activity requiring two differing degrees of effort, e.g. pulling either a light or a heavy wagon. In the passive condition, participants imagined passive movement without activity on their part, e.g. watching a wagon roll towards their body. The results demonstrated that it is not just any spatial prime that induces changes in temporal perspective taking. The effectiveness of spatial priming seems to be mediated by the engagement of mental motor imagery, not just motion in space as such.

Núñez et al., (2006) gathered experimental evidence for the psychological reality of the *perspective-neutral* viewpoint distinguished in the Ego-RP versus Time-RP distinction (Núñez & Sweetser, 2006; cf. Moore, 2000, 2006), which was discussed in Section 2.3. In their experiments participants were primed with an animation of cubes moving across a computer screen horizontally (in either direction), then responded to the question: "Last Wednesday's meeting got moved forward two days. On what day did the meeting take place?". The results showed a strong predominance of Monday responses over Friday responses. The choice of Monday rather than Friday, after priming with motion scenes with no reference to ego's location, supports the conclusion that such metaphoric phrases as *move a meeting forward* are construed independently of ego's perspective with respect to a temporal path or landscape. If the participants had been construing spatial relations relative to ego, they, most likely, would have construed all of last week as behind them, not in front of them.

The results of the above-reviewed experiments provide evidence for the psychological reality of different temporal schemas involved in sequencing events in time, and demonstrate that spatial conceptual schemas play an important role in structuring conceptualizations of temporal relations (see also Section 4.6). Kövecses (2010, p. 42) points out that such experiments show that people make use of conceptual metaphors when they comprehend metaphorical expressions on-line. The source domains are clearly activated in the real-time comprehension of target-related metaphorical meanings even in the case of highly conventional metaphorical expressions, which leads to a conclusion that "understanding" conceptual metaphors involves both the on-line and off-line senses.

2.8 Spatialization of time across languages and cultures

Anthropological research on temporality has found that certain aspects of time experience are generally universal across worldwide groups and cultures. One such aspect includes the experience of time as a perpetual change marked by altering states of objects, which results in the widespread conception of time as a *unidirectional vector*. Another universal basis for construing temporality derives from the recurrence of *temporal cycles*, including the day/night cycle, the moon cycle, the change of seasons, etc. As summarized by Maines (1989, p. 117), "despite the great differences in cultural time logics and the substance of time-consciousness . . . various cultures have much in common when it comes to temporality". Gell (1992) describes the situation in a more evocative manner:

> There is no fairyland where people experience time in a way that is markedly unlike the way in which we do ourselves, where there is no past, present and future, where time stands still, or chases its own tail, or swings back and forth like a pendulum. All these possibilities have been seriously touted in the literature on the anthropology of time . . . but they are travesties, engendered in the process of scholarly reflection (Gell, 1992, p. 315).

In a cross-linguistic comparison of metaphors of time in English, Mandarin, Hindi, and Sesotho, Alverson (1994) distinguished only five basic classes of conceptualization: (1) time as *a partible entity*; (2) time as *causal force or effect*; (3) time as *medium in motion*; (4) time as *a course*; (5) time as *an artifact of ascertainment of the change of time*. Apart from the exception of Hindi, which has no conception of time as a linear or orbital course, Alverson's study indicates a common experiential basis and phenomenological universality in the experience of time among speakers of different languages.

However, some aspects of time are underspecified by experience, leaving open the possibility of different construals. This applies in particular to the directional axis along which the spatially construed time moves: is it from front to back, top to bottom, left to right, east to west – or perhaps the reverse direction? A number of studies have provided substantial evidence for cross-linguistic differences in conceptions of time in this context.

Probably the most widespread pattern, discussed in numerous cognitive linguistic studies (e.g. Fillmore, 1971/1997; Traugott, 1978; Lakoff & Johnson, 1980; 1999; Lakoff & Turner, 1989; Radden, 2004), and empirical psycholinguistic research (e.g. McGlone & Harding, 1998; Boroditsky, 2000; Gentner, 2001; Boroditsky & Ramscar, 2002) construes time along the *front/back axis*, where typically front is assigned to the future, and back to the past.

However, a striking reversal in the direction of time can be observed in the Chilean language of the Andes *Aymara*, which arranges time in the reverse way (Núñez & Sweetser, 2006). In Aymara the future is behind ego, and the past is in front of ego.[37] It is rationalized by the argument that the past is in front because we already know what is in the past; and the future is in back because we cannot see the future, just as we cannot see behind our back. A more recent report (Núñez & Cornejo, 2012) adds that in Aymara times and events in time can be conceived as having the same metaphorical canonical orientations as humans and objects (see also Traugott, 1978; Zinken, 2010). Thus, time is "facing" East, where earlier times (sunrise) are in front of later times (sunset). Aymara speakers appear to integrate the basic inferential structure of the time reference-point mapping for sequence time (earlier is ahead, later is behind) with the inferential organization of their unusual vision-driven Ego-RP mapping for deictic time. As a result, *now* is also canonically oriented facing East. This culture-specific cognitive pattern was confirmed by both linguistic and gestural data.

On the horizontal plane time is also conceptualized along the *lateral axis*. The direction of temporal sequences in the *mental timeline* (see Bonato, Zorzi & Umiltà, 2012) seems to mirror the *direction of writing* (Tversky, Kugelmass & Winter, 1991; Fuhrman & Boroditsky, 2010; Bergen & Chan Lau, 2012; de Sousa, 2012). Speakers of languages that arrange writing from left to right tend to associate past time with the left, and future time with the right space (Santiago, Lupianez, Perez & Funes, 2007; Ouellet, Santiago, Israeli & Gabay, 2010). People who read texts arranged from right to left, e.g. *Arabic* and *Hebrew*, conceptualize time as flowing from right to left (Fuhrman & Boroditsky, 2010).

A study conducted in laboratory conditions (Torralbo, Santiago & Lupianez, 2006) demonstrated a substantial flexibility in conceptual projection of time onto spatial frames of reference. One experiment demonstrated that inconsistent metaphoric mappings (*front/back* and *left/right*) may coexist in semantic memory and be activated in different situations and by different reasons determined by *attentional mechanisms*. Therefore, under the framework of attentional dynamics mutually inconsistent time-to-space mappings can be deployed in different sociolinguistic contexts (see also Miles, Tan, Noble, Lumsden & Macrae, 2011).

[37] Núñez and Sweetser (2006) emphasize that for the Aymara this is a *static*, not a path-based metaphor, which excludes the possibility of likening a person's life to walking backwards along the timeline.

Studies conducted in speakers of Mandarin (e.g. Alverson, 1994, Boroditsky, 2001; Boroditsky, Fuhrman & McCormick, 2011; Bergen & Chan Lau, 2012) found[38] that while English speakers spatialize time on the horizontal plane, Mandarin speakers are also likely to think about time along the *vertical axis*. Native speakers of Mandarin Chinese from Taiwan, where characters are written predominantly top to bottom and then right to left, are as likely to depict time in non-linguistic tasks as moving from left to right as from top to bottom, with earlier time-points located above and later time-points located below. Miles et al. (2011) demonstrated that Mandarin–English bilinguals employ horizontal or vertical representations of time, depending on subtle variations in the culturally specific characteristics of the task at hand. To manipulate the cultural context without explicitly drawing attention to the linguistic distinction between Mandarin and English, participants were asked to perform a non-linguistic task: to arrange a set of photographs into a temporally ordered sequence. Importantly, two sets of photographs were used: one depicted Jet Li and the other Brad Pitt, respectively a Chinese and American actor. A change in sociolinguistic context, i.e. Mandarin vs. English, resulted in participants' spontaneously adopting a spatial representation of time consistent with prevailing norms within that language.

Studies conducted in a remote Aboriginal community of *Pormpuraaw* from Cape York Peninsula in Australia (Boroditsky & Gaby, 2010; Gaby, 2012) found that the Pormpuraawan languages do not make extensive use of relative spatial terms like left and right. Instead, speakers of these languages rely on absolute spatial terms based on the cardinal directions, i.e. "north," "south," "east," and "west". Experiments conducted with linguistic and non-linguistic tasks found that Pormpuraawans conceptualize time using the absolute frame of reference employed in spatial descriptions: they mentally arrange time from east to west. This arrangement differs strikingly from all other documented conceptualizations, which are relative to the human body. It means that for Pormpuraawans time flows from left to right when one is facing south, and from right to left when one is facing north. However, this absolute space-time mapping was found to be restricted to non-linguistic cognition and co-speech gesture: the absolute east/west reference frame was not used for linguistic descriptions of time.

[38] Some follow-up studies attempting to corroborate Boroditsky's (2001) findings with Mandarin speakers (Chen, 2007) and English speakers (January & Kako, 2007) reported inconsistent results. However, subsequent research conducted with different experimental paradigms (Fuhrman et al., 2011; Miles, Tan, Noble, Lumsden & Macrae, 2011) confirmed the initial findings as valid. See Boroditsky, Fuhrman & McCormick, 2010 for a detailed explanation.

Another recent study (Núñez, Cooperrider, Doan & Wassmann, 2012) conducted among the *Yupno*, an indigenous group from the mountains of Papua New Guinea, shows that they spontaneously construe time in terms of allocentric topography of the land: *the past is construed as downhill*, and *the future as uphill*. Moreover, the Yupno conceptions of time appear to be not linear, but reflect a particular geometry mirroring the local terrain. However, the relationship between temporal linguistic expressions and conceptualizations of time is much more complex. For example, speakers of Mayan *Tzeltal*, a language spoken in the rural community of Tenejapa in southeastern Mexico, also use an absolute frame of reference grounded in the overall *downhill/uphill* slope of the land for describing locations and movement in space.[39] They habitually construe time in terms of extending *uphillwards* into the future, e.g., "I'll see you at its-uphill of New Year," means "just after New Year's Day" (Brown, 2006). A recent study (Brown, 2012) found that while the "time moves uphillwards" metaphor is important in Tzeltal linguistic expressions for time, it is not strongly reflected in responses observed in non-linguistic tasks.

Brown's (2012) findings are in a sense the opposite of what was found in the above-mentioned studies of Pormpuraaw (Boroditsky & Gaby, 2010; Gaby, 2012). It is noteworthy that in both cases the experimenters used the same linguistic and non-linguistic tasks. The study of Tenejapans demonstrated that systematic and consistent use of spatial linguistic expressions in the absolute frame of reference does not necessarily transfer to consistent absolute time conceptualization in non-linguistic tasks. Consequently, Brown (2012) concludes that spatial terms and reference frames habitually used to talk about space do not strictly determine the frames of reference used for conceptualizing time (see also Bender, Rothe-Wulf, Hüther & Beller, 2012).

The body of research reviewed above demonstrates that despite certain universals, conceptions of time differ spectacularly throughout cultures. This leads to a basic question asked by Whorf: "Are our own concepts of 'time,' 'space,' and 'matter' given in substantially the same form by experience to all men, or are they in part conditioned by the structure of particular languages?" (Whorf, 1939/1956a, p. 138).

[39] Although the use of the absolute *uphill/downhill* spatial frame of reference may seem awkward from the Western perspective, a recent study on spatial reasoning skills in Tenejapans (Li, Abarbanell, Gleitman & Papafragou, 2011) found that Tzeltal speakers easily solve the language-incongruent problems, and their performance is generally more robust in such tasks than in language-congruent tasks based on the geocentrically-defined coordinates.

Although the strong variant of Whorfian hypothesis[40] of language determining cognition was generally rejected, Gell (1992, p. 327) admits that "different languages seem to highlight particular temporal/ aspectual/modal relationships between events at the expense of others". Since the above-reviewed studies demonstrate that cultural and environmental factors influence conceptions of time, they provide arguments for claims about temporal *linguistic relativity*, which posits that speakers of different languages, who use different temporal metaphors, are likely to think about time differently (see Boroditsky, 2001, 2011a; Kosecki, 2001; Casasanto, 2008).

The apparent paradoxical contrast between *universality* and *relativity* of temporal experience evident in linguistic representations of time may be explained by the distinction between *basic* and *interpreted* levels of temporal experience proposed by Langacker (2012). At the lowest level of abstraction derived directly from the organic functions, the universal properties of temporal experience are reflections of our biological potential. At this level all languages can be viewed as very much alike. On the other hand, languages demonstrate open-ended variability at the level of *interpreted experience of time*, where language-specific structures are the product of cultural elaboration and social transmission between generations.

The cultural aspect of temporal conceptions is emphasized by Kövecses (2005, Ch. 10; 2006, p. 69 & 135), who notes that the particular ways in which people conceptualize time depend on their *differential experience* and *differential cognitive preferences and styles*. Kövecses (2006, p. 135) emphasizes that a substantial part of our understanding of the world comes through the *metaphoric frames* structured by *cultural models* shared by members of a given society (cf. Goffman, 1974). These frames constitute a complex system of knowledge employed for construal of meanings in linguistic communication, thinking, and acting in the life space of our daily functioning (see also Radden, 2004 for a similar view).

[40] The strong variant of *Whorfian hypothesis* a.k.a. *Sapir-Whorf hypothesis*, or the *linguistic determinism* (Whorf, 1939/1956a, 1940/1956b) holds that the language we speak determines our perception and understanding of the world. See Koerner (1992) for a historical overview of linguistic ideas that contributed to development of the hypothesis. Several "stronger" and "weaker" variants functioning in the contemporary cognitive science under the umbrella term of *linguistic relativity* are reviewed in Section 7.4.

Conceptions of time are affected by a multitude of factors, including the range of metaphorical representations in the particular language, the current linguistic context, and the particular metaphors employed for a conceptualization of time in a given situation (Boroditsky, 2011b). Kimmel (2004, p. 293), in his review of metaphorical variation across cultures from an anthropological perspective, emphasizes that both anthropology and linguistics should “avoid extremism, either in the snares of super-relativistic *constructionism*, or slapdash *universalism*” in research relating culture and cognition. This conclusion also applies to conceptions of space, which are discussed in the following chapter.

Chapter 3

Cognition of spatial distance

Knowledge about space is one of the earliest forms of knowledge people use … Spatial knowledge is critical to our interactions with each other and to our interactions with the physical world, indeed to our very survival.

Taylor and Tversky (1996) *Perspective in Spatial Descriptions*

3.1 A question of the nature of space

Since all human activity takes place in space, we use knowledge of space both in our interactions with the physical world, and among one another. The previous chapter introduced selected aspects of using spatial terms in temporal representations. However, *spatial semantics*, i.e. the study of the meaning of spatial language, extends well beyond the basic role of space in conceptualizations of time into numerous other semantic domains that are systematically conceptualized in terms of spatial image schemata (Hampe, 2005; Evans & Chilton, 2010; Mix, Smith & Gasser, 2010). As emphasized by Zlatev (2007), understating spatial semantics as a central and universal aspect of human experience provides the key to human conceptualization in general.

Deliberations about the nature of space date back to the pre-socratic thought. Early Greek philosophers were preoccupied with the discussion whether space should be regarded as a material entity, which was argued by the school of Parmenides and Melissus, or as a void, which was argued by the Epicureans (Barnes 1982, Ch. X; Tatarkiewicz, 2005). The former school supported their views with argumentation that it was impossible for nothingness to have the property of extent. The latter philosophers (also referred to as *atomists*) pointed out that however big the extent of space was, it was always possible to throw a javelin beyond it, which suggests empty infinity. Plato supported the material view of space. He considered air as a substance with geometrical properties, which allows for identification of three-dimensionality of body and matter (Sorabji, 1988, Ch. 8–9).

The material view of space was questioned by Zeno, who was pondering over the following paradox of relative location: if everything is in a place, and place is something, place itself is in something, but what? [41] (Barnes, 1982, pp. 201–203). Aristotle, found a solution to Zeno's paradox by defining the notion of place as: "the innermost motionless boundary of what contains it" (Aristotle, 350BC/1995b, *Physics*, 212a20–21). Therefore, Aristotle considered space as the adjacent or inner boundary of the matter constituting objects, which extends as a nested series of places to the outer boundary of the universe. This view reduces space to a place and denies the possibility of existence of an empty vacuum (Grant, 1981, pp. 5–8; Sorabji, 1988, Ch. 9). *Nature abhors a vacuum*, as Aristotle's famous dictum has it. Such views prevailed in spatial thought until the Renaissance, when philosophers abandoned scholastic approaches to space based on Platonic and Aristotelian ideas.

In 1637 Descartes developed a three-dimensional rectangular coordinate system, (called the *Cartesian coordinate system* after his name), which has been used ever since, for example, by air traffic controllers and cartographers to accurately describe where to find people and places. However, for Descartes space and matter were still essentially one and the same thing: material substance has no essential property but extension, and extension is the essential property of space as well. Therefore, he concluded, there can be no space without matter: if every region of space is a region of matter, then there can be no space without matter (Grant, 1981; DiSalle, 2006, pp. 18–19; 2009).

Subsequently, Newton proposed the seminal distinction between *relative* and *absolute* space: "Absolute space, in its own nature, without relation to anything external, remains always similar and immovable. Relative space is some movable dimension or measure of the absolute spaces; which our senses determine by its position to bodies" (Newton, 1687/1995, p. 6). Because we cannot sense absolute places and motions, instead we use relative ones without much inconvenience in common affairs (DiSalle, 2006, pp. 25–36; Rynasiewicz, 2012).

Newton's idea of absolute space was opposed by Leibniz in a series of letters exchanged in the years 1715–1716 with Newton's ardent supporter Samuel Clarke (H. Alexander, 1956). In the correspondence Leibniz develops his own theory of space and time, which assumes that space and time should not be regarded as containers in which things are located, but instead as abstract relations holding between things. Thus, space is not something material, but rather a system of relations, or more precisely *spatial relations*, between coexistent objects, as time is a

[41] A somewhat parallel question about time was put forward by Smart (1949), who in his essay "The River of Time" asked: if time flows, what is the time that time flows in?

system of *temporal relations* between successive events. Because space and time are relations, they are not real, but rather *ideal* phenomena. This view is called the *relational theory of space and time* or *relationism* (Huggett & Hoefer, 2009; Grant, 1981, pp. 247–254).

Kant in his early writings sided with Leibniz's relational account of space. Later, in his dissertation on incongruent counterparts (Kant, 1768/1968), he embraced the Newtonian view (DiSalle, 2006, pp. 60–64). Finally, he dissociated himself from both views and formulated his own theory of space and time, which he compared in the preface to the second edition of *Critique of Pure Reason* (1787/2003) to the Copernican revolution:

> Up to now it has been assumed that all our cognition must conform to the objects; but all attempts to find out something about them *a priori* through concepts that would extend our cognition have, on this pre-supposition, come to nothing. Hence let us once try whether we do not get further with the problem of metaphysics by assuming that the objects must conform to our cognition, which would agree better with the requested possibility of an *a priori* cognition of them, which is to establish something about objects before they are given to us. This would be just like the first thought of Copernicus, who, when he did not make good progress in the explanation of the celestial motions if he assumed that the entire celestial host revolves around the observer, tried to see if it might not have greater success if he made the observer revolve and left the stars at rest. (Kant, 1787/2003, B/XVI)

Kant proposed that space and time are not objective realities, but subjective requirements of the human sensory-cognitive faculties to which all conceptualized entities must conform. According to this ground-breaking view space is not an empirical concept derived from outer experiences, but an innate subjective condition, which makes cognition possible at all. Thus, Kant regards space and time as indispensable tools that arrange and systemize the images of the reality imported by our sensory perception. Without *a priori* conceptions of space and time, our minds would not be able make sense of the raw stimuli supplied by our eyes and other sensory organs (Ben-Zvi, 2005; DiSalle, 2006, pp. 66–72).

This cursory review of philosophical ideas about space and its cognition cannot do justice to an enormous spectrum of views on the nature of space discussed in philosophical and scientific discourse. They are discussed in abundant literature on the perception and conception of space, frequently in a relation to time (e.g. Smart, 1964; Grant, 1981; Sorabji, 1988; Le Poidevin, 2003; Levinson, 2003; DiSalle, 2006; 2009; Huggett & Hoefer, 2009; and references therein).

The semantics of space is complex and differs substantially across languages (see Levinson & Wilkins, 2006 for a comprehensive review). A general linguistic framework for space description tends to follow the Leibnizian view of space as a system of relations between objects, rather than the Newtonian view on space as an abstract void. The space of common sense is constructed by piecing together information about common entities acquired from remembered experiences in the environments, maps, verbal descriptions, and other sources of information (Tversky, 2009). This chapter focuses predominantly on those aspects of subjective space experience discussed in modern cognitive research that are relevant to cognition of spatial distance.

3.2 Cognitive representations of space

In physics, geometry, and cartography space is unitary, metric, and measured precisely in formal units. On the contrary, human conceptions of space tend to be constructed predominantly around spatial entities, which are located and oriented in terms of rough relations among them (Tversky 2003, 2005a, 2009). Our mental representations of space are derived from disparate sources of information: they come from looking, hearing, and touching, but to some extent also from smell and taste (Spence & Driver, 2004; Millar, 2008). Other important sources of spatial information include imagination and language. When we estimate a distance between two separate locations, or try to figure out directions how to get from one place to another, spatial information is conveyed linguistically and processed in imagination (Tversky & Lee, 1998; Landau, Dessalegn & Goldberg, 2010).

We function in many different spaces. They are constructed mentally with reference to different objects and spatial relations that are relevant to the task at hand. For instance, we interact with the space of the body in dancing, the space around the body in housecleaning, and the space of navigation in traveling (Tversky, 2003). Each of these spaces is conceptualized in a different manner, depending on the functions it serves for perceptual-motor interactions.

A basic space for human activity is the *space of the human body*. It is important for movements and sensations. It is conceptualized predominantly in terms of functional significance and perceptual salience of different body parts. Depending on the activity we are engaged in, the different parts of the body interact in different ways with the surroundings. Since we use feet for walking, hands for manipulating objects, and head for sensing the surroundings and communication with other people, this space is used to infer functions of parts of objects encountered in the surroundings (Tversky, 2003). Another space with significance for human activity is the *space around the body*, which can be defined in general terms as the space that can be seen and reached from the current position. This space is organized in three dimensions, defined by the three axes of the body: up/down, front/back, and left/right, which was already distinguished by Aristotle in *Physics* (350BC/1995b). In this space the up/down and front/back axes seem to be associated with a greater perceptual and functional salience in our conceptions of the spatial world than the left/right axis, because they are correlated respectively with the asymmetric axis of the world set by gravity, and the asymmetric axis of the human body (Tversky, 2003).

The space people consider to make sense of distances in the world is the *space of navigation,*[42] which is encountered by exploring the environment. Since it is generally too large to be seen at once from a single viewpoint, it is pieced together in cognition from different views and through different modalities. Cognitive processing of space enables us to conceive of large spaces as integrated wholes rather than fragmentary patches of space as they are actually experienced (Tversky, 2000). Unlike the space around the body, the space of navigation tends to be conceptualized in two dimensions, rather than three. Although people's mental representations of space seem to resemble *cognitive maps*, which was originally proposed by Tolman (1948), Tversky (1993) argues that that a more apt metaphor for people's mental representations of large spaces should be *cognitive collages*. They contain figures, spatial information, and differing perspectives, but lack the coherence of maps. She adds that in the case of simple or well-learned environments, people have coherent mental representations of spatial layouts, which allow perspective-taking, reorientation, and spatial inferences. Such representations of space are termed *spatial mental models*, and are discussed separately in Section 3.7.

There are other functionally distinctive and psychologically meaningful spaces apart from the three mentioned above. One of the earliest distinctions between types of spaces within the space of navigation was introduced by Lynch (1960), who divided urban space according to cognitive environmental images used in social development, people's experiences, emotional security, and movement around the environment. Based on interviews with dwellers of three American cities, Lynch (1960, pp. 105–106) distinguished *spatial nodes*, i.e. spaces that can be scanned

[42] *The space of navigation* is also referred to as *the environmental space* by other researchers, e.g. Ittelson, 1973; Cadwallader, 1979; Montello, 1993. These terms are used interchangeably in this book.

quickly, usually from one position; *spatial districts*, i.e. large subsections of a city that have common defining characteristics, e.g. ethnicity of inhabitants or types of building; and *spatial regions*, which are characterized by structured continuum of spatial form. Districts and regions must be learned over time because they incorporate multiple nodes connected by *paths*.

Studies in developmental psychology (Piaget and Inhelder, 1948/1956; Piaget, Inhelder & Szeminska, 1948/1960) distinguished *perceptual space*, i.e. the mental representation of space resulting from the direct perception of the environment, from *conceptual space*, i.e. the mental representation of space resulting from relationships which cannot be perceived directly. An individual's spatial knowledge involves knowledge of the space as well as the ability to manipulate that knowledge in mental processing. Generally, cognitive representations of space are free from constraints of physical space, since they involve a variety of factors related to beliefs, knowledge, and memory (see Freundschuh & Egenhofer, 1997 for a review of other categorizations of space that have been proposed over the years). Each cognitive space is invoked for different activities, serves different functions, and involves different elements and relations, which are used for constructing spatial frames of reference.

3.3 Spatial frames of reference

Spatial descriptions locate objects with respect to a *frame of reference*[43] (cf. *perspective system* in Levelt, 1996), which is "a system of spatial coordinates that allows an individual to establish her/his orientation with respect to the surrounding environment" (Tommasi & Laeng, 2012). Brewer and Pears (1993) explain the notion of frame of reference by using an example of glasses worn on someone's nose: do the glasses change their location or not, when a person goes from one room to another? The answer depends on the frame of reference – the nose or room. Depending on the perspective taken in a particular situation, the reference frame may include a coordinate system, a point of view, an origin, a reference object, and terms of reference (Levinson, 2003).

[43] It is noteworthy that in Langacker's (1987a, 2008a) Cognitive Grammar, the notion of frame of reference corresponds roughly to the concept of *nonbasic domain*, and is generally subsumed in the notion of *domain* (Langacker, 2008a, pp. 44–47). Langacker views the reference points and other geometric notions as constituting the *domain* for the definition of a spatial expression. Cognitive Grammar discusses processes involved in the perception of figure vs. ground under the label of *focusing*, which involves processing background/foreground relations (Langacker, 2008a, pp. 57–65).

As pointed out by Levinson (1996, 2003), spatial thinking discussed in cognitive literature is rooted in two millennia of Western philosophical thought, which results in egocentric, anthropomorphic, and relativistic spatial concepts discussed predominantly in psychology and linguistics. The *egocentric* view, originally postulated by Protagoras (Barnes, 1982, pp. 430–432), puts *ego* in the centre of the universe. Because of that, spatial thinking is predominantly *relativistic*, i.e. relative (or *deictic*) to our position, not external points of reference. Moreover, spatial coordinates are discussed according to six primary directions based on the *anthropomorphic* planes of human body, as distinguished by Aristotle (350BC/1995b). The above assertions have been widely regarded as universal, hence repeatedly used, in all kinds of studies on spatial language and cognition (e.g. Piaget & Inhelder, 1948/1956; Clark, 1973, p. 28; Miller & Johnson-Laird, 1976, pp. 380 & 394–395; Lyons, 1977, pp. 690–691; Talmy, 1983).

However, Levinson (2003; see also Levinson & Wilkins, 2006) discusses a number of worldwide languages that do not work in the relativistic manner. He argues that in the context of spatial frames of reference the tradition in which the human body is the source of all our notions of orientation and direction is a major ethnocentric error, which results from the European perspective. He demonstrates that in certain contexts it is not always possible to distinguish *deictic*, i.e. viewer-centered, and *intrinsic*, i.e. object-centered frames of reference in a principled way. Consequently, Levinson (2003) proposes a more universal reformulation of the traditionally distinguished frames of reference[44] used for reviewing spatial concepts.

According to his proposal, an *intrinsic frame of reference* is based on an object-centered coordinate system, where the coordinates are determined by the inherent or intrinsic features, e.g. sidedness or facets, of the object used as the *ground* for reference (Levinson 2003, p. 41). The origin of the coordinate system is a specific object. Locations of spatial entities in question are described in relation to the object's intrinsic front, back, left, right, top, and bottom. For example, in the sentence "The remote is in *front* of the TV" the "front" is understood in terms of the TV's natural front side, i.e. the screen. The use of

[44] See Levinson 2003, Table 2.1 and the relevant discussion (pp. 25–34) for a concise survey of spatial frames of reference distinguished across modalities in philosophy, brain sciences, psychology, and linguistics.

this frame requires that all participants have a common understanding of the intrinsic sides of the reference object. Levinson notes that the reference object can also be a person, therefore intrinsic uses include some cases included in the traditional *deictic* classification (e.g. Levelt, 1996).

A *relative frame of reference* is roughly equivalent to the traditionally distinguished deictic frame of reference. This frame presupposes a certain *viewpoint*, which is the origin of the coordinate system identified by the location of one of the participants, the speaker or the addressee. As emphasized by Levinson (2003, p. 43) calling it deictic is confusing because the viewer does not need to be *ego*[45] (see Tversky & Hard, 2009). In this frame a spatial relation between *figure* and *ground* is specified by using coordinates fixed on the viewpoint used to assign directions. For example, comprehending the sentence "The ball is to the left of the tree" depends on knowing how the perceiver is oriented (facing/backwards) with respect to the tree. Thus, comprehending spatial relations specified in the relative frame of reference involves three elements: an origin, i.e. the viewpoint, the figure, and the ground used for reference. Levinson (2003, p. 43) adds that the perceptual basis for this frame is not necessarily visual, therefore calling it *viewer-centered* is potentially misleading.

Bennardo (2004) adds that the appearance of a second object in the field of the viewer creates a double possibility of relating the object in question either to the viewer or the second object. To account for this alternative variants Bennardo (2004) proposes distinguishing *translation* and *reflection subtypes* of the basic relative frame of reference, which is illustrated in Figure 3.1 together with other basic frames.

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[45] People frequently find themselves in situations where taking another's perspective is used for effective social interaction. For example, when one person asks another in a conversation where something is located, the respondent may favor the interlocutor's perspective to their own. Tversky and Hard (2009) found that people spontaneously adopt another person's perspective when describing spatial scenes including a presence of another person, without any demand to communicate to that person. They used a questionnaire that included a photograph of a bottle and a book on a table, with or without a person behind the table. When answering a question: "In relation to the bottle, where is the book?" the mere presence of a person in the photograph encouraged many respondents to take that other person's spatial perspective rather than their own, despite the cognitive difficulty of reversing left and right.

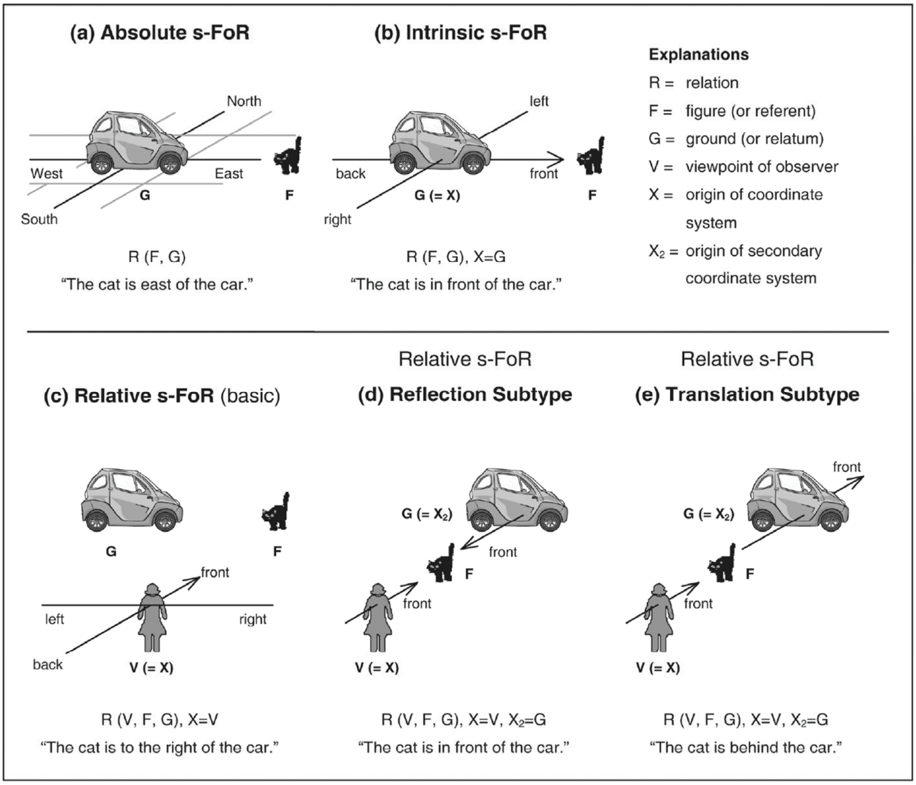

Figure 3.1 Spatial frames of reference

An *absolute frame of reference* relates the figure to an external reference ground. This frame requires maintaining orientation with respect to some antecedently fixed bearings in space (Levinson 2003, p. 48). The origin of the coordinate system is external to the scene. All languages use such a system in the vertical dimension for specifying *up* and *down* with reference to gravity.[46] Another common extrinsic coordinate system includes the cardinal directions: north, south, east, west, which is based on the Sun's position or Earth's magnetic field. Absolute frames of reference can be observed in well documented cases of worldwide languages that use such systems on the horizontal plane, e.g. Mayan language *Tzeltal* (Brown, 2006); Australian language *Kuuk Thaayorre* (Gaby, 2012); Papuan language *Yupno* (Núñez et al., 2012).

[46] Aristotle (350BC/1995b, *Physics*, 208b9–208b26) attributed particular importance to *up* and *down*, as anchored respectively to the celestial spheres and the centre of the earth, which indicates that he recognized the difference between *absolute* and *relative* directions (see Levinson, 2003).

Taylor and Tversky (1996) support Levinson's distinction by pointing out that intrinsic, relative, and absolute frames of reference correspond largely to *route*, *survey*, and *mixed perspectives* used by people in spatial descriptions,[47] which seem to reflect natural ways of interacting with the environment. However, they note that there are some exceptions that break the correspondences proposed by Levinson. For example, it is possible for relative uses to be object centered, e.g. "from the entrance, the ticket office is right of the elevator" (see Bennardo, 2004). As summarized by Zlatev (2007), despite a possibility of such exceptions, the division proposed by Levinson has gained a wide acceptance due to its elegance and simplicity. Frames of reference not only enable us to locate and orient entities included in them, but they also integrate different spaces in the human mind into a common space.

Logan and Sadler (1996) argue that space is configured mentally in relation to reference frames using a number of additional parameters including orientation, direction, origin, spatial template, and scale. The *orientation* parameter refers to the association of a set of orthogonal axes with the vertical (above/below) and horizontal (front/back and left/right) dimensions. The *direction* parameter specifies the relevant endpoint of a given axis (i.e. the front vs. the back endpoint of the horizontal axis). The *origin* indicates where the reference frame is imposed on the reference object. The *spatial template* parses the space around the reference object into regions for which the spatial term offers an appropriate (or not) characterization of the located object's placement. The *scale* parameter indicates the units of distance to be applied to space. They add, however, that not all spatial terms refer to all parameters of a reference frame. For example, "near" is somewhat more generic than "left/right", since it refers to *distance* and *origin*, but not *direction* and *orientation*. Apprehension of linguistic representations of space, involves processing interactions between the frames of reference, the parameters, the context, linguistic elements in the utterance, the reference object, and the object in question (see Carlson, 2010 for a review). This coordination is achieved within a *spatial mental model* or a *simulation*, which is discussed in Section 3.7.

[47] The *route perspective* takes a changing viewpoint from within the environment. It resembles a mental tour through the surrounding space. The *survey perspective* takes a bird's eye view. It resembles viewing the surrounding space from the top of a hill. The first type provides a set of directions for way-finding in the environment, while the second type provides an overview of the spatial layout. The *mixed perspective* mixes both viewpoints (Taylor & Tversky, 1996).

3.4 Schematization of spatial relations

As noted by Tversky (2003), an impressive feat of the human mind is that it can effortlessly convert space experienced in the three surrounding dimensions to a space that is two-dimensional, as if viewed from the bird's eye view. Classic studies investigating spatial cognition found that it is extremely difficult to identify simple relationships between physical space and its cognitive representation (Lynch, 1960; Cadwallader, 1979). An extensive body of cognitive research that has been conducted from that time (see Tversky 2009 for a review) indicates that we do not possess cognitive spatial representations of the world in terms of Euclidian geometry. Directions and rotations are not expressed in degrees or meters but rather as general relations.[48] In verbal accounts, angles and distances are represented with simple words, such as "turn" or "take", which was found in a corpus of spontaneous route directions (Denis, 1997). It suggests that the space of navigation as a mental construction is prone to *schematization*.

Basic elements distinguished in the space of navigation are regarded as *cognitive reference points* (Rosch, 1975a), i.e. spatial entities that are more prominent than others due to their perceptual salience or functional significance. Not all environmental elements are cognitively equal: some are larger, or famous, or more central to our activities. These elements, typically called *landmarks* (as termed by Lynch, 1960; cf. Langacker, 2008a, pp. 70–73), are tied in cognition to other less distinguished elements, such as paths, links, and nodes (Lynch, 1960; Levelt, 1996). Since landmarks seem to extend themselves to encompass whole neighborhoods, they are often used as reference elements for constructing spatial relations.

Studies in linguistic representation of space found that expressing spatial relations with arithmetic and geometric precision is hardly ever used, and is comprehended vaguely by ordinary language users (Leibowitz, Guzy, Peterson & Blake, 1993). The basic functional principle of spatial descriptions is based on the distinction between *figure* and *ground* (Talmy, 1975; 2000a, Ch. 5), where the entity to be located is the *figure*, and the object that provides the reference point for location is the *ground*, (cf. *referent* and *relatum* in Miller & Johnson-Laird, 1976; Levelt, 1996, see also *trajector* and *landmark* in Langacker, 1987a; 2008a). Since, most spatial descriptions include both elements, expressing spatial relations in

[48] Although much of human behavior in space occurs without precise metric information about distances, some quantitative knowledge of physical distance, even if not very accurate, is required for successful human activity in the environment, for example for navigation or spatial planning (Montello, 1997, 1998).

language is typically based on specifications of figure–ground relations. When the figure and ground are contiguous, it is often sufficient to say that "figure is *at* ground", where "at" expresses some kind of a contiguity relation, e.g. containment, adjacency, etc. (Talmy, 1983; 2000a, Ch. 3; 2005a). However, when the figure and ground are displaced, their relationship is expressed in relation to a certain frame of reference, which was discussed in the previous section.

Talmy (1983, 2000a, Ch. 3) observed that language schematizes space by selecting certain aspects of a scene while neglecting others. His analysis of schematization demonstrates the role of closed-class particles and words, and the syntactic structures of phrases and clauses in expressing spatial relations. For example, the preposition *across* applies to a set of spatial configurations that do not depend on metric properties such as shape, size, and distance. Instead, the use of *across* depends on the global configuration of the thing doing the crossing and the thing crossed. Prototypically, the entity that crosses is smaller than the entity being crossed, and the crossing is accomplished in a path perpendicular to the length of the thing being crossed. Talmy (1988b/2007; 2000a, Ch. 1 & 3) argues that language reflects *topological* cognition of space, which abstracts away the metric properties of shape, size, angle, contour, and distance, which are normally expressed in lexical elements and focuses instead on relative relationships rather than absolutely fixed quantities.

Landau and Jackendoff (1993) pointed out that across languages, prepositions such as *over*, *above*, *on*, *within*, and *in*, are used to encode locational relations between objects in space, whereas detailed geometric properties, in particular the object's shape, tend to be encoded in object names. Thus, open-class categories of words are used to express more fine-grained distinctions, e.g. *jar* and *jug*, or *cup* and *mug*, whereas closed-class word categories, primarily prepositions, tend to be used to encode non-metric and relatively coarse spatial functions, such as relative distance, relative direction, containment, and contact.

Tversky and Lee (1998) note that despite the fact that language and conceptualization always interact in a particular context, there are certain levels of schematization that hold more or less universally across different contexts. We do not reinvent vocabulary and syntax for every specific context, thus "schematization in language and in 'ception' is always a compromise; it must be stable enough for the general and the venerable, yet flexible enough for the specific and the new" (p. 160). Tversky (2005b, 2009) adds that, on the one hand, schematization reduces memory load, allows for integration of disparate bits of information, and facilitates information processing, but on the other hand introduces distortions and errors.

Landau, Dessalegn and Goldberg (2010) discuss two central mechanisms in the interaction between language and space. One embraces *selectivity*, i.e. linguistic tendency to encode certain selected distinctions and not others in linguistic representations of space (cf. *schematization* in Talmy, 2000a, p. 177). The other involves *enrichment*, which is the capability of language to expand the representational power with which we can carry out certain spatial tasks by permitting us to go beyond what is available directly to senses. Enrichment occurs because language has the representational power to robustly encode certain properties that are encoded in the visual-spatial system only in transient form. These features of language–space interaction indicate that the role of language in spatial representations should be viewed in a dynamic manner, rather than causing permanent changes to spatial cognition.

Because the interaction between language and space employs schematization mechanisms, it is possible that not all aspects of spatial meaning can be expressed linguistically, and vice versa, not all aspects of language have a correspondence in spatial notions (Landau & Jackendoff, 1993; Jackendoff, 1996). This mutual interaction indicates that the perception of space should not be interpreted as simple object recognition, but rather as *spatial understanding* (Jackendoff, 2012). Consequently, any investigation of the linguistic representation of space must take into account the role of language faculty to explain how we talk about what we see – and how we see the things we talk about, which puts language in the position of a crucial source of evidence about spatial cognition.

3.5 Cognition of spatial distance

The research on spatial cognition discussed so far in this chapter indicates that cognitive representation of distance depends predominantly on hierarchically organized schematic knowledge, which eliminates the need to encode all possible metric distances. On the other hand, the tendency to conceptualize space as landmarks and paths relative to frames of reference leads to distortions in judgments of distance. For example, distance judgments are not necessarily symmetric (McNamara & Diwadkar, 1997). People tend to estimate the distance from a prominent landmark, such as the Eiffel Tower, to an ordinary building to be less than the distance from an ordinary building to a landmark (Sadalla, Burroughs & Staplin, 1980). Distance perception is also affected by other, seemingly irrelevant psychological and social factors. For instance, Arabs perceive distances between Arab settlements to be smaller than distances between an Arab and Jewish settlements. And vice-versa, Jews perceive distances between Jewish settlements to be shorter than distances between Arab and a Jewish settlements (Portugali, 1993, Ch. 9). Moreover, distance estimates are often exaggerated when there are barriers along the way, or when there is an excessive number of turns, nodes, or other types of reference points retained from the environment. Distance judgments are also influenced by viewpoint, by groupings, and other factors (see Tversky, 2005b for a review).

Wagner (2006, pp. 15–16) notes that people tend to conceptualize spatial distance in terms of various metrics depending on environmental conditions. One of the most general types of distance that people intuitively distinguish in space is *straight line distance*, i.e. the shortest path between two points in space. However, distance does not need to be defined in Euclidean terms. For example, in urban regions spatial distance is frequently expressed in terms of *the city block metric*, i.e. the number of blocks that must be traveled to reach a destination. Moreover, city dwellers tend to conceptualize distance in terms of *travel time metric*, which reflects a time required to reach a particular place (Burnett, 1978; MacEachren, 1980). Dwellers of urban regions use this metric naturally because in cities different roads at different times of the day yield different traffic intensity.

A cognitive *subjective distance* refers to people's knowledge and beliefs about distances between places which are far apart from each other (Ittelson, 1973). MacEachren (1980) proposed a hypothesis that it is travel time that determines conceptualizations of cognitive distance in the space of navigation. Wagner (2006, p. 16) notes that depending on the real life conditions a variety of other metrics, often quite whimsical, may be more natural to use. For example, people living in the cold climate tend to conceptualize distances in terms of the pain one suffers from the cold while staying outside. Tourists tend to think of distance not only as a geographical separation or travel time, but also in terms of travel costs (Nyaupane, Graefe & Burns, 2003). Thus, a *functional distance* reflects separation between places in terms of time, effort, money, or other resources required for an interaction (Deutsch & Isard, 1961; Montello, 2009).

Montello (1991) points out that although people naturally express distance in *familiar units*, e.g. kilometers or miles, which they know from common knowledge, they have rather general and varied ideas about the extent of a kilometer or a mile. Moreover, conceptions of distance in familiar units are seriously influenced by the use of maps, road signs, verbal directions, and other established *symbolic sources* of spatial knowledge. Distances expressed in this manner tend to reflect socially shared ideas of distance, rather than actual distances experienced by an individual. Montello (1991) adds that distance perception may be a function of exposure to the environment. People who are used to traveling a lot may have different spatial knowledge from those who do not have many opportunities to travel.

The cognition of spatial distance derived from locomotion through the environment embraces heterogeneous, partially redundant sources of information, including *number of environmental features*, *travel time*, and *travel effort* (Montello, 1997). People take advantage of these multiple sources in different combinations on different occasions to acquire knowledge of spatial distance. Estimates of spatial distances at a global scale, i.e. ones that have not been experienced directly, often involve *plausible reasoning*, which is based on using general bits of knowledge from various domains to generate an answer (Friedman & Montello, 2006). Similarly to other categories of knowledge pertaining to complex real-world domains, cognitive knowledge of environmental distance is influenced by a variety of factors, involves multiple cognitive processes, and is learned over the entire life span (Montello, 2009).

3.6 Linguistic encoding of spatial distance

Languages afford a wide range of ways of encoding spatial distance both in explicit and implicit manners. The explicit manners include overt expressions of *absolute distance*, i.e. one expressed in units of space measurement, as well as expressions of *relative distance* enunciated in more general terms, for example, with spatial adverbials involving various forms of words such as "near/far", "close/distant", "short/long", etc. Moreover, distance in space can be actively inferred by interlocutors from the context of a particular speech situation. There are also some more intricate manners of encoding spatial distance in linguistic representations. Miller & Johnson-Laird (1976) argue that the mental representation of an object in space encompasses an area of space surrounding the object, which they term *penumbra*, or the region of interaction. They suggest that objects invoke distance values associated with their characteristics and typical interactions in which they participate with other objects.

Consequently, spatial distance is conveyed implicitly by the scale of described objects. Morrow and Clark (1988) found that the estimates of distance between objects described in a spatial scene vary as a function of the object size. For example, participants estimate the distance between two objects in the sentence "A secretary is approaching the flower stand" as closer than in the sentence "A secretary is approaching the department store", which shows that larger objects are estimated as being farther apart than smaller ones. In a similar manner, numerous explicit spatial predicates take their scale from their referents: "near the penny" is closer than "near the tree" (Carlson & Covey, 2005). As put by Zacks & Tversky (2012):

> If one of us were to tell you that you can get a great sandwich near the Saint Louis Arch you might reasonably take the spatial predicate *near* to refer to a radius of several blocks. However, if we were to say that 'the sandwich is on the counter near the fridge', a two block walk would be quite a shock. Near is certainly nearer than far, but the distance metric used—the spatial grain—is set by the things involved. A far atom is a shorter distance away than a near galaxy; a large shrew is shorter in length than a small rhinoceros. (Zacks & Tversky, 2012, p. 123)

Additionally, Logan & Sadler (1996) pointed out that certain spatial words, such as "near/far", convey the distance, whereas other spatial words, such "front/back" or "left/right", do not relate to this spatial parameter.

However, Carlson and Covey (2005) offer evidence that distances associated with the term "front" tend to be smaller than distances associated with the term "back", despite the fact that these terms do not explicitly convey the distance parameter. In their study, a secretary described as *in front of* the department store was estimated to be closer to the building than one described as *behind* the store. This can be explained by the fact that front sides of objects are typically the sides associated with the objects' function. A successful interaction with an object requires a close distance, which is not associated with the *back*. The results provide support for the idea that dimensions relevant to the processing of spatial distance are not limited to information explicitly conveyed by the spatial terms (see Carlson, 2010 for a review).

Langacker (1993) points out grammatical traces of some "invisible" semantic constructs that trigger mental representations of distance. For example, the concept of *search domain*, which is a certain region within which the trajector is located with reference to the landmark, defines distance implicity. The search domains is neither precisely bounded nor explicitly mentioned. In expressions such as "upstairs", "in the bedroom", "under the bed" the search domain is left implicit, but can be analyzed as vaguely delimited regions in space designated by these representations (Langacker, 1993, pp. 334–341). The concept of *setting* in the canonical event model (Langacker, 1993, pp. 348–353; Langacker, 2008a, pp. 357–358) also implicitly relates to the designation of spatial distance. The "park" in the sentence "In the park last Sunday, Janet saw a friend." functions as the setting that designates a spatial region and implicitly defines the range of spatial distance involved in the event.

3.7 Time in spatial situation models

Classic studies in narratives of space (Linde & Labov, 1975; Levelt, 1982) observed that we tend to impose a linear structure on space accounts, as if from the perspective of traveling through spatial environments. Levelt (1989) proposed the following explanation for this tendency: because space is three-dimensional, and speech is linear, describing space requires imposing a sequential order. We tend to impose a sequential-temporal order on spatial accounts because it corresponds to a natural way of experiencing the world, which takes place through exploration. Levelt (1989) argues that ordering messages in narratives of space follows not only the *principle of connectivity*, i.e. each utterance in a discourse connects to previous and subsequent utterances, but also the *principle of natural order*, which in space descriptions rely on temporal order to describe spatial environments according to the SOURCE-PATH-GOAL schema (see Lakoff, 1987; Hampe, 2005).

Subsequent studies on spatial perspectives derived from narratives of space (Taylor & Tversky, 1992a; 1992b; 1996) demonstrated that this tendency can be observed not only in *the route perspective*, i.e. a mental tour analyzed by Levelt (1982), but also in narratives from *the survey perspective*, i.e. a bird's eye view (Taylor & Tversky, 1992a, 1996). As concluded by Tversky (2004), people naturally impose a sequential linear path on stationary three-dimensional environments because in human cognition temporal order serves as an organizer for describing multidimensional spatial relations. It was also found that blind people form spatial mental models in a similar manner[49] (Noordzij, Zuidhoek & Postma, 2006).

Studies of spatial situation models (see Rinck, 2005 for a review) show that people usually forget the *surface structure*, i.e. the wording of a text very quickly, and instead use memory to build a *spatial situation model*, i.e. a mental representation of spatial information that corresponds to deep understanding and

[49] Noordzij, Zuidhoek and Postma (2006) found that that early and late blind people can form spatial mental models on the basis of both route and survey descriptions. However, in contrast to sighted people, who build up spatial mental models more efficiently from survey descriptions, blind people perform better on the basis of route descriptions.

integrates the information stated in a text with the reader's prior knowledge. However, situation models created from narratives are never purely spatial, they are characterized by *multidimensionality*. Other important aspects represented in situation models include time, entity, causation, intentionality, and emotions (see Zwaan & Radvansky, 1998; Therriault & Rinck, 2007 for reviews).

Evidence that temporality interacts with location information has been provided by studies of mental models in narrative comprehension. Morrow (1985, 1990) carried out experiments in which people invariably used *aspectual markers of temporality* (see Comrie, 1976; Croft, 2009) to resolve what object is being referred to. In ambiguous expressions, such as "John walked past the car up the road into the house. The windows were dirty." readers assume that the text refers to be the windows of the house, whereas in expressions such as "John was walking past the car up the road into the house. The windows were dirty." readers tend to take that "the windows" part refers to the car, which indicates that people actively simulate[50] the described scene. Moreover, readers combine verb aspect (*walked* vs. *was walking*) with information provided by prepositions (e.g., walked *toward* vs. walked *into*) to decide where the figure is located in the situation described in a text (see Bower & Morrow, 1990 for a review).

Other studies found that readers use temporal information to focus attention on most relevant parts of the situation model they create during narrative comprehension. Rinck and Bower (2000, Exp. 2) tested the accessibility of objects located at differing spatial and temporal distances from the protagonist's current location in a spatial scene. They manipulated story time distance, i.e. fictitious time passing inside the narrative, by inserting an intervening episode lasting for either minutes or hours. They found that objects were more accessible if the intervening episode was described as short. The results indicate that the effects of spatial distance and story time distance are complementary in comprehension of spatial narratives (see also *Construal-Level Theory of Psychological Distance* in Trope & Liberman, 2010).

[50] Zwaan (2009, p. 15) views *situation-model theories* and *simulation theories* as complementary in explaining processing of temporal event flow in language, and provides the following distinction: "Whereas situation-model theories tend to treat events as empty nodes, simulation theories go 'inside the node' … The former [perspective] provides insights into the flow between event representations and their interconnectedness in memory, whereas the latter provides insights into the internal structure of the event representations."

Knowledge of the environmental space can also be acquired from *maps*. Although representations of space learned from maps differ in significant ways from those learned from actual navigation (Thorndyke & Hayes-Roth, 1982), at least for some kinds of judgments, such representations are indistinguishable (Montello, 1993). Learning locations of landmarks from maps appears to follow a sequential spatial-temporal pattern, too. Studies on building mental representations of space from maps (e.g. Clayton & Habibi, 1991; Curiel & Radvansky, 1998) showed that spatial and temporal information is used conjointly to integrate individual map features into a unified mental representation of space in memory. It was also observed that readers of spatial descriptions appear to draw landmarks in maps in the order they had been mentioned in descriptions (Taylor & Tversky, 1992b). A more recent study (Naylor-Emlen & Taylor, 2009) demonstrates that spatial and temporal information is flexibly weighted and manipulated interactively in spatial tasks. The balance between the use of spatial and temporal structure depends on the task demands, learning goals, and the spatial context. A general entanglement of space and time in cognition is discussed more systematically in the following chapter.

Chapter 4

(A)symmetry of space and time in cognition

All the vital problems of philosophy depend for their solutions on the solution of the problem: what Space and Time are and more particularly how they are related to each other.

Samuel Alexander (1920) *Space, Time and Deity*

4.1 Conceptions of space–time relationship

Entanglement of space and time in cognition is among the most intensely pursued problems in contemporary cognitive science (Núnez & Cooperrider, 2013). The relationship between mental representations of space and time can be viewed in several different manners. The empiricist philosophers assumed that all knowledge originates from sensory experience, thus the nature of all knowledge is affected by sensory access to reality. From this perspective, the perception of space is by definition inextricably connected with the perception of time, since it is difficult to think about either without thinking about the other. Space and time serve as our two basic locational frameworks by means of which we situate objects and events. As put by Locke (1689/1995, p. 140), "expansion and duration do mutually embrace and comprehend each other; every part of space being in every part of duration, and every part of duration in every part of expansion".

Engberg-Pedersen (1999) argues that space and time are so strongly interwoven in cognition, that they should not be analyzed as two separate domains. She notes that although it is possible to distinguish between conceptualizations of space and time at some cognitive levels, the distinction between space and time should be attributed to the difference between static configurations and dynamic events, rather than space and time as such. Such views on space and in the human mind make these two domains *symmetrically dependent* on each other.

An alternative proposal posits that that space and time are *asymmetrically dependent*. This view stems from the assumption that while the domain of space appears to be directly accessible through the senses, the domain of time escapes sensory perception. As put simply by Lakoff (1993, p. 218), ". . . we have detectors for motion and detectors for objects/locations. We do not have detectors for time". Consequently, it is plausible to assume (e.g. Clark, 1973; Lakoff & Johnson, 1980; 1999) that space is a concrete domain that provides us with means of structuring time. As a result, time is processed indirectly and structured metaphorically in terms of space (as well as other concrete domains, which was discussed in Chapter 2).

As a third possibility, we can assume that conceptions of space and time are *independent* of each other, although they are very much alike due to a structural similarity between these two domains. For example, Jackendoff (1983, 2002; see also Jackendoff & Aaron, 1991) suggests that, although our conceptions of time and space may be thematically parallel, which is reflected in spatial metaphors used for expressing temporal concepts, the presumed primacy of space is illusory. Jackendoff points out that it is epistemologically equally plausible to assume that space and time are essentially unrelated domains organized by a common set of parameters that are simply more transparent in the spatial than in the temporal language. From this perspective, it is plausible to assume that metaphors referring to space and time arise out of the similarity of pre-existing conceptual structures between space and time. Although such metaphors have become conventional ways of talking about time in terms of space, they are actually unrevealing about their mutual relations (Murphy, 1996, 1997).

Moreover, space and time can also be viewed from the perspective of a *unitary framework of space-time*, which was geometrically modeled by Minkowski[51] (1908/1964) with reference to Einstein's (1905/1952a) Special Theory of Relativity developed in physics. Subsequently announced Einstein's (1916/1952b) General Theory of Relativity assumes that we function in a four-dimensional universe determined by three-dimensional space combined integrally with the fourth dimension of time (Hawking, 1988; DiSalle, 2006, Ch. 4). The theory forces us to accept that time is not completely separate from and independent of space, but is combined with it to form an entity called *space-time*. As explained in accessible terms by Hawking:

[51] Minkowski (1908/1964, p. 297) began his address delivered at the 80th Assembly of German Natural Scientists and Physicians on September 21, 1908 with the following, famous statement: ". . . Henceforth space by itself, and time by itself, are doomed to fade away into mere shadows, and only a kind of union of the two will preserve an independent reality".

> An event is something that happens at a particular point in space and at a particular time. So one can specify it by four numbers or coordinates. The choice of coordinates is arbitrary; one can use any three well-defined spatial coordinates and any measure of time. In relativity, there is no real distinction between the space and time coordinates, just as there is no real difference between any two space coordinates (Hawking, 1988, pp. 23–24).

Hawking adds that although it is sometimes helpful to think of the four spatial-temporal coordinates of an event in terms of space-time pictured mentally as a four-dimensional space, imagining a four-dimensional space is in fact impossible.

Although the concept of space-time has been considered in some linguistic studies (e.g. Sattig, 2006; Jaszczolt, 2009; Bączkowska, 2011), it normally escapes human intuition[52] and has been disregarded in this study. As noted by Hawking (1988, p. 10), we still use Newton's model for practical purposes because the difference between its predictions and those of general relativity is very small in the situations that we normally deal with. Simply put, Newton's model is still the way most people, including scientists, think and talk about time and space in everyday situations.

As emphasized by Langacker (2012, pp. 200–203), the assumption that space and time form a four-dimensional representational space in conception of objects and events is a foregone conclusion. Despite certain parallelisms suggesting that space and time are comparable, there exist important asymmetries indicating that time is not just another space-like cognitive dimension. For example, although from the outlook of modern physics it would be equally accurate to assume that motion through space occurs in time or that motion through time occurs in space, in everyday language we are inclined to say that a falling apple gets "closer and closer", rather than "later and later" to the ground, which Langacker (2012) attributes to *conceptual layering*. Relations between space and time are discussed in abundant literature (e.g. Smart, 1964; Le Poidevin, 2003; DiSalle, 2006; 2009; Tenbrink, 2007 and references therein). This chapter presents a concise review of contemporary cognitive research on the relationship between psychological space and time, focusing mainly on the opposition between symmetric and asymmetric views.

[52] Hawking (1988, p. 83) quotes an anecdote about the British astronomer Sir Arthur Eddington, who in the early 1920s was considered as an expert on general relativity. When told by a journalist that he was regarded to be among the only three people in the world who at that time understood general relativity, Eddington, after a moment's thought, replied "I am trying to think who the third person is".

4.2 (Dis)similarities in experience of space and time

Comparisons between psychological space and time are difficult to conduct because sensory modalities involved in the perception of space have more clearly defined aspects than those involved in the perception of time (Grondin, 2010). The perception of space was historically both intuitively and in empirical philosophy, e.g. by Locke, Berkeley, and Hume, most closely associated with the visual modality (Millar, 2008, Ch. 1). However, systematic studies in blind and sighted individuals (e.g. Klatzky, Colledge, Loomis, Cicinelli & Pellegrino, 1995; Noordzij et al., 2006; see Millar, 2008, Ch. 2 for a review) have provided ample evidence that visual experience is not an essential feature in the mental development of spatial representations. Since cognitive construction of space in the common sense involves cognitive computations integrating stimuli received through different senses (Millar, 2008), it is assumed to be multimodal and cross-modal (Spence & Driver, 2004). The perception of time is assumed to be multimodal, too. We can sense pulses and rhythms through visual, auditory, and tactile channels (Grondin, 2008). However, to date neither research in psychology (Hancock & Block, 2012) nor in neuroscience (Wittmann, 2013) has distinguished a definitive sensory system responsible for perception and processing of time, which was discussed in Chapter 1.

What makes investigations of the relationship between space and time in cognition difficult to conduct is that they are attributed different dimensionalities. Time is generally regarded as a linear vector extending ahead into the future, i.e. *protensive*, or extending back into the past, i.e. *retrotensive* (Kastenbaum, 1994). On the other hand, space is discussed in terms of one-dimensional distances, two-dimensional planes, and three-dimensional spaces. The cognitive representation of perceived dimensions is non-linear for areas and volumes (Butler & Overshiner, 1983), which causes problems for comparisons. Another basic difference between space and time is that the dimension in which time extends, or "flows" as we often say, is not reversible. There is nothing particularly special about being left rather than right of the tree. But arriving at the bank just before a robbery makes a huge difference to arriving there just after the bank has been robbed (Radvansky & Zacks, 2011).

On the other hand, there are certain similarities observed between space and time. Classic studies in psychophysics (Stevens, 1957, 1969, 1986) have demonstrated that people use structural similarity to associate various temporal and spatial stimuli. For example, we associate lines of different lengths with tones of different durations, and vice versa. Both adults and young children recognize them as meaningful representations and provide consistent and systematic responses to them in psychophysical tasks. Stevens (1986) argues that this spontaneously occurring cognitive binding indicates that different dimensions of experience, including spatial length and temporal duration, are represented by analogue magnitudes and participate in cross-modal matching (see also Walsh, 2003; Cantlon, Platt & Brannon, 2009). It is noteworthy, that this observation has been frequently employed in modern cognitive studies conducted with adults, young children, and infants (e.g. Casasanto & Boroditsky, 2008; Casasanto, Fotakopoulou & Boroditsky, 2010; Srinivasan & Carey, 2010) employing non-linguistic tasks for spontaneous alignment of representations of temporal duration with representations of spatial length (see Section 4.4).

Studies investigating how people judge objects used in graphs and diagrams (Pinker, 1990; Zacks, Levy, Tversky & Schiano, 1998; I. Spence, 2004) found that the apparent space represented in two- or three-dimensional displays can produce linear psychophysical functions when only one dimension is recognized as relevant by an observer. For example, a set of depicted three-dimensional boxes with identical bases but varying in height, despite their visible dimensionality of three, can be perceived as having only one relevant dimensional aspect in observation.

More recently, a similarity between spatial and temporal dimensions of psychological distance has been observed in their relation to the level of mental construal. An extensive series of studies on construal of temporal distance (Liberman, Sagristano & Trope, 2002; Trope & Liberman, 2003), and spatial distance (Fujita, Henderson, Eng, Trope & Liberman, 2006; Henderson, Fujita, Trope & Liberman, 2006) found that events located further away in space and time are more likely to be represented in terms of abstract and general features at a higher level of mental construal. On the contrary, events in the near spatial and temporal vicinity are more likely to be represented in terms of concrete and contextual details, which is reflected in representations of events, and the breadth of object categorization. According to *Construal-Level Theory of Psychological Distance* (Trope & Liberman, 2010), spatial and temporal (as well as other) instances of psychological distance are related to one another, and act in the human mind in a complementary and compensatory way.

In a recent article, Galton (2011) has determined and discussed basic properties of space and time that can be compared and contrasted. With reference to the properties of time proposed by Lakoff and Johnson (1999, p. 138; see Section 2.3), Galton enumerates the following key attributes of time: 1) extension, 2) linearity, 3) directedness, 4) transience. He notes that he omits *continuity* as an attribute of time because these basic attributes form a logical chain: “time cannot be linear without being extended, it cannot be directed without being linear, and it cannot be transient without being directed” (Galton, 2011, p. 696). He also adds that it is a matter of contention whether time is really continuous or not.

The attribute of *extension* means that time can be divided into distinct moments, which enables us to locate events in time. Due to this attribute events that include otherwise identical actions by the same subject in the same place, can be identified as different by virtue of occupying distinct times. Space also shares the attribute of extendedness, although it comes in three different categories of length, area, and volume, depending on the dimensionality of space taken under consideration. Galton notes that the discrepancy between the assumed one dimension of time, and three-dimensional space can be explained by a closer examination of the *linearity* attribute. Although space itself is not linear but rather three-dimensional, we distinguish the three dimensions of space according to three salient axes, and each axis of space is itself linear. As an attribute of time, linearity can be characterized by a primitive notion of “betweenness”, which essentially means that for any given three distinct moments of time, one must be between the other two.

The attribute of *directedness* of time means that relative to a given moment, all other moments are either past or future in an asymmetric manner, which has been discussed in philosophy and physics under the label of “the arrow of time”[53] (see Le Poidevin, 2003, Ch. 12). In comparison to time, space does not seem to have intrinsic direction corresponding to the asymmetry of time. However, in principle we can also distinguish asymmetry of space, by imposing a direction on any linear subspace and treating it as a one-way path. However, since this presupposes time for the possibility of motion along it, we can agree that space shares the attribute of directedness to a limited extent.

Therefore, we can assume that extension is straightforwardly an attribute of both space and time, linearity can be applied to time and any of the one-dimensional axes of space, and directedness is shared by time and space to some extent. Galton (2011) emphasizes that of all the above-enumerated attributes of time, one that is most

[53] A coinage of the phrase “the arrow of time” is attributed to the British astrophysicist, Sir Arthur Eddington. Le Poidevin (2003, Ch. 12) notes that what draws our attention to time’s arrow is that processes are essentially *temporally asymmetric*. He adds that in fact we can discuss at least three different arrows of time with reference to different processes. The *thermodynamic arrow of time* is the direction from order to disorder (entropy). The *psychological arrow of time* is the direction from perceptions of events to their memories. The *causal arrow of time* is the direction from cause to effect. In each of these cases, the direction of the process coincides with the direction from earlier (past) to later (future).

obviously not an attribute of space is transience. Space as such does not possess this attribute, and can only acquire it under certain circumstances through being correlated with time by means of motion, which is however, not related directly to its inherent nature.

The temporal transience, which was already discussed in Section 2.5, is an attribute of time that relates to the general awareness shared by all people that any given moment only occurs once at that very moment, with no possibility of return, which was discussed by Bergson (1922/2002, pp. 205–222) as the *evanescent* nature of time. Galton (2011, p. 702) emphasizes that "without this attribute, time would be just another dimension like those of space, and we would have a four-dimensional universe in which there is no change, just different qualities at different spatio-temporal locations". A conclusion that emerges from this study is that although space and time share a number of properties, they are qualitatively distinct conceptual domains. This imposes crucial limits on spatialization of time. A purely spatial metaphor can never fully capture the nature of time as a feature of our experience. Galton (2011) notes although motion may be essentially defined as "change of position", it is the *change* part of the definition that correlates with the transience of time. It is therefore more appropriate to describe spatial metaphors of time, or at least some of them, as *change-based* metaphors.

Langacker (2012) points out that the experience of space involves global accessibility and stability. The *global accessibility of space* means that through the sense of vision we have immediate awareness of an extensive spatial region, and additionally by moving in space we can potentially reach any spatial location. Because of the *stability of space* we can return to the same location as many times as we like. Our experience of time is different because we have no immediate access to anything beyond the current moment of time (see Section 1.3 for a discussion of *nowness* in temporal consciousness). Since we cannot actively traverse the temporal dimension to return to a point in time in the past, nor to reach a temporal location in the future, we are confined to what is happening right now (except for *mental time travel*, see Suddendorf & Corballis, 2007).

4.3 Psychological relativity of space and time

The first psychologist to demonstrate a link between space and time in human perception was probably Vittorio Benussi, who in 1913 published findings of an experiment (discussed in Aschersleben & Müsseler, 2010) demonstrating that judgments of spatial distance are related to temporal intervals in which that distance is presented. In the experiment three successive flashes of light at different locations marked two spatial distances and two temporal intervals. Benussi found that when two equidistant points in space were combined with two unequal temporal intervals, participants judged the spatial distance not by the actual separation in space, but by the temporal interval produced by the lights. That study followed the publication of Einstein's (1905/1952b) Special Theory of Relativity, and its translation by Minkowski (1908/1964) into the geometrically rendered space-time (DiSalle, 2006, Ch. 4.3), which negates separation of absolute time from absolute space. Since that time spatiotemporal relations have been tenaciously pursued in disciplines preoccupied with human cognition.

The above-described illusion, labeled *tau effect* (Helson, 1930; Helson & King, 1931), demonstrates the dependence of judgments of spatial distance on temporal duration: shorter temporal intervals are associated with shorter spatial distance judgments, and vice versa. The reverse phenomenon, i.e. *kappa effect* (Cohen, Hansel & Sylvester, 1953; Price-Williams, 1954), demonstrates the dependence of judgments of temporal duration on spatial distance. In the kappa effect shorter spatial distances are coupled with shorter temporal interval judgments, and vice versa. Subsequent studies (e.g. Cohen, Hansel & Sylvester, 1954; 1955; Collyer, 1977; Jones & Huang, 1982) found that these effects occur in different modalities and experimental settings. For example, experiments conducted in the auditory modality demonstrated that they occur with speech and non-speech auditory stimuli (Shigeno, 1986), and can even be observed in the influence of pitch on the temporal perception of music (Crowder & Neath, 1995).

Some of the above-mentioned studies reported that participants intuitively attribute movement to visual, auditory, or tactile stimuli, as if the signals were "traveling" at a certain speed from one point to another. Subjects made errors in their judgments when that imputed motion changed between successive intervals, which violated their intuition that it would continue to "travel" between points at the inferred speed. For that reason, these spatiotemporal illusionary effects were hypothesized (e.g. Price-Williams, 1954; Cohen et al., 1955; Jones & Huang, 1982) to result from the cognitive primacy of movement discrimination, which was assumed to effectuate in the imputed motion intuitively inferred from the overall pattern of stimulation. However, subsequent studies (e.g. Collyer, 1977; Sarrazin, Giraudo, Pailhous & Bootsma, 2004; Sarrazin, Tonnelier & Alexandre, 2005) reported data inconsistent with the imputed motion hypothesis.

These spatiotemporal illusions seem to reflect the natural link between space and time specified by the General Theory of Relativity. For that reason, the tau and kappa phenomena were assumed to reflect the existence of a general relativity principle that overlaps scientific disciplines (Cohen, 1967). Although a wide range of hypotheses for the explanations of the tau and kappa effects have been tested in different modalities (e.g. Goldreich, 2007; Henry, McAuley & Zaleha, 2009; Roussel, Grondin & Killeen, 2009; Aschersleben & Müsseler, 2010), the psychological relativity of space and time reflected in these effects has not been fully accounted for.

Another optical illusion in which stationary objects appear to move is the phenomenon of *apparent movement* (Steinman, Pizlo & Pizlo, 2000), which was discovered by Max Wertheimer (1912), one of the founders of Gestalt psychology. The *apparent movement* is perceived when no stimulus actually moves (changes position over time) in the visual field. In a typical experimental setting illustrating *phi phenomenon*[54] participants are exposed to two spots of light shown at two different locations in rapid succession transcending the threshold at which they can be perceived separately (typically for 150 milliseconds with the interval of 50 milliseconds). The participants report that they notice the light moving, rather than two independently lit points. Steinman et al. (2000) emphasize that the perception of motion in the phi phenomenon is *non-veridical*, i.e. the percept does not agree with the conditions present in the physical world.

Fauconnier and Turner (2000) propose an explanation for the perceptual phenomenon of apparent movement in terms of conceptual blending. They argue that our perception of the beam of light sweeping in real time between flashes of light is a result of the visual system's integration of effects and causes in cognition. The effects seem to us to be in the cause, thus we compress mentally two separate events into a unified percept of motion. As expounded by Coulson and Oakley:

> In a conceptual integration network, one input space represents light 1 flashing in place p1 at time t1, while the other input space represents light 2 flashing in place p2 at time t2. In the blend, a single light, which we will call light 3 maps onto light 1 <u>and</u> light 2. By composing the events in the two inputs, light 3's transition from p1 at t1 to p2 at t2 is understood and experienced as the result of motion (Coulson & Oakley, 2000, p. 182).

Moreover, the relationship between spatial and temporal dimensions of stimuli was observed in a study of motor control (Lee, 2000), in which right hand movements of participants were monitored with an attached sensor while they produced a series of visually guided movements following stimuli displayed on a computer screen. To

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[54] Steinman, Pizlo & Pizlo (2000) emphasize that apparent movement in *phi phenomenon* should not be confused with *beta phenomenon*. Although they are related, the phi phenomenon is caused by luminous impulses going on and off at regular intervals, whereas the beta phenomenon is apparent movement caused by a set lights that seems to move over an area. The *perception of apparent movement* is involved in watching motion pictures, where series of still photographs are projected in rapid succession onto a screen (Ramachandran & Anstis, 1986).

examine how the temporal and spatial patterns of movement sequence are learned, the experimenter manipulated the sequence of target locations and the consistency in the timing of target presentation. Optimal performance was obtained with both the location and timing of targets following a consistent pattern. When the same temporal and spatial patterns were presented with a phase shift introduced between the spatial and temporal patterns, there was a small but consistent deficit observed in performance. (The participants were unaware of the phase-shift.) The results indicate that learning of spatiotemporal patterns is implicit in cognition and becomes sub-optimal, if the sequence of pattern presentation is not consistently aligned with timing.

4.4 Asymmetric views on cognition of space and time

Although the above-discussed studies demonstrate a close relationship between space and time in cognition, they do not reveal anything about characteristics of that bond. Generally, there are two opposing views on the nature of this relationship. The *asymmetric* view holds that our conceptions of space and time are asymmetrically dependent: we construct abstract mental representations of time by referring to concrete mental representations of space, but not vice-versa. It is based on observations of conventional time–space mappings used in everyday language: typically people talk about time in terms of space more frequently than they talk about space in terms of time. This view was articulated by Clark's (1973), who concluded his study of child's acquisition of linguistic expressions of time and space with a hypothesis that linguistic references to time are merely metaphoric extensions of the dimensional semantics of space.

The view that the domain of time appears to be asymmetrically structured in terms of space is epitomized by the conceptual metaphor theory (Lakoff & Johnson, 1980, 1999), which was reviewed in Chapter 2. It holds that time constitutes an abstract cognitive construct that is conceptualized in the human mind through perceptual and motor experience in the concrete domain of space.[55]

[55] Although some studies attribute the "TIME IS SPACE" metaphor to Lakoff & Johnson, in the course of investigations conducted for this study a literal expression of such metaphor was nowhere to be found in their writings. Instead, Lakoff & Johnson (1999, pp. 159–161) introduce the SPACE–TIME metaphor by referring to the General Relativity Theory, which implies much more complex reciprocity of spatiotemporal relations. The authors of "The Philosophy in the Flesh" provide a fair warning (Lakoff & Johnson, 1999, p. 160) that metaphorical conceptualization of time in terms of space should not be taken literally, "since as a metaphor, it can lead us to silliness if we are not careful".

The theory is supported by evidence from psycholinguistic experiments demonstrating that people construct spatial representations of time when processing temporal statements.

Boroditsky (2000, Exp. 3) investigated the influence of spatial and temporal priming questions on response times to spatial and temporal target scenarios. She found that priming participants to adopt a specific spatial frame of reference facilitated their processing of temporal sentences (e.g. "March comes before May"). However, interpreting spatial sentences was not influenced by consistent temporal primes. Overall, results of Boroditsky's (2000) experiments indicate that in real-time processing spatial schemas influence how we think about time, but access to temporal schemas does not influence thinking about space, which lends support to the conceptual metaphor theory.

Using non-linguistic, low-level psychophysical tasks, Casasanto and Boroditsky (2008) investigated whether the asymmetric relationship between space and time found in linguistic metaphors can also be found in non-linguistic mental representations of time. In a series of experiments, adult English speakers watched dots or lines growing across the computer screen. Participants were asked to reproduce either the duration of the stimulus, i.e. the time the line remained on the screen, or the spatial extent, i.e. the distance that the line traveled on the screen, with computer mouse clicks. The experiments showed that the lines that traveled a shorter distance were judged by participants to take a shorter time, and the lines that traveled a longer distance were judged to take a longer time, even though all growing lines took on average the same amount of time, regardless of their spatial length. Even when the participants were instructed that they should pay attention to the temporal dimension of the stimulus, they were still incorporating irrelevant spatial information into their temporal judgments. The reverse effect, i.e. the influence of the temporal duration of stimuli on judgments of spatial extent was not found in the study. The results suggest that our conceptions of space and time might be asymmetrically dependent in the manner that has been observed in language (see Casasanto, 2009 for a review).

In subsequent experiments Casasanto et al. (2010) investigated a possibility suggested by Piaget (1946/1969; 1946/1970; Piaget & Inhelder, 1948/1956; Piaget, Inhelder & Szeminska, 1948/1960) that at early stages of development space and time form an inseparable entity, and emerge as asymmetrically related concepts as we acquire metaphorical representations in the course of cognitive development. To investigate this possibility, Casasanto et al. (2010) conducted a series experiments using low-level psychophysical tasks with native Greek children from kindergarten (aged 4–6) and elementary school (9–10 years olds). The tasks were adjusted for children, so instead of dots they watched cartoon movies of snails racing or jumping for different distances or durations across the computer screen. The children were asked to judge which snail had traveled for a longer distance, or had traveled for a longer time. Similarly to adults, children were able to ignore irrelevant temporal information in the stimuli when making judgments about space, but they had much greater difficulty ignoring irrelevant spatial information when making judgments about time. The results indicate that the basic non-linguistic representations of distance and duration are already asymmetrically linked in children's minds by about age of 5, which is several years before they develop adult-like conceptions of space and time.

In a series of experiments conducted with adult participants and nine-month-old infants Srinivasan and Carey (2010) found that both these groups were better able to bind positively correlated pairings of lines of different length and tones of different duration than pairings of lines of different length and tones of different loudness. Their findings indicate that representations of spatial length and temporal duration may functionally overlap to a greater extent than representations of spatial length and other categories of experience, e.g. tone amplitudes. This functional overlap observed in adults and infants suggests that the relation between time and space extends beyond metaphoric construction processes mediated by learning to flexibly use words such as "long" and "short". Srinivasan and Carey (2010) suggested that such overlap may reflect an innate evolutionary recycling of spatial representations for temporal purposes, which is independent of language and other cultural heritage.

Results of the above-reviewed studies indicate that time–space mappings are not only observable in linguistic expressions, but that they are psychologically real. Additionally, time–space mappings are evident in cultural artifacts, such as clocks and calendars used as *material anchors* for conceptual structuring of time (Hutchins, 2005; De Smedt & De Cruz, 2011). Such instruments facilitate conceptualization of events as happening in time that can be measured in units analogous to those of spatial measurement (see also Fauconnier & Turner, 2008; Evans, 2003, Ch. 9).

4.5 Symmetric views on cognition of space and time

An alternative proposal holds that the relationship between space and time is *symmetric*. It is epitomized by ATOM theory (A Theory of Magnitude) proposed by Walsh (2003), which assumes that time, space, and number are processed in cognition by a common processing mechanism. ATOM underpins its claims with an extensive number of neuropsychological findings, brain imaging studies, single-unit studies, and TMS (Transcranial Magnetic Stimulation) studies, which report shared brain areas for processing space, time, and number as an analogue magnitude (see Bueti & Walsh, 2009 for a review).

A more recent proposal (Cantlon et al., 2009) postulates a specialized Approximate Number System (ANS), which represents the number of discrete objects or events as a continuous mental magnitude and bears a set of behavioral and brain signatures universally displayed across animal species, human cultures and development (see Dehaene & Brannon, 2011 for a comprehensive review of research on space, time, and number in the brain).

The symmetric view on the relationship between space and time in cognition is supported by the recently observed STEARC effect (Ishihara, Keller, Rossetti & Prinz, 2008). In a series of experiments participants were asked to listen to sequentially presented auditory clicks with their eyes shut and indicate whether the clicks appeared earlier or later than expected critical timing by pressing horizontally aligned response buttons. The results showed that left-side responses to early onset timing were faster than those to late onset timing, while right-side responses to late onsets were faster than those to early onsets. Interestingly, such a congruity effect was not observed with vertically aligned response keys. These results suggest that time is represented as a continuous mental magnitude along the horizontal axis in space (see Bonato et al., 2012 for a review of evidence for a mental time line). This effect is analogous to the SNARC effect[56] observed originally with numerical stimuli (Dehaene, Bossini & Giraux, 1993), and subsequently obtained with ordinal sequences of months and letters (see Gevers, Reynvoet & Fias, 2003; Fias, van Dijck & Gevers, 2011 for reviews).

Moreover, for some people simultaneous perception of time, number, and space is triggered automatically in *synesthesia*[57], in which an association of time and space

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[56] The SNARC effect, standing for Spatial Numerical Association of Response Codes (Dehaene, Bossini & Giraux, 1993), indicates an existence of a spatially oriented left-to-right mental line used for number representation. In the original experiment participants were asked to classify a single digit as being odd or even by pressing a left or a right response button. The study found that, for a given numerical interval, smaller numbers were responded to faster with the left than with the right hand, whereas larger numbers were responded to faster with the right than with the left hand, irrespective whether the number was odd or even. This effect remained when participants cross their hands, showing that it is spatially based. Since that time the SNARC effect has been replicated numerous times in studies using different stimulus and task configurations.

[57] *Synesthesia* (from the Greek *syn* [=together] and *aisthesia* [=perception]) is a harmless neurological condition (with a genetic basis) in which a perceptual or conceptual stimulus in one sense triggers an additional concurrent experience in another sense. For example, some people see digits in colors. In other reported cases, hearing music might cause a synesthete to experience colors or textures, or a sound might trigger a taste, or a weekday might trigger a

occurs as an explicit and vivid experience of time and/or number as occupying a predefined spatial location. The ability to "glue" time, number, and space together is termed *TNS synesthesi*a (Kadosh & Gertner, 2011). Synaesthetes often draw sophisticated curvilinear or three-dimensional representations of their subjective time and/or number line. For example, in one common variant of time–space synaesthesia individuals report a consistent experience of months bound to a spatial arrangement described as a circle extending outside of the body (Smilek, Callejas, Dixon & Merikle, 2007).

What makes the symmetric model convincing is that it integrates a substantial body of research from several different fields into a single mechanism regulating fundamental dimensions of human experience. Besides the overlapping neural areas observed in brain studies, as well as responses observed in psychophysical tasks, the symmetric proposal is supported by developmental research on magnitude representation in human infants (de Hevia & Spelke, 2010; Lourenco & Longo, 2010) and primates (Cantlon & Brannon, 2006; Merritt, Casasanto & Brannon, 2010), in which patterns consistent with symmetric processing have been observed.

4.6 Fitting time into space: temporal frames of reference

Observations that space and time are closely linked in everyday talk and, most likely, cognitive computational mechanisms, have spawned a number of studies attempting to organize the variation in conceptions of time observed across languages and cultures in the form of *temporal frames of reference*, i.e. systematic mappings between spatial frames of reference and temporal representations. Research toward this end was inspired by an idea that if we tend to think about time in terms of space, then we are likely to consistently map spatial frames of reference onto the temporal domain in order to facilitate conceptual organization of temporal descriptions.

Bender, Bennardo and Beller (2005) performed an analysis of spatial frames of reference for temporal relations in English, German, and Tongan speakers. They related the temporal frames to spatial frames of reference distinguished by Levinson's (2003) with adjustments proposed by Bennardo (2004), which was discussed in Section 3.3. Accordingly, they distinguished an *absolute* frame of reference, in which coordination of events is determined by the calendar, and an *intrinsic* frame in which time is located with reference to beginnings and ends of

color (see Cytowic & Eagleman, 2009 for an accessible review). Synesthetic expressions are common in langauge, e.g. *loud colors*, *sweet music*, *sharp tones*, *warm person*, etc. (see J. Williams, 1976). Simner (2007) views synaesthesia as a psycholinguistic, rather than exclusively neural phenomenon.

events. Additionally, a *relative* frame was proposed in two variants: in one speakers locate time in relation to their position, in the other they translate their perspective onto some external point of reference. Bender et al. (2005) suggested that despite differences in dimensions and directionality between space and time, it is possible to map spatial frames of reference onto temporal relations, because the directionality of time allows for the Moving-Time and Moving-Ego perspectives, and the finite character of events characterized by beginnings and ends compensates for the deficiency in dimensions.

Kranjec (2006) used the distinction between the Ego-Time-Reference-Point (Ego-RP) and Time-Reference-Point (Time-RP) proposed by Núñez & Sweetser (2006; see also Moore, 2006; discussed in Section 2.3), to correlate Ego-RP metaphors with a *deictic* frame. He also divided Time-RP metaphors into two sub-types: *intrinsic* framework and *extrinsic* framework based on the arrow of time derived from a speaker's writing direction (see Tversky et al., 1991; Fuhrman & Boroditsky, 2010; Bergen & Chan Lau, 2012; de Sousa, 2012). Kranjec's (2006) taxonomy uses the position of *ego* to define past/future relations, and forward motion to define the direction of either earlier or later times, depending on the perspective.

Generally, the above taxonomies follow an assumption that the spatial model of frames of reference should be transferable, more or less directly, to temporal conceptions of time. However, Zinken (2010) observed that temporal frames of reference based on spatial frameworks run into problems. He pointed out that the separation of reference to subjective past/future from reference to anteriority/posteriority relations proposed by Núñez & Sweetser (2006) is not all encompassing. We should first determine the association between the ideas of front and future for A-series reference, and front and anteriority for B-series reference, since they can be associated with the speaker's perspective, some primary external ground, or a secondary ground, depending on the origin of the coordinate system. Zinken (2010) suggested that data from a more varied sample of languages and cultures should be taken into consideration before drawing conclusions about universal correlations between the domains of space and time.

Meanwhile, Bender et al. (2010) developed a further systematization of temporal frames of reference using data from German, English, Mandarin Chinese, and Tongan speakers. They again distinguished the absolute frame, which derives its orientation from the time line; the intrinsic frame, which derives its orientation from the event in question; and additionally three variants of the relative frame obtained by *translation*, *reflection*, or *rotation* in the speaker's orientation toward the future. Tenbrink (2011) also used Levinson's (2003) taxonomy as the basis for her research, but she focused exclusively on English and employed a different approach. In the outcome, she developed an elaborate, purportedly language-independent, conceptual framework encompassing external and internal, static and dynamic spatial situations, as well as temporal relationships. Her taxonomy includes nine temporal frames of reference, or even more if variants within frames are taken into consideration.

Moore (2011) focused specifically on frames of reference used for spatial construals of time that are path-configured, i.e. involve a series of positions in one dimension in the source domain. Illustrating his taxonomy with data from Wolof, Japanese, and Aymara, he distinguished two basic types of temporal frames of reference. One, *ego-perspective frame of reference* (perspective specific) structures time in relation to the perspective of the speaker. This frame does not correspond directly to any of Levinson's (2003) three major types, but is related to the formerly distinguished *deictic perspective system* (see Levelt, 1996). The other, *field-based frame of reference* (perspective neutral) includes Levinson's (2003) *absolute* type, which means that it essentially can be aligned to compass bearings.

Recently, Bender has returned to the problem of relations between spatial frames of reference and temporal representations for the third time (Bender et al., 2012). This time the assumption that the preference for a specific spatial frame of reference is carried over to the domain of time was comprehensively scrutinized with a review of data from recent studies and experimental evidence from speakers of German, USA-English, Mandarin Chinese, and Tongan. Surprisingly, the study did not find any experimental evidence for the correspondence between temporal and spatial references in the four languages under scrutiny. Across experiments, speakers of all those languages generally preferred using the *translation* frame of reference, i.e. one in which front and forward motion are projected onto the space beyond the original position in the direction of the speaker's gaze. The correspondence between spatial and temporal frames was not changed by adjusting the experimental conditions. The results cast doubt on the previously published taxonomy (Bender et al., 2010) and indicate that although representations of space and time do interact, a direct link between referencing preferences across domains of space and time is hard to establish.

Evans (2013a) concludes that Bender et al.'s (2012) study has demonstrated that space structures temporal representations only to a certain extent. He emphasizes that while space is important for supporting temporal reference, the experience that underlies temporal representations is inherently temporal, rather than spatial in nature. Evans (2013a, 2013b) argues that attempts to render temporal reference in terms of space miss the essence of time, which is *transience* (Galton, 2011; see also *evanescence* in Bergson, 1922/2002, pp. 205–222). He adds that constructing models of temporal relations must take into consideration transience as the aspect of time that underpins our ability to experience and fix events in time.

Accordingly, Evans (2013a) proposes distinguishing three distinct types of temporal frames of reference in relation to three distinct types of transience, which he terms *anisotropicity*, *succession*, and *duration*. *Anisotropicity* is the felt experience that the passage of time exhibits inherent asymmetry, which leads to the distinction between future, present and past. This type of transience gives raise to a *deictic temporal frame of reference*, which involves an egocentric coordinate system. Within this frame events are configured with reference to future, present and past. The awareness of *now* serves as the anchor that aligns present with the experiencer's location in time, e.g. "We are moving closer to Christmas", "Christmas is getting close".

The second type of transience is *succession*, which can be defined as the felt experience of the time's passage involving earlier and later experiences, which are sequenced with respect to one another. It provides the basis for a *sequential temporal frame of reference*, in which the coordinate system is provided by a sequence of events being earlier or later to each other. A target event in this frame is fixed with respect to another event, which serves as the reference point, e.g. "Christmas comes before New Year's Eve", "The keynote presentation is followed by a reception", etc.

The third type of transience distinguished by Evans (2013a) is *duration* defined as the felt experience of the time's passage constituting an elapse as something that lasts longer than the *perceptual moment* (see Pöppel, 2009; Wittmann, 2011). It gives raise to an *extrinsic temporal frame of reference*. Fixing events in time in this frame is achieved by virtue of anchoring events to an encompassing temporal matrix, which arises from calendars and clocks as time and event reckoning systems. Since clocks and calendars are essentially counting systems, they facilitate the use of periodicities for marking when an event has occurred with lesser or greater precision against the temporal matrix. This frame provides means of fixing events in an absolute way, without reference to an observer or another event, e.g. "The war started in 1939", "The concert ended at 8am".

Generally, the studies on temporal frames of reference reviewed in this section have demonstrated that the mapping temporal reference systems in spatial terms is not an easy task. On the one hand, certain uses of *deixis* in the temporal domain suggest that conceptual reference frames are also used in the domain of time. On the other hand, spatial and temporal domains differ substantially enough to make a straightforward transfer from spatial frames of reference to the temporal domain difficult to establish. This prompts for a question to what extent conceptual schemas underlying temporal language correspond to those of spatial language. Núñez and Cooperrider (2013, p. 221) suggest a possibility that "humans do not map space and time onto each other in an exhaustive fashion, but rather recruit a limited subset of possible spatial experiences (e.g. forward motion along a path) for construing the full complement of temporal experiences". Another important factor, which is taken into account in this study, is the assumption that the relationship between space and time, at least in linguistic representations, hinges on a higher-order conceptual distinction between objects and events.

4.7 Relations between space and time in objects and events

One of the basic functions of language is to structure the constant flux of goings-on in the world into coherent units referred to as *events*. Although this structuring seems to be intuitively obvious to ordinary language users, studying linguistic representations of events is a challenging task that lies at the intersection of linguistics, psychology, and philosophy (Tenny & Pustejovsky, 2000; Casati & Varzi, 2010; Lewandowska-Tomaszczyk, 2011). The significance of linguistic structuring of events for the logical representation of sentences was recognized by David Davidson in his article *The Logical Form of Action Sentences* (1967/2001). Davidson's article stimulated the development of the framework of *event semantics*, in which "the ultimate semantic properties of the event description encoded in particular sentences are determined by a complex interaction between the lexical semantics of the verb, the referential properties of arguments and their morphosyntactic expression, and properties of temporal and locative adjuncts" (Rappaport Hovav et al., 2010, p. 2). The framework of event semantics contributed to the study of the semantics of verbs and their arguments within formal semantics, converging with the work developed independently in lexical semantics (see Higginbotham, Pianesi & Varzi, 2000; Lewandowska-Tomaszczyk, 2008a; Rappaport Hovav et al., 2010 for edited collections of studies).

The study of event semantics has demonstrated that, despite the fact that what happens in the world can be characterized by an infinite number of properties, only a certain set of these properties is linguistically significant. "These linguistically relevant properties define the templates for the linguistic representation of events, referred to as *event structure*" (Rappaport Hovav et al., 2010, p. 2). Event structure essentially encompasses event participants and the temporal properties associated with the linguistic representation of events.[58] We conceive of events as residing primarily in time, which involves a variety of temporal dimensions (see Mani et al., 2005). For example, some verbs lexically entail the endpoint, or *telos*, on the event they describe, which is referred to as *telicity*, e.g. "He arrived in London" vs. "He went to London" (Verkuyl, 1993). Secondly, an event may be represented using *perfective* (completed) or *imperfective* (ongoing) aspect (Comrie, 1976). Thirdly, an event is temporally anchored in relation to the discourse through the *tense* (Comrie, 1985). Next, an event may be evaluated with respect to circumstances distinct from those holding in the actual world, expressed via the *modal system* (Palmer, 2001). Moreover, event structure varies in relation to *active*, *passive*, or *middle voice* associated with a verb (Lyngfelt & Solstad, 2006). Telicity, aspect, tense, mood, and voice interact with one another in linguistic representation of events (see Radden & Dirven, 2007 for an overview of situations as temporal units involving aspect, tense and modality in cognitive grammar of English). As a result, event structure emerges as a highly complex system of dependencies between event configurations and verb features, with significant differences observed across languages (Rappaport Hovav et al., 2010, Ch. 1).

An important thread in the linguistic discussion on the relationship between space and time concerns differences between objects and events as reflected in nouns and verbs (Langacker, 1987b; 2008a, Ch. 4.2; 2012). While formalist approaches traditionally distinguish word classes in distributional terms (Chomsky, 1970), Cognitive Grammar proposes to use a more functional, semantically motivated approach to this distinction. Langacker (2008a, p. 103) argues that prototypes of nouns and verbs consist of experientially grounded conceptual archetypes. The archetype functioning as a category prototype for nouns is the conception of a physical object. For verbs, the archetype is the conception of a process in which participants interact in a *force-dynamic* event (see Talmy, 1988a; 2000a, Ch. 7; Kardela, 2007). Langacker (2008a, p. 104) notes that these two categories are so fundamental to our experience that we generally take them for granted, but their conceptual emergence is essential for our capacity of apprehending relationships and tracking them in time.

[58] The body of research that has led to formulation of event-based semantic theories embraces a tremendous range of topics, including tense and aspect, nominalization, anaphora, plurals, adverbial modification, naked infinitives, and numerous other features of language discussed in relation to event structuring (see Higginbotham, Pianesi & Varzi, 2000; Lewandowska-Tomaszczyk, 2008a; Mani, Pustejovsky & Gaizauskas, 2005; Rappaport Hovav, Doron & Sichel, 2010, for multidisciplinary collections of studies).

Langacker sees both nouns and verbs as prominent participants in a fundamental conceptual archetype, which he terms *canonical event model* (Langacker, 1991, Ch. 7; 2008a, pp. 357–358). It is the basis of the prototypical finite clause describing an action performed by an agent on some affected object, which reflects our way of apprehending events. As shown in Figure 4.1, in the canonical event an agent acts an energy source and the initial participant in an action chain. A patient usually undergoes a change of state as the result of being affected by outside forces. In the default coding of an event, clausal elements assume their prototypical values: the prototypical *noun* encodes agents as clausal subjects, and patients as clausal objects; the prototypical *verb* encodes an agent-patient interaction. The canonical event model incorporates also a setting, and a viewer observing it from an external vantage point.

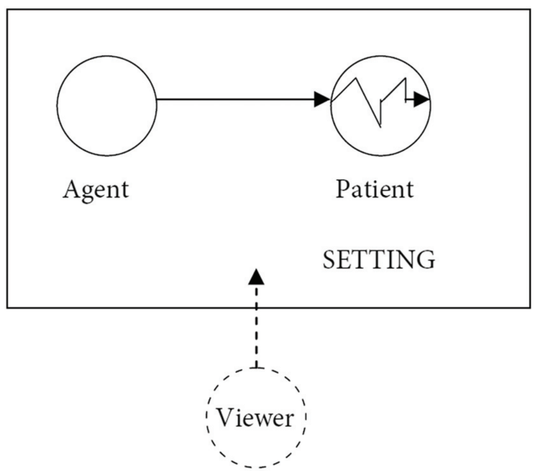

Figure 4.1 The canonical event model

According to Langacker (2008a), this cognitive model (cf. EVENT-STRUCTURE metaphor in Lakoff, 1993, pp. 219–229; Lakoff & Johnson, 1999, pp. 194–201) is the basic foundation of our apprehension of the world, which occurs according to what Langacker describes as a *billiard-ball model*:

> We think of our world as being populated by discrete physical objects. These objects are capable of moving about through space and making contact with one another. Motion is driven by energy, which some objects draw from internal resources and others receive from the exterior. When motion results in forceful physical contact, energy is transmitted from the mover to the impacted object, which may thereby be set in motion to participate in further interactions (Langacker, 2008a, p. 103).

Within this model, the noun and verb prototypes stand as polar opposites contrasting in their basic properties. Prototypically, *noun* designates a spatially bounded *physical object* (animate or inanimate) composed of a material substance. It resides primarily in space, where it has spatial extension, a spatial configuration, and its own spatial location. In opposition, *verb* refers prototypically to an *energetic interaction* that is transient and immaterial. A corresponding force-dynamic event unfolds primarily in time, where it is temporally bounded and has its own temporal location. Hence, the noun prototypes are closely tied to space, and the verb prototypes are closely tied to time.

However, despite being contrasting opposites, the relationship between nouns and verbs is not straightforwardly detachable. On the one hand, an object can be perceived as conceptually autonomous because its conception does not require the conception of any event involving it. But on the other hand, an event cannot be conceptualized without the participants who interact in its development (Langacker, 2008a, p. 104; 2012, p. 194). Therefore, while static spatial relations between material objects can be described without reference to the temporal dimension, conceptualizations of events necessarily involve both spatial and temporal aspects.

As shown in Table 4.1, objects and events can be distinguished according to four major aspects: their prototypical word class, primary domain of instantiation, spatial/temporal extension, and autonomy.

	Object	**Event**
Prototypical word class	Noun	Verb
Primary domain of instantiation	Space	Time
Extension in space/time	Spatially compact Temporally unbounded	Temporally compact Spatially unbounded
Autonomy	Autonomous	Dependent

Table 4.1 Contrasts between objects and events

For objects, which in the canonical event model are prototypically encoded with nouns, the primary domain of instantiation is space. They are conceived of as relatively compact along the spatial axis, but they are relatively permanent with reference to their temporal extension. Referents of nouns tend to be conceptualized as autonomous objects: a billiard ball can exist without being involved in any energetic interaction. On the other hand, events are prototypically encoded with verbs and their primary domain of instantiation is time. They are temporally compact, but can be very expansive along the spatial axis, e.g. a long distance call between Sidney, Australia and London, UK. However, they are not autonomous because an event cannot be conceptualized without the interacting entities: a billiard game cannot be executed without balls.

Langacker (2012, p. 194) illustrates the distinction between objects and events by pointing out that a natural question to ask for objects is "Where?", while for events it is "When?". Consequently, it is natural to ask: "*Where* is an apple?", but the question "*When* is an apple?" sounds rather strange. However, such asymmetry does not occur for events because it is not strange to ask "*Where* did you eat an apple?" or "*When* did you eat an apple?". This demonstrates that events have locations both in space and in time[59] (see also Radvansky & Zaacks, 2011). The link between space and time in verbs arises directly from their prototypical role of event referents. For example, although the verb "enter" designates a relationship in space, the change in spatial configuration that constitutes the described event can only take place along the temporal axis.[60]

Moreover, Langacker (1987b; 2012, pp. 197–200) argues that the parallelism between nouns and verbs occurs at the level of their major subcategories. The division between *count* vs. *mass* nouns (see Langacker, 2008a, Ch. 5.1) corresponds to the distinction between *perfective* and *imperfective* verbs (see Langacker, 2008a, Ch. 5.2), as distinguished in Cognitive Grammar. A key factor in this analogy is *bounding* (see Langacker, 2008a, pp. 136–139), which profiles physical substances as spatially bounded objects in count nouns, and states as temporally bounded events in perfective verbs. Langacker (2012) points out that count/mass and perfective/imperfective oppositions are perfectly analogous in space and time as their respective domains of instantiation, i.e. domains in which the entity profiled by a noun or a verb resides in conception, respectively.

Although the noun-verb parallelism suggests that space and time are symmetrically comparable, Langacker (2012, pp. 200–201) emphasizes that there exist crucial linguistic asymmetries between these two categories indicating that time cannot be viewed as just another space-like dimension. Apart from the above-discussed asymmetry between objects being conceptually autonomous, while events being conceptually dependent of participating objects, another linguistic asymmetry

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[59] Radvansky and Zaacks (2011) emphasize that each event is embedded in a *spatial–temporal framework*, which acts as the basic organizing factor for mental representations of events in mental models.

[60] Langacker (2008a, p. 79 & 118) notes that in English, the temporal dimension of an event is typically encoded in the verb itself, and the spatial dimension in the corresponding preposition, e.g. "She *entered* <u>through</u> the door", "They *marched* <u>across</u> the field", etc.

between space and time concerns the domain of instantiation. Langacker (2012, p. 202) notes that for verbs this domain is always time, but for nouns space is only prototypical, not invariably necessary. For example, nouns like *minute*, *hour*, and *day* profile bounded temporal units,[61] and a *beep* is a specific type of sound bounded by a short temporal duration.

Another important thread in the discussion on intertwined relations between space and time in language and cognition, contributed by Langacker (1986, 2005, 2008a), relates to parallels between conceptualizations of *actual* and *fictive*[62] *motion* events (see also Talmy 1996; 2000a, Ch. 2; Matlock, 2004b; Matsumoto, 1996). Langacker points out that expressions of movement in the primarily spatial sense, e.g. "They went from Cambridge to Oxford", and expressions of movement in the primarily temporal sense, e.g. "The concert went from midnight to 4 a.m.", are both based on a conception of a mover proceeding through an ordered series of component states. Thus, conceptualization of such events embraces a process taking place in time in relation to locations in space or points in time, respectively.

The difference between the two above is that in the temporal sense time serves as the cognitive domain of the relation between each component state of the mover and a point in time, whereas in the spatial sense each component state of the mover in time is related to a location in space. Still, both expressions listed above are based on the conceptualization of *movement* involving *mental scanning* (Langacker, 2008a, pp. 82–83). In both cases the conceptualizer tracks mentally a series of locations in space or time, respectively, in order to situate the process in relation to a reference point (see *sequential* vs. *summary scanning* in Langacker, 2008a, pp. 111–112; cf. Broccias & Hollmann, 2007 for a criticism; see Langacker, 2008b for a reply).

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[61] Temporal units of *minute*, *hour*, and *day* seem to be rather controversial as examples of prototypical temporal entities because they are derived from the clock and calendar, which are culturally created and spatially bounded artifacts used for conceptualization of time (see Fauconnier & Turner, 2002, pp. 195–198; Hutchins, 2005; Roeckelein, 2008, pp. 5–7). For that reason, Langacker distinguishes a separate category of temporal nouns that "make indirect reference to time by invoking abstract conceptual frameworks serving to measure it and distinguish temporal locations" (Langacker, 2012, pp. 208–209). Still, there are nouns independent of culturally created material anchors, e.g. *season* or *life*, which undeniably express temporal meaning. To what extent they are spatially bounded concepts is a topic for a separate discussion that exceeds the scope of this study (see also Evans, 2003).

[62] Initially, Langacker (1986) used terms "concrete/objective" for *actual motion* and "abstract/subjective" for *fictive motion*. However, from that time terminology used in cognitive linguistics has evolved. This study employs terms used in more recent publications (e.g. Langacker, 2008a; 2012).

Apprehension of the temporal aspect of actual motion events through direct observation, e.g. an apple fall to the ground, involves *sequential scanning*. In this process temporal evolution of events develops through "time slices" in a sequential order: successive moments in conceived time correspond to successive moments in processing time. Consequently, events are conceived in a certain order, which enables us, for example, to distinguish an event of *falling* from an event of *rising*. Although the relevant intervals of processing time and conceived time are referentially distinct in *summary scanning* employed for apprehension of past events, they are nevertheless processed in the appropriate order, which indicates that recalling or imagining events involves partial simulations of the real-time sequential experience of observing real events (see Bergen, 2012).

Langacker (2012, p. 205) notes that sequential processing of events demonstrates our cognitive capacity for *summation*, by means of which structures experienced sequentially are superimposed, as in a multiple-exposure photograph. The continued activation and superimposion of successive "time slices" produces a stable and coherent conception of event, which encompasses more than the relation of component states in space and time at a single moment. Once built up in this fashion, conceptions of events are accessible as conceptual structures functioning as unitary *gestalts* (cf. Fauconnier & Turner, 2000, p. 286; Coulson & Oakley, 2000, p. 182, for a discussion on *gestalts* in conceptualizations of *apparent movement* from the perspective of conceptual blending). For Langacker (2012), summation is a way of overcoming the transience of temporal experience (cf. Galton, 2011). However, he questions whether the transfer from space to time observed in the metaphorical extension of spatial expressions to temporal representations is sufficient to claim that space is conceptually more basic than time.

Engberg-Pedersen (1999) follows Langacker in her doubts whether the uses of space in temporal metaphors are sufficient to view space as more conceptually fundamental than time. She draws on data from Danish Sign Language to show that linguistic means used to express temporal and spatial relations are linked in systematic ways (see also Emmorey, 2001). For example, to denote a relationship between three moments in time, signers of deaf sign language use a locus at their body and two loci at different distances out from their body, which largely corresponds to expressing spatial relations. However, in order to know what corresponds to *earlier* and what to *later* from the tenseless perspective, they first need to distinguish between the *moving-time* and *moving-ego* variants. Otherwise, the point in time represented by the locus in the middle could be understood to be either as earlier or later than the point in time represented by the locus farther away from the signer.

Therefore, even though in deaf sign language the same configuration of loci can be used to express spatial and temporal relations, there is a difference between the static-locative and temporal-dynamic use of space. According to Engberg-Pedersen (1999, p. 143): “This difference between the two uses of space in sign language underlines the role of the cognitive difference between static situations and dynamic events in the description of temporal expressions, no matter whether these are semantically static or dynamic”. Because the notion of *event* pertains as much to the concept of space as to the concept of time, it is fundamental to linguistic expressions of both temporal and spatial relations. Engberg-Pedersen (1999) argues that the distinction between space and time should be attributed to the basic perceptual difference between static configurations and dynamic events, rather than space and time as such. She adds that neither time nor space should be seen as metaphorical extension of the other. Although at certain cognitive levels it is possible to distinguish between conceptualizations of space and time, these two concepts are so tightly interwoven in cognition, that it is possible to talk about space-to-time metaphors as well as time-to-space metaphors at some other cognitive levels.

Langacker (2012) argues that there are reasons for considering space to be more basic than time, as well as reasons for considering time to be more basic than space. On the one hand, space is more basic as the *object of conception*, which is indicated by the direction of metaphorical conceptions of time in terms of space. But on the other hand, the dynamicity of spatial conception, where time functions as the *medium of conception*, makes time more basic as the fundamental prerequisite for cognitive processing of space. Consequently, the relationship between time and space seems to be in a sense circular: time enables the apprehension of space in the subject of conception, which in turn allows for the apprehension of time as an object of conception.

However, Langacker (2012, p. 202) emphasizes that in apprehension of motion events, motion in space is not mutually interchangeable with motion in time. We are inclined to conceptualize motion as movement through space that occurs through time, rather than movement in time that occurs through space. Although from the outlook of contemporary physics based on relativity, there is no real distinction between the space and time coordinates (Hawking, 1988, Ch. 2), we normally describe a falling apple as “getting closer and closer to the ground” through time rather than as “getting later and later to the ground” through space.

Similarly, it makes sense to ask "How much time does it take to get from Oxford to Cambridge?", but it would sound preposterous to ask "How much distance does it take to get from 1 p.m. to 2 p.m.".[63] Langacker attributes using such spatially inclined linguistic patterns to *conceptual layering*.

The discussion of the relationship between space and time in language and cognition with reference to objects and events is continued in Chapters 6–9 of this book, which explore this problem from the perspective of empirical linguistic research based on corpora. However, to begin with, it requires a basic introduction to the corpus-based cognitive linguistic workbench, which is presented in the following chapter.

[63] It is noteworthy that describing passage of time in terms of spatial distance seems natural when we explain workings of an analogue clock. In this context it is natural to say that "A quarter will pass when the big hand of the clock moves from 3 to 6", etc. Such examples demonstrate that in certain spatial-temporal contexts conceptual layering is not rigid. See Williams, 2004 for a discussion on the constitutive role of the clock, especially the analogue clock with a face and moving hands, in conceptualizations of time.

Chapter 5

Corpus-based cognitive linguistics

I see linguistics as an avenue to how the mind works…. Sometimes doing this kind of work—delving into the mind and seeing something of its phenomena—feels like unveiling some of the mysteries of the cosmos.

Leonard Talmy (2010) in *Science Today*

5.1 Cognitive approach to language study

This book approaches relations between space and time manifested in language from the perspective of *corpus-based cognitive linguistics*, which relies on explanatory notions adopted by the *cognitive linguistics* framework, but approaches them in such a way that their relevance to a given linguistic phenomenon can be empirically validated in large corpora, frequently with an aid of advanced statistical techniques (Heylen, Tummers and Geeraerts, 2008, p. 92). Simply put, this approach to language study combines the descriptive framework of cognitive linguistics with the methodological workbench of corpus linguistics.

Cognitive linguistics is a contemporary approach to studying language, meaning, and conceptual structure. It views language as intrinsically linked to general cognitive processes. Cognitive linguistics emerged out of dissatisfaction with formal approaches to language study based on the principles of Generative Grammar (Chomsky, 1957, 1965) and Formal Semantics (Montague, 1974), which dominated in linguistics and philosophy in the 1960s and 1970s (see Kalisz, 2001 for an analysis). Currently, cognitive linguistics is one of the most influential and fastest developing perspectives on the nature of language, the mind, and their mutual interaction with reference to socio-cultural and physical experience (Evans, 2012).

Cognitive linguistics assumes that "language is governed by general cognitive principles, rather than by a special-purpose language module" (Croft & Cruse, 2004, p. i). Studying language from this perspective provides insights into the nature, structure, and organization of thoughts and ideas, rather than organization of linguistic structure alone. It must be emphasized that cognitive linguistics is not a single, narrowly spelled out theory, but rather a broad conceptual perspective on the relationship between language and cognition. For that reason, it is sometimes described in general terms as an "intellectual movement" (Langacker 2002, p. i) or an "enterprise" (Evans & Green, 2006).

Cognitive linguists have developed a number of influential frameworks describing cognitive mechanisms reflected in language. These frameworks measure themselves against what is now known about workings of the mind from cognitive psychology, cognitive neuroscience, and other fields practiced in the interdisciplinary domain of *cognitive science* (see Frankish & Ramsey, 2012). Some of these frameworks focus more explicitly on the study of language structure and organization, which includes, for example, Talmy's (2000a, 2000b) cognitive semantics, Langacker' (1987a, 1991, 2008a) Cognitive Grammar, as well as the cognitive grammar of English (Radden & Dirven, 2007). Other frameworks focus on language as a means for studying aspects of knowledge representation and meaning construction, which includes, for example, the conceptual metaphor theory (Lakoff & Johnson, 1980, 1999), the mental spaces theory (Fauconnier, 1994, 1997), and the conceptual blending theory (Fauconnier & Turner, 1998, 2002). Selected hypotheses proposed within these frameworks with reference to time, space and their mutual relations were discussed in the preceding chapters. They serve as the explanatory frame for research discussed in the following part of this book.

What provides the cognitive linguistic approach to language study with coherence is a set of basic principles that serve as guiding assumptions for the study of language and cognition. Croft and Cruse (2004, pp. 1–4) enumerate three major hypotheses that are fundamental to cognitive linguistics. The first one assumes that *language is not an autonomous cognitive faculty*. It is opposed to the hypothesis that language is an autonomous cognitive faculty or module of the brain separated from non-linguistic cognitive abilities.[64] Cognitive linguistics views the representation of

[64] A view that language constitutes an entirely distinct autonomous module of mind that arises from an innate structure with a domain-specific learning mechanism was proposed by Chomsky (1965, 1975). His hypothesis of *fixed innate core* found supporters (e.g. Fodor, 1983), but at the same time generated a lot of controversy, especially among psychologists (e.g. Piaget, 1979). Under increasing criticisms, the original proposal has been subsequently updated and adjusted in its scope (Chomsky, 1986, 1995). The most recent, substantially modified version proposed with reference to insight from in evolutionary biology, anthropology, psychology, and neuroscience (Hauser, Chomsky & Fitch, 2002) has also come under sharp criticism (Pinker & Jackendoff, 2005; see Fitch, Hauser & Chomsky, 2005 for a reply; see Jackendoff & Pinker, 2005, for counter-

linguistic knowledge as essentially the same as the representation of other conceptual structures. It assumes that "the organization and retrieval of linguistic knowledge is not significantly different from the organization and retrieval of other knowledge in the mind, and the cognitive abilities that we apply to speaking and understanding language are not significantly different from those applied to other cognitive tasks, such as visual perception, reasoning or motor activity" (Croft & Cruse, 2004, p. 2).

The second basic hypothesis of cognitive linguistics assumes that *grammar reflects conceptualization*. It is opposed to *truth-conditional semantics* (Montague, 1974; see Cann, 1993 for a more recent introduction), which evaluates semantic metalanguage in terms of truth/false propositions relative to an established model of the world that we agree to share. This thesis is generally grounded on Langacker's (1987a, 1991; see also Kardela 1992 for a review) position that conceptual structure cannot be reduced to a simple truth/false conditional correspondence with the world because language is used primarily to describe states of affairs in the world, which are thus central to the account of linguistic meaning. Cognitive linguistics assumes that an essential aspect of human cognitive capacity encapsulated in linguistic structure is the imaginative projection of embodied experience to be communicated (Evans & Green, 2006, pp. 455–458).

The third underlying hypothesis of cognitive linguistics assumes that *knowledge of language emerges from language use*. It is opposed to reductionist tendencies in both generative grammar and truth-conditional semantics, which aim at maximally abstract and succinct representations of grammatical form and meaning (Croft & Cruse, 2004; Kardela, 2006b). While the traditional approach relegates idiosyncratic or anomalous patterns to the "periphery" of language use, cognitive linguistics assumes that they are as central in discourse processing, because "categories and structures in semantics, syntax, morphology and phonology are built up from our cognition of specific utterances on specific occasions of use" (Croft & Cruse, 2004, p. 4). Analysing subtle variations in syntactic behavior and semantic interpretation allows for accommodating both general and highly idiosyncratic patterns of linguistic behavior for a proper interpretation of the relationship between language and cognition.

Evans (2012) provides a somewhat broader set of central theses guiding cognitive linguistic studies. Besides the above-discussed hypotheses, he puts a strong emphasis on an *embodied* perspective on human cognition, which holds that human

argumentation). A heated debate it still generates seems to be far from being settled (see Lewandowska-Tomaszczyk, 2008b for a review).

conceptions are based on multimodal representations that emerge from our embodied experience in the world (see Lakoff & Johnson, 1999; Gibbs, 2005; Kardela 2006a). Evans (2012) adds the thesis of *encyclopedic semantics*, which assumes that semantic representations in the linguistic system are closely tied to representations in the conceptual system constituting a vast network of structured knowledge that is encyclopedic in its nature and scope (see Kardela 2006b). The fifth and final thesis listed by Evans (2012) is a *symbolic thesis*, which holds that our mental grammar comprises of units consisting of pairings of form and meaning, which are termed *symbolic assemblies* in Langacker's (2008a) Cognitive Grammar. Such meaningful units of mental grammar range from morphemes to sentence-level structures (see Goldberg, 2003, 2006; Goldberg & Suttle, 2010).

5.2 Challenges before cognitive linguistics

Cognitive linguistics assumes that examination of the linguistic structure should reflect and augment convergent evidence about human cognition from other branches of cognitive science. As such, it has always been strongly influenced by theories and findings from cognitive psychology, cognitive neuroscience, anthropology, philosophy, and artificial intelligence. Evans (2012) argues that what makes cognitive linguistics additionally distinctive in the contemporary study of language and the mind is its specific *cognitive linguistic worldview*, which embraces the following basic dimensions: 1) language reflects conceptual organization; 2) language is a lens on the mind; 3) language provides a mechanism for construal; 4) language influences non-linguistic cognition; 5) humans have a common conceptualizing capacity.

Evans (2012) notes that in the course of its development cognitive linguistics had to cope with various fundamental issues, some of which have still remained unresolved. One, for example, relates to the nature of concepts, more specifically to the difference between linguistic versus conceptual meaning, which has been debated over many years without reaching a satisfactory conclusion (see Fodor, 2008 for a compelling, albeit not entirely impartial review of the dispute).

Another concern that has been voiced in the cognitive linguistics community relates to an increased awareness of some essential methodological issues. As put by Heylen, Tummers and Geeraerts (2008, pp. 91–92), "More and more researchers feel that traditional methods of linguistic enquiry, relying mainly on introspective analysis, are not sufficient for the study of cognitive grammar or conceptualization processes." See the study by Sandra and Rice (1995) on prepositional networks, which is discussed in Section 6.2, for an example of criticism.

It seems that such concerns are not unjustified. It has been found long ago in psychology that intuitive judgments often lead to heuristics and biases (A. Tversky & Kahneman, 1974; Kahneman & A. Tversky 1982; Kahneman, 2011). Similarly in linguistics, some aspects of language are generally perceived, while others have to be computed to be evaluated properly. As emphasized by Sinclair (1991, p. 4), "human intuition about language is highly specific, and not at all a good guide to what actually happens when the same people actually use the language". A number of scholars have been postulating that cognitive linguistics should put a stronger emphasis on applications of empirical data derived form corpora, e.g. Geeraerts, 2006; Grondelaers, Geeraerts & Speelman, 2007; Deignan, 2008; Heylen et al., 2008; Gries & Divjak, 2010. They emphasize that since the usage-based approach to language study is among the central theses of cognitive linguistics, the use of natural language samples brings important advantages to cognitive linguistic research.

The benefits of corpus-based evidence in cognitive linguistic investigations have been already demonstrated in a number of studies (e.g. Deignan, 2005; Gries & Stefanowitsch, 2006; Fabiszak, 2008; Lewandowska-Tomaszczyk & Dziwirek, 2009; Glynn & Fischer, 2010). Stefan Gries, who has shown a number of highly innovative applications of corpora in cognitive linguistic studies (e.g. Gries, 2003, 2006; Gries & Divjak, 2009), views corpus linguistics as a crucial element of the modern cognitively-inspired language investigations. He does not, however, favor using corpora as the sole source of evidence in linguistics, but instead advocates for more fruitful exchanges among corpus linguistics, cognitive linguistics, and psycholinguistics (Gilquin & Gries, 2009; Gries, 2012).

5.3 Corpus linguistics

Corpus linguistics emerged as a separate field of study in 1980s, when it achieved an important position as a methodology unveiling new horizons in linguistics (McEnery & Wilson, 2001, Ch. 1). It can be essentially defined as "the study of language data on a large scale that involves computer-aided analysis of extensive collections of spoken and written texts" (McEnery & Hardie, 2012, p. i). Some researchers (e.g. Tognini-Bonelli, 2001; Teubert, 2005) view corpus linguistics as a theoretical framework, while others (e.g. McEnery & Wilson, 2001) consider it rather as a methodology of linguistic studies. What has been generally agreed (Teubert, 2005; Gries, 2009; McEnery & Hardie, 2012) is that the object of study in corpus linguistics is real language data, which makes it an empirical science.

The empirical approach to language study is one of the greatest benefits of applications of corpora in linguistics. "Empirical data enable the linguist to make statements which are objective and based on language as it really is rather than statements which are subjective and based upon the individual's own internalized cognitive perception of the language" (McEnery & Wilson. 2001, p. 103). Thus, the principal advantage that corpus linguistics brings to linguistic studies is objectivity and verifiability of results (McEnery & Hardie, 2012; see also Geeraerts, 2006, 2010). Moreover, the methodology of corpus linguistics is not restricted to any specific area of language study or any particular aspect of language use.

An important asset that the corpus methodology brings to linguistic research is providing access to statistics on the *frequency of language patterns*. Sinclair (1991, 2004) points out that systematic examination of linguistic corpora is the only reliable source of evidence about this language feature, since it is unavailable through linguistic intuition. He emphasizes that verifiable data on the frequency of different language items provide linguistic evidence with unprecedented quality. Apart form analyzing frequencies, probably the most common way of using corpora in language studies is through a *concordance* analysis (Sinclair, 2003a; Waliński, 2005a). A concordance is an index to the places in a corpus where a particular *search item* (word or phrase) occurs. In modern computer software it is typically presented in the KWIC (Key Word In Context) format, in which the search item is shown in the center with a certain amount of context visible on left and right.

Although reading concordances requires certain skill (Sinclair, 2003a), it is profoundly revealing for *semantic prosodies* (see Sinclair, 1991, pp. 70–75; Stubbs, 1995) and other aspects of language use that notoriously escape intuition. Such apparently unsophisticated corpus linguistic techniques yield facts about language use that might otherwise remain hidden. For example, Deignan (2005, 2008) offers excellent examples of non-quantitative corpus-based cognitive semantic analyses of metaphorically used words that have contributed developments to understanding of metaphor. Moreover, data retrieved from the corpus can be analyzed statistically to estimate statistical significance of results, detect patterns in data, or identify multiple senses of words, etc. (see Baayen, 2008; Gries, 2013 for comprehensive guides to statistics in linguistic studies).

There is a certain lack of clarity in the application of the terms "corpus-based" and "corpus-driven" linguistics with reference to the conceptual split of the field introduced by Tognini-Bonelli (2001):

> [T]he term corpus-based is used to refer to a methodology that avails itself of the corpus mainly to expound, test or exemplify theories and descriptions that were

> formulated before large corpora become available to inform language study… (Tognini-Bonelli, 2001, pp. 65–66) … [I]n a corpus-driven approach the commitment of the linguist is to the integrity of the data as a whole, and descriptions aim to be comprehensive with respect to corpus evidence. The corpus, therefore, is seen as more than a repository of examples to back pre-existing theories or a probabilistic extension to an already well-defined system. The theoretical statements are fully consistent with, and reflect directly, the evidence provided by the corpus… (Tognini-Bonelli 2001, pp. 84–85).

As pointed out by McEnery and Hardie (2012, pp. 150–151), this distinction is rather fluid in practice.

> A corpus-based researcher may apply a scheme based upon a pre-existing theory but then, when the scheme is applied to data and is found to be deficient, goes on to refine the scheme in what could be termed a corpus-driven fashion. Such a process may be cyclical, as has been well understood by linguists in general and computational linguists in particular for some time. (McEnery & Hardie, 2012, p. 150).

Some authors, who object to the *corpus-based/corpus-driven* distinction, use the term "corpus-based" in the broad sense that encompasses both approaches distinguished by Tognini-Bonelli (see McEnery, Xiao & Tono, 2006, pp. 8–11). This is the reason why in this book, the term *corpus-based* is used consistently to refer to semantic studies based on corpora, which would probably be labeled by other authors as "corpus-driven" (cf. Glynn, 2010). Here, the term *corpus-based* is distinguished in opposition to *corpus-illustrated* approach, following the distinction made by Tummers, Heylen and Geeraerts (2005).

5.4 Corpora in linguistic studies

In modern linguistics, the term *linguistic corpus* generally designates a large collection of texts, usually stored in a machine readable form, collected according to specific criteria in order to represent a particular variety or use of language (Sinclair, 2005; McEnery & Hardie, 2012). A linguistic corpus is assumed to have certain characteristics that distinguish it from a mere collection of texts. Although different authors define the minimum conditions for the linguistic corpus somewhat differently (e.g. Sinclair, 1996 vs. McEnery & Wilson, 2001), they depend to a great extent on a particular corpus design and intended applications.

Among different types of corpora (see Sinclair, 1996; Waliński, 2005a, 2005b) one that is particularly relevant to this study is a *reference corpus*, which is designed to provide comprehensive information about a language. Although in reality no corpus can ever hope to be representative of a language (McEnery and Wilson, 2001, pp. 77–78), reference corpora attempt to provide users with as much of a complete picture of the language as possible. To that end, the reference corpus collects a large number of overlapping language varieties, which share the bulk of their respective vocabularies and syntactic rules, but are differentiated by specific vocabulary items and individual phraseology. Moreover, it includes a maximum number of such linguistic features as formality, preparedness, and broad subject-matter (Sinclair, 1996).

The reference corpus follows a model of balance and representativeness, which defines a number of parameters for the inclusion of as many sociolinguistic variables as possible, and prescribes the proportions of each selected text type (Sinclair, 1996, 2005; see Aston & Burnard, 1998 for an example). Typical procedures used for achieving maximum representativeness in compilation of reference corpora include application of *sampling frame*, i.e. the boundaries of language variety in question, and *stratification*, i.e. the hierarchical structure of corpus texts in terms of genres and channels of communication (Biber, 1993). These parameters are executed through *probabilistic sampling procedures*, which are augmented with an array of *statistical measures* that ensure maximal degree of representativeness of the corpus for a linguistic variety. Biber (1993) adds that actual construction of a representative corpus proceeds in cycles implementing *pilot-study analyses* at subsequent stages of compilation to monitor outcomes at staging posts, and implement necessary revisions in the structure on the way towards the final product.

Another type of corpus relevant to research discussed in this study is a *spoken conversational language* corpus. In a prototypical form it is composed of transcribed impromptu conversations with no involvement of mass media samples. Spoken conversational corpora are extremely difficult to compile. While texts in a written language corpus have an orthographic existence prior to the corpus, the words in transcriptions of speech are only a partial representation of the original speech event. It is because audio recording provides only an incomplete view of what occurred, since some visual and tactile features are lost in the data capture (Thompson, 2005). Yet, this corpus type has a particular significance for some linguistic investigations. As put by Sinclair (1996), "informal, impromptu speech is regarded by many scholars as the most important variety of all, closest to the core of language, revealing the characteristic patterns of a language in a way that no other variety does". See Chapter 9 for an application of such a corpus in cognitive linguistic research.

An important aspect of corpus compilation procedures involves enhancing basic linguistic content of the corpus with *annotation*, which can be essentially defined as "the practice of adding interpretative linguistic information to a corpus" (Leech, 2005, p. 17). Annotation also refers to the end-product of this process, thus an *annotated corpus* is one that is enhanced with various types of additional information that increases its usefulness for research. At the linguistic level, one common type of corpus annotation is *part-of-speech tagging* (POS tagging), which involves addition of tags indicating the part of speech to words in the corpus. Apart from POS tagging, there are other types of annotation corresponding to different levels of linguistic analysis of texts, e.g. phonetic annotation, semantic annotation, pragmatic annotation, etc. (see Garside, Leech & McEnery, 1997 for a comprehensive review). Corpus annotation extends considerably the range of research questions that a corpus can readily address.[65]

5.5 Corpus linguistics workbench

Studies discussed in the following chapters of this book employ the corpus linguistics methodology to examine relations between time and space from the empirical linguistic perspective. The problem of *corpus-based* versus *introspection-based* approaches to linguistic study have been debated ever since Noam Chomsky questioned the relevance of collecting corpus evidence for linguistic analysis as inadequate for reflecting any more than a fraction of the infinite nature of language:

> Any natural corpus will be skewed. Some sentences won't occur because they are obvious, others because they are false, still others because they are impolite. The corpus, if natural, will be so widely skewed that the description would be no more than a mere list. (Chomsky, 1962, p. 159 cited in McEnery & Wilson, 2001, p. 10)

Since that time it has been demonstrated, however, that corpora reveal facts about language that go unnoticed by the native speakers (McEnery & Wilson, 2001, Ch. 1). Conclusions based on intuition may be unreliable because language users tend to notice unusual occurrences more than typical occurrences. Moreover, corpus data allow for *testing hypotheses* in an objective and verifiable way. For example, to compare the language use patterns for words *big* and *large*, one needs to know how many times each word occurs in the corpus, how many different words form collocations with each of these adjectives, etc. Such data are easily accessible from corpora, which enables us to investigate how speakers actually *use* language in natural contexts, rather than study what is theoretically possible in language (Biber, Conrad & Reppen, 1998, pp. 3–11).

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[65] Some researchers, most notably John Sinclair (2003b, 2004, pp. 190–191) would rather not engage in corpus annotation. According to their view annotated information is always suspect, since it reflects preferences, or even errors, of annotators. It is the pure text that should be the primary focus of linguistic investigation.

This book focuses on the corpus-based examination of relations between space and time in linguistic representations of distance. It employs a range of corpora and computational resources for research (see *Reference materials* section following *Bibliography* for details). The following chapter demonstrates *testing hypotheses* about language use against *frequency data* in reference corpora for English and Polish, which shows in a verifiable manner how often certain patterns occur relative to other patterns. As emphasized by Sinclair (1991), access to verifiable statistics on the frequency of language patterns provides linguistic evidence of unprecedented quality. The frequency data retrieved from corpora are additionally verified through a *concordance analysis*[66] to exclude matches resulting from coincidental sharing of linguistic patters with other types of expressions.

The following chapters demonstrate how the precision of corpus queries can be raised by application of patterns based on the *part-of-speech annotation*. Moreover, subsequent chapters augment these procedures with the application of *proximity queries*, which allow for defining linguistic patterns in more general terms by specifying how far apart lexical items included in a query can be from one another to be still returned as a result to the query (Bernard & Griffin, 2009). Simply put, proximity queries afford for occurrence of additional modifiers between the query terms. Additionally, the study discussed in Chapter 8 employs *wordnets* (Fellbaum, 2006), which are discussed in a separate section below, for identification of synonyms, near-synonyms, and related terms for specific semantic fields.

As long as marked differences between spatial and temporal patterns can be observed directly from their frequencies, this study does not use statistical procedures to keep the discussion as straightforward as possible. However, the last chapter employs a different kind of linguistic corpus based on spoken conversational data. Since it is much smaller, the linguistic analysis in that chapter involves the use of statistics for checking significance for differences in frequency of temporal representations found across selected demographic groups. Tests of statistical significance, which are commonly used in social sciences, indicate how likely it is that a particular quantitative result could have occurred by chance (Baayen, 2008; Gries, 2013). Please note that since the following chapters include a series of studies, methodological details are spelled out separately for each study.

[66] It is noteworthy that Sinclair (1991, 2003a) views *concordancing* as being superior to any other method in corpus linguistics, since "it not only brings reliable data, but what is more, frequently uncovers unexpected facts about language" (Sinclair, 1991, p. 42; see also Stubbs, 1995).

5.5.1 Corpora used in this research

The first corpus used in the empirical linguistic research discussed in this book is *the British National Corpus* (henceforth, the BNC). It is a 100 million word collection of samples of both spoken and written British English from a wide range of sources, which is a flagship example of the reference corpus. The written part of the corpus (90%) includes extracts from a wide selection of regional and national publications, including specialist periodicals and journals for all ages and interests, popular fiction, academic books, unpublished informal communication, and many other kinds of text. The spoken part (10%) consists of orthographic transcriptions of impromptu, informal conversations collected in a demographically balanced way, as well as other spoken language samples collected in a variety of contexts. The texts are not limited to any particular subject field, genre or register (Aston & Burnard, 1998; see www.natcorp.ox.ac.uk for more information).

As revealed in a survey conducted by Xiao (2008), the model for achieving corpus balance as well as methodological procedures used for compilation of the BNC have been employed for construction of a number of other linguistic corpora. This includes the *National Corpus of Polish* (henceforth, the NCP), which is the second corpus employed for the purpose of this research. In its balanced and representative variant, it is a 240 million word collection of samples of both spoken and written contemporary Polish from a wide range of sources, whose structure loosely mirrors that of the BNC. The written part of the corpus (90%) contains classic literature, daily newspapers, periodicals and journals, and a variety of online publications. The spoken part (10%) includes transcripts of impromptu, informal conversations collected in a demographically balanced way, transcripts of TV and radio broadcasts, and other spoken language samples collected from various regions in Poland. The unbalanced archive of texts used for compilation of the representative variant of the corpus includes 1.5 billion words (Przepiórkowski, Bańko, Górski & Lewandowska-Tomaszczyk, 2012; see www.nkjp.pl for more information).

The third corpus used in this study is the *PELCRA Spoken Conversational Corpus of Polish* (henceforth, PELCRA SCCP). It is composed of meticulously transcribed spontaneous speech recordings that were annotated with demographic information about age, gender, and education of speakers. The corpus has been compiled by the PELCRA team (Lewandowska-Tomaszczyk, 2004, 2008c) at the Institute of English Studies of the University of Lodz. The compilation of the corpus started in 2000 when the first edition of PELCRA SCCP was published. Over the last 12 years the corpus has been regularly expanded with the financial aid provided by

Polish State Committee for Scientific Research projects (2003–2005: 'PELCRA', No. 2H01D00825; 2005–2008: 'INTUNE', No. 232/6PRUE/2006/7; 2006–2009: 'Categorization' No. 152/COS/2006/03; 2007–2011: 'NKJP', No. R1700303) as well as various EU Research Projects (2005–2009: 'IntUne - Integrated and United', UE FP6; 2006–2009: 'Stability and Adaptation of Classification Systems', COST Action 31; 2010–present: 'TIMELY - Time in Mental Activity', COST Action TD0904), in which it has been used in a variety of studies and practical applications. As discussed by Lewandowska-Tomaszczyk (2008c), the corpus has evolved from pseudo-markup to full XML standard and is now stored in a relational database that enables convenient access via a web-interface (Waliński & Pęzik, 2007).

This study is based on the 2010 edition of PELCRA SCCP, which includes 205,197 distinct utterances (as it is impossible to distinguish sentences in spontaneous speech). The corpus contains 2,372,186 communication segments (as some stammers are difficult to categorize as words) reflecting 513 conversations represented in over 218 hours of recordings. The corpus includes conversations held among 1712 speakers (over 700 different individuals, as sometimes the same person took part in different conversations), who represent 326 distinct demographic profiles from various regions of Poland (see Pezik, 2012a for a general description of the corpus data). It is noteworthy that the conversations included in the corpus were recorded with most of the speakers being unaware that they were being taped (although they were subsequently informed about it and eventually granted their permission to publish the recordings). The only difference between original conversations and their transcriptions is that some sensitive personal details, e.g. surnames, addresses, security numbers, etc. mentioned in the conversations were *anonymized*, i.e. replaced with fictitious counterparts, in the process of transcription. The PELCRA SCCP is available publicly free of charge with full access to the corpus data through a user-friendly online concordancer at: www.nkjp.uni.lodz.pl/spoken.jsp as an offshoot of the National Corpus of Polish project.

As emphasized by McEnery & Wilson (2001, p. 32), an essential aspect of the linguistic corpus is the principle of *standard reference* for the language variety it represents. It presupposes wide availability of a corpus to other researchers, who can attest, verify, and expand studies based on its linguistic contents. It also means that the corpus is *finite*,[67] i.e. no more texts are added to it after its final compilation.

[67] The idea of a constantly changing *monitor corpus* has been introduced by Sinclair (1996), who views the assumption of a finite limit of a corpus size as an unnecessary restriction. Although the

Because of wide availability and stability of corpus data, any variation between studies may result from the methodology contained in research, but not from differences in the linguistic data under examination. Please note that all corpora used in this study entirely fulfill this standard.

5.5.2 Wordnets used in this research

Besides linguistic corpora, the research discussed in this book employs *WordNets*. As discussed by Fellbaum (1998, 2006), the idea of WordNet as a manually constructed electronic lexical database was conceived in 1986 at Princeton University. WordNet was originally intended to test theories of human semantic memory in the field of Artificial Intelligence (see Miller, 1995). Essentially, WordNet is a semantic network linking words and groups of words by means of conceptual-semantic and lexical relations. The basic building blocks of WordNet are sets of cognitive *synonyms* (called "synsets"), each expressing a distinct concept. Each synset contains a brief definition and, typically, one or more sentences illustrating the basic usage.[68] Additionally, some synsets are marked with a domain label, e.g. *medicine*, *sports*, etc. The resulting network of related words and concepts can be explored with a web-browser using the online version at: wordnet.princeton.edu or downloaded free of charge for offline use

WordNet consists of four separate components, each containing synsets for words from the major open syntactic categories: nouns, verbs, adjectives, and adverbs. Although each member of a given synset essentially relates to the same concept, they are not necessarily interchangeable in all possible contexts, e.g. *hit* and *strike*, or *big* and *large*, etc. Membership of words in a given synset illustrates the phenomenon of *synonymy*. Membership of a word in multiple synsets illustrates the phenomenon of *polysemy*. For example, the word *trunk* appears in WordNet in synsets referring to {trunk, tree trunk}, {trunk, torso}, and {trunk, proboscis}.

Since WordNet groups words together based on their meanings, at first glance it resembles a thesaurus. It is, however, a much more sophisticated tool, which links not just word forms, but also specific senses of words. In result, words found in

monitor corpus also has a relatively steady balance of components, over time new data are constantly added to it in order to monitor ongoing changes in language. It is particularly useful for lexicography, since it allows for identification of new words, tracking changes in lexical meaning, and movements in word usage.

[68] As noted by Fellbaum (2006), because in 1986 digital corpora were not widely available, the contents of Princeton WordNet were derived largely from its creators' intuitions. Subsequently, illustrative sentences have been added to it from web data.

close proximity to one another in the network are semantically disambiguated. Moreover, while paper thesauri follow the pattern of meaning similarity, the digital format of WordNet enables look-up for words and concepts from multiple semantic access points. For example, the relations encoded for noun synsets include *hyperonymy* and *hyponymy*, i.e. the super-subordinate relation. WordNet links more general synsets like {container} to increasingly specific ones like {box}, then {mailbox, letter-box}, etc. Moreover, the hyponymy relation in WordNet is transitive: if a *mailbox* is a kind of *box*, and if a *box* is a kind of *container*, then an *mailbox* is a kind of *container*. WordNet distinguishes among *types* (common nouns) and *instances* (specific persons, geographic entities). Another semantic relation marked in WordNet is that of *metonymy*, i.e. the part-whole relation. For example, {chair} is linked to {back, backrest}, {seat} and {leg}. Parts are inherited from the superordinates: if a *chair* has legs, then an *armchair* has legs as well, but not from subordinates: all kinds of chairs have legs, but not necessarily all kinds of furniture.

Verbs are arranged in WordNet by *entailment relations*, the most prevalent being *troponymy*, which relates to increasingly specific manners characterizing an event, e.g.{communicate}-{talk}-{whisper}. Other relations marked in WordNet include *backward entailment*, e.g. {divorce }-{marry}, *presupposition*, e.g. {buy}-{pay}, and *cause*, e.g. {show}-{see}. Since synsets already collect synonymous words, adjectives are organized in terms of *antonymy*, distinguishing pairs of strong semantic contrast, e.g. {wet}-{dry}. Moreover, each of such polarizing adjectives is linked to a number of semantically similar ones, e.g. *dry* is linked to *parched*, *arid*, *desiccated* and *bone-dry*. Additionally, *pertainyms*, i.e. relational adjectives, point to the nouns from which they are derived, e.g. {criminal}-{crime}. There are relatively few adverbs in WordNet since the majority of English adverbs are derived from adjectives. Princeton WordNet version 2.1 released in March 2005 contains almost 118,000 synsets, comprising more than 81,000 noun synsets, 13,600 verb synsets, 19,000 adjective synsets, and 3,600 adverb synsets (Fellbaum, 2006; see wordnet.princeton.edu for more information).

In 1990s other wordnets stared to be developed in research centers around the world.[69] In 2000 the Global WordNet Organization was founded with the express goal of guiding WordNet development and ensuring communication between various wordnets (Miller & Fellbaum, 2007). A wordnet for Polish has been developed at Wrocław University of Technology. The creators of *plWordNet*

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[69] A notable example of modern wordnet is EuroWordNet embracing eight European languages (Vossen, 2002). As noted by Miller and Fellbaum (2007), it introduced some fundamental design changes that have become the standard for many of subsequent wordnets.

dismissed the idea of translating indiscriminate mapping of Princeton WordNet into Polish, and instead decided to build the Polish wordnet from scratch by first developing the synsets and their language-internal relations, and only later generating equivalence relations to Princeton WordNet (see Piasecki, Broda & Szpakowicz, 2009 for more information). Currently plWordNet, or *SłowoSieć*, describes 106,000 nouns, verbs, and adjectives. It is available for exploration with a user friendly search interface available online at plwordnet.pwr.wroc.pl .

5.6 Corpus-based cognitive semantics

Cognitive semantics is a subfield of cognitive linguistics. Similarly to the larger enterprise of which it is a part, it is not a single unified framework, but is rather generally concerned with "investigating the relationship between experience, the conceptual system and the semantic structure encoded by language" (Evans & Green, 2006, p. 48). Glynn (2010) discuses the complexity of such a holistic approach to meaning, which goes far beyond adding pragmatics to semantic analysis. Essentially, it entails that everything the speaker knows about the world is relevant to description of meaning, which implies that any cognitive study of linguistic meaning should "simultaneously account for the semantic motivation behind and interaction between syntax, morphology, lexis, prosody, and all of this relative to discourse structures, world knowledge, and social variation." (Glynn, 2010, p. 7; see also Evans, 2009 for a discussion on the role of *cognitive models*, understood as large-scale multi-modal structures of non-linguistic knowledge, in meaning creation).

Moreover, the broad definition of cognitive linguistics emphasizes that it is essentially a usage-based model rather than a hypothetical "ideal" module of language competence. It means that cognitive semantics must account for the fact that meanings vary subtly from individual to individual, which increases the complexity of the object of study exponentially. Glynn (2010) points out that the growing tendency of cognitive linguistics to stress its essential nature as a usage-based linguistics means that the idea of *grammaticality* is being replaced with that of *entrenchment*, which was proposed by Langacker (1987a):

> Every use of a structure has a positive impact on its degree of entrenchment, where […] disuse has a negative impact. […] Moreover, units are variably entrenched depending on the frequency of their occurrence (*driven*, for example, is more entrenched than *thriven*)… The absence of a sharp division between units and non-units has the consequence that the scope of a grammar is not precisely delimited. (Langacker, 1987a, 59–60).

More recently, Langacker elaborates on the usage-based approach to meaning in the following manner:

> Meanings (like other linguistic structures) are recognized as part of a language only to the extent that they are (i) entrenched in the minds of individual speakers and (ii) conventional for members of a speech community. Only a limited array of senses satisfy these criteria and qualify as established *linguistic units*. But since entrenchment and conventionalization are inherently matters of degree, there is no discrete boundary between senses which have and which lack the status of established units. We find instead a gradation leading from novel interpretations, through incipient senses, to established linguistic meanings (Langacker, 2008a, p. 38).

Glynn (2010) argues that although Langacker's idea of entrenchment is primarily concerned with the status of a linguistic unit, it can be extended to substitute for the notion of *grammatical correctness*, where the principle of frequency of use for the individual is replaced with that of frequency of occurrence in the community. Since entrenchment varies from individual to individual, grammatical rules are rather *generalizations* about language usage, and the basis of linguistic research is real language use, in all its complexity.[70]

From that perspective, making hypotheses about meaning should be based on a *sample of language usage*, which reflects language usage in the population in question, rather than individual subjective competence of a particular linguist (see also Bybee, 2006, 2010). In the early days of cognitive linguistics, with some notable exceptions, e.g. Lehrer (1983/2009), that "sample" was usually very small, and typically based on observations of the linguist discussed, perhaps, with some of his/her colleagues. This contributed to criticisms of cognitive semantic studies as being largely based on subjective introspective judgments of individual researchers, rather than empirically sound methodology (see Sandra & Rice, 1995).

Recent years have seen an increased interest in applications of empirical methodology based on applications of corpora in cognitive semantic studies (e.g. Glynn & Fischer, 2010; Glynn & Robinson, in press). Nevertheless, there are

[70] For example, Apple, Inc. is famous for notoriously using marketing slogans that break conventions of grammaticality. In 1997 the company introduced the attention-grabbing slogan "Think different" to promote their products. It was received as grammatically unconventional, despite the fact that American Heritage Dictionary (2006) list *different* as an adverb that can mean "in a different way or manner" and *think* is considered as a linking verb, which can be interpreted together as "Think about computers in a different way". In spite of initial criticisms, the slogan has been widely accepted, which makes it grammatical (Trenga, 2010).

cognitive linguists who argue that *introspection*[71] should be the central method of cognitive semantics. For example, Talmy (2000a, pp. 4–6) argues that cognitive semantics is a branch of phenomenology and that "the only instrumentality that can access the phenomenological content and structure of consciousness is that of introspection". More recently, he states explicitly that corpus research "cannot directly yield many abstract linguistic patterns" (Talmy, 2007, p. xix). Glynn (2010) addresses this reservation by pointing out that psycholinguistic experimentation does not provide direct access to the mind, either. (Neither does brain scanning, e.g. fMRI or TMS techniques). He emphasizes that, despite limitations, the patterns of natural language usage observed through language corpora produce a clear picture of language structure, which provides a rich source for working out how people use language.

Cognitive linguists working with corpora (e.g. Grondelaers, Geeraerts & Speelman, 2007, Geeraerts 2010; Gries & Divjak, 2010) try to reconcile phenomenological and empirical approaches to cognitive language study by emphasizing that empirical research is not meant to replace introspection. It is rather that introspection serves to propose hypotheses, which then can be analyzed in empirical studies designed to adequately attest such proposals. From this perspective, corpus data drawn from actual usage is not only permissible, but outright necessary in cognitive semantic research. Geeraerts (2010) explicitly states that introspection plays a crucial role as the first step in the research cycle, but is not sufficient for a true advancement of the study. Gries and Divjak (2010) see an important advantage of corpus-based approaches to semantics in restraining slapdash models that do not find support in corpus data and statistical significance. They warn, however, against a tendency to believe that corpus-based semantic studies are automatically more objective than traditional methods, since in the study of semantics the choices involved in the annotation of empirical language data still remain largely subjective.

Perhaps the greatest concern about application of corpora in cognitive semantics stems from the question: "how can meaning, the most qualitative of all linguistic features, be expressed in numbers, and more broadly, how could meaning, the most

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[71] In a recent review in cognitive science Engelbert and Carruthers (2010) address two main questions about introspection: whether it exists, and whether it is a reliable source of self-knowledge. They point out that most philosophers have assumed that the answers to both questions are positive, whereas an increasing number of cognitive scientists take the view that introspection is either non-existent or at least unreliable. They review a number of different models of self-knowledge and discuss evidence bearing on the existence and reliability of introspection.

ephemeral and subjective of all linguistic phenomena, be tackled with methods that aim at objectivity?" (Geeraerts, 2010, p. 64) Fischer (2010) addresses this question by pointing out that cognitive semantics involves four different aspects of meaning: *conceptualization*, *usage*, *world knowledge*, and *reference*. They interact with one another in immensely complex and inseparable ways. These aspects of meaning lend themselves to examination with quantitative methodologies to different degrees. While *conceptualization* is inaccessible to direct scientific probing (cf. Talmy, 2007), what can be investigated with collections of natural language samples included in corpora, at least to some degree, is *usage*. The following chapters demonstrate how corpus-based studies of usage reveal the relationship between space and time in linguistic representations of distance.

Chapter 6

From space and time in prepositions to motion

> *It's a rabbit hole phenomenon—namely, there's just a little opening, but there's something very rich and deep and important and mysterious, something big, going on down there, beneath the surface. And that lure has always governed which phenomenon I chose to explore.*
>
> Steven Pinker (2007b) in *Discover Magazine*

6.1 Modern conception of prepositions

The descriptive grammar of the English language has been undergoing substantial changes over the recent years, which have seen the publication of two voluminous reference grammars of present-day English: *Longman Grammar of Spoken and Written English* (Biber, Johansson, Leech, Conrad & Finegan, 1999) and *Cambridge Grammar of the English Language* (Huddleston & Pullum, 2002). Although the genesis of these modern reference works is closely linked to *A Comprehensive Grammar of the English Language* (Quirk, Greenbaum, Leech & Svartvik, 1985), which for a long time has been regarded as the authority on English grammar, they take a different approach to numerous facets of the grammatical system of contemporary English.

Biber, et al. (1999, pp. 74–77) define prepositions as "links which introduce prepositional phrases" (PPs), which they regard as "devices which connect noun phrases with other structures". Their grammar demonstrates a great deal of overlap between prepositions and other word classes, including adverbs, subordinators, adjectives, and verbs. However, Huddleston and Pullum (2002, Ch. 7; see also Huddleston & Pullum, 2005 for a more recent albeit much thinner edition for university students), employ a definition of the category of prepositions that is considerably broader than those used in traditional grammars of English. Following recent developments in linguistics, they view prepositions as *heads of preposition phrases*, which are comparable in their structure to phrases headed by verbs, nouns, adjectives, and adverbs.

With this innovative approach, preposition phrases can contain dependents of many different sorts. Accordingly, the noun phrases (NPs) in expressions such as *to you*, *of the house*, *in this way*, etc., are complements of the preposition, and phrases such as *a few minutes before lunch* and *straight after lunch* act as modifiers to prepositions. Complements of a preposition, similarly to those of a verb, may be OBJECT NPs, as in the above-quoted examples, or PREDICATIVES, as in *They regard him* [*as a liability*] or *It strikes me* [*as quite reasonable*]. Some other prepositions, can take PPs as complements, e.g. *She ran* [away from her parents] or *She watched* [from behind the curtain]. A good number of prepositions take various kinds of SUBORDINATE CLAUSE as complement, e.g. *I saw him* [before he left] or *We agreed* [on how to proceed]. There are a handful of prepositions that can take adverbial phrases as complement, e.g. *I didn't meet him* [until recently] or *It won't last* [for long]. Moreover, with this modification, PPs can take no complement, e.g. "I've seen that face [before]", which parallels other kinds of phrases that do not necessarily contain a complement, either.

For example, while the traditional grammars treat *before* in (1) as a preposition, in (2) as a subordinating conjunction, and in (3) as an adverb, Huddleston and Pullum (2002) see this triple assignment as an unnecessary complication.

(1) We left *before* the last act. [NP COMPLEMENT]
(2) That was *before* he died. [CLAUSE COMPLEMENT]
(3) I had seen her once *before*. [NO COMPLEMENT]

They argue that it is much simpler to treat *before* as a preposition in all three examples. To support their argument they point out that *before* has the same meaning in all the above sentences, and can take the same modifiers, e.g. *shortly*, *an hour*, *a short while* in frontal position in all three examples (1–3). The difference between the three instances is solely a matter of the complement and nowhere else in the grammar is a part-of-speech distinction based purely on a difference of this kind.

Hence, within this innovative framework, all words traditionally classified as prepositions are still classified as prepositions, but now the category includes a number of other lexical items, formerly classified as subordinating conjunctions, or as adverbs. For the latter category redrawing of the boundaries includes words like *aboard, across, along, away, beyond, off, over, through*, etc., which can occur either with an NP complement or without a complement. In the traditional approach they are analyzed as *prepositions* when they have an NP complement, e.g. *She went* aboard the liner, but as adverbs when they have no complement, e.g. *She went* aboard. Huddleston and Pullum (2002) note that they are regarded as adverbs predominantly because they are obviously not nouns, verbs, adjectives or conjunctions, and there is nowhere else to put them except in the adverb category.[72]

But these words in fact do not satisfy the traditional definition of adverbs, which views them as 'words that modify a verb, an adjective or another adverb'. The classification of words like *aboard* and *outside* as adverbs is inconsistent for two major reasons: 1) adverbs do not normally occur as dependents of nouns, but see: the conditions *aboard*, the temperature *outside*; 2) adverbs cannot normally function as complement of the verb *be* in its ascriptive sense, but see: She is *aboard*, He is *outside*. Since such restrictions do not apply to prepositions, this inconsistency can be removed by amending the definition of prepositions so that they are no longer required to have an NP complement. Huddleston and Pullum (2002) point out that if we treat such words as prepositions both when they have NP complements and when they occur alone, we simultaneously get rid of the complication of a dual classification for these words and remove them from the adverb class, which makes it significantly more coherent.

In the context of the present study it is worth adding that most prepositions have been traditionally regarded as non-inflected particles expressing relations in space or time, e.g. *at the post office* indicates a spatial location, *after lunch* locates a time period, and *into the garden* fixes a direction of movement. While the introduction of the above-discussed modification expands the class with prepositions that do not have this kind of meaning, which refers in particular to words regarded formerly as subordinators, e.g. *although, because, if, unless whether*, etc., Huddleston and Pullum (2002) still view this particular aspect of meaning as relevant to the general definition of the class.[73] They note that PPs are the most usual form for complements indicating *source*, *goal*, and *location*. Source and goal PPs obviously qualify as complements since they normally need to be licensed by the verb of motion, e.g. *We drove from Boston to New York* [source + goal]. PPs expressing location complements can be observed in examples such as *She stayed in her room all morning* or *The suitcase is underneath my bed.*

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[72] Huddleston and Pullum (2002) suggest that the traditional adverb category has something of the character of a "classificatory wastebasket", i.e. a repository for words that do not belong to any of the other, more clearly defined, categories.

[73] Huddleston and Pullum (2005, p. 137) provide the following concise definition of a preposition: "The term preposition applies to a relatively small category of words, with basic meanings predominantly having to do with relations in space and time, containing among its prototypical members grammaticised words that serve to mark various grammatical functions."

6.2 Cognitive semantics of prepositions

Semantics of prepositions has been undergoing considerable changes in studies of language and cognition. Classical approaches to meaning of prepositions derived from traditional conceptions of semantics (e.g. Tarski, 1944), which were predominant in studies conducted in the 1970s (e.g. Bennett, 1975), were confronted by Herskovits (1985, 1986) in her study of locative expressions. She demonstrated that a simple interpretation of locative prepositions is inadequate for capturing a variety of meanings carried by these words. According to her proposal, comprehensive account of prepositional meaning should be based on two essential assumptions: "first, the simple spatial relation, often given as the meaning of the spatial prepositions, is only an 'ideal' from which there are deviations in context; second, a level of 'geometric conceptualization' mediates between 'the world as it is' and language." (Herskovits, 1985, p. 341).

The first assumption entails the idea that the lexical information attached to a preposition consists of: (a) an *ideal, prototypical meaning*, which is an abstract geometric relation derived from ideal geometric reality, e.g. points, lines, surfaces, definite relations of inclusion, contact, intersection, etc.; (b) a collection of *use types*, which are complex bundles of information corresponding roughly to various senses in which the preposition is used. Varying uses of prepositions are derived from the geometric ideas by means of operations involving adaptations and deviations from the ideal meaning. These shifts are in part a matter of *convention*, and in part are *pragmatically* controlled. For example, if we assume that the preposition *on* carries the ideal meaning of "support and contiguity", the phrase "the wrinkles on his forehead" reflects resemblance to the ideal meaning, even though a wrinkle is not an object contiguous with, nor supported by, the forehead. Pragmatic "near-principles" allow for shifts in the meaning of a preposition that do not reflect the ideal meaning in strict terms. For example, the sentence "the atlas on the table" may involve situations with a tablecloth between the table and the book. We obviously allow for such fuzziness of descriptions in real-life situations due to *tolerance*. There are a number of pragmatic "near-principles" relating to *relevance*, *salience*, *tolerance,* and *typicality*, which motivate certain prepositional choices.

According to the second assumption, the ideal meaning of a preposition does not itself map directly onto the world. There is an intermediate level of *geometric conceptualization*, where geometric functions map locative descriptions onto objects. These geometric functions determine what the preposition contributes to the meaning of a particular description, which may be, for example, a specific "kind of space" occupied by the object. *Table* in the phrase "the lamp on the table" identifies a space that is solid, bounded and definite, whereas *water* in the phrase "the child in the *water*" identifies a space that is liquid, unbounded, and indefinite. The geometric functions of prepositions allow for distinguishing between solid and liquid objects, parts and holes, idealizations and good-forms, etc.

A related perspective was presented by Vandeloise (1991, 1994), who argues that spatial relations have functional consequences that arise from how we interact with objects and entities in our physical environment. For example, we say "The bulb is *in* the socket", but not "?The bottle is *in* the cap", despite the fact that the spatial relationship between objects depicted in these sentences is practically identical. He attributes explanation of this phenomenon to the dynamic factor of *force* (cf. Talmy, 1988a; 2000a, Ch. 7). "While the socket exerts a force on the bulb and determines its position, the opposite occurs with the cap and the bottle" (Vandeloise, 1994, p. 173). This observation indicates that our knowledge of functional consequences associated with the relations holding between objects motivates the contextual acceptability of prepositions.

In the 1980s, Brugman (1981/1988) conducted a pioneering work on the polysemy of *over*, which was subsequently refined and expanded by Lakoff (1987; a shortened version in Brugman & Lakoff, 1988). This framework approaches *over* as a linguistic particle that denotes a spatial path between *figure and ground* (cf. Talmy, 1975; 2000a, Ch. 5). Brugman/Lakoff's framework assumes that prepositions are polysemous items that have a *primary sense* from which *non-primary* ones extrude in the form of *radial network* of meanings. Such a network can be interpreted as a structure with a centre and a periphery, which goes in line with the cognitive assumption that categories are organized with respect to a *prototype*[74] (see Lewandowska-Tomaszczyk, 2007 for a review of polysemy, prototypes, and radial categories).

Lakoff took a highly fine-grained approach to the semantics of *over* presenting an extensive case study (Lakoff, 1987, pp. 416–461) which discusses more than twenty distinct meanings of this preposition. He argued that differences observed in various uses of *over* should be regarded as distinct senses, i.e. distinct representations that language users keep in their mental lexicons. He termed his outlook *full-specification approach*.

According to Lakoff's (1987; Brugman & Lakoff, 1988) proposal, the primary sense of *over* is "above and across". However, that particular choice of the primary sense for the meaning of *over* has been questioned in subsequent studies. For

[74] Description of prepositions as polysemous items with a primary sense from which non-primary ones emanate can be viewed from a broader perspective as application of *prototype theory* developed by Eleanor Rosch (1975b, 1978).

example, Dewell (1994) proposed to replace the flat "across" trajectory with a "curved arc-trajectory" to overcome problems arising from relations of the figure to some specific landmarks. He justified his claim by stating that "it seems intuitively more accurate" (Dewell, 1994, p. 353). Kreitzer (1997) disagreed, suggesting that the primary sense[75] of *over* involves something more analogous to "above", as in "The helicopter hovered over the city" or "I peeled the apples over the sink". In these sentences *over* can be substituted with the static preposition *above* with no obvious change of meaning.

By referring to Talmy's (1983; 2000a, Ch. 3) work on linguistic structuring of space, Kreitzer (1997) distinguished between three levels of image-schematic structure: (1) the *component level*, which embraces the schematic components of spatial scenes, like surfaces, lines, and points; (2) the *relational level*, which organizes these components into specific spatial relations; and (3) the *integrative level*, which is structured by multiple image schemata. To constrain the number of senses within prepositional polysemy networks in a systematic way, he proposed to restrict *prepositional senses* to the relational level, and *image schema transformations* to the component level. The polysemy of *over* is probably among the most well-researched phenomena in the recent history of linguistics. Glynn (in press, Table 1, p. 215) lists more than a dozen of different proposals of the number of senses for *over* in English, Dutch, and German.

Another aspect of Lakoff's (1987) analysis questioned in subsequent studies is whether the full-specification approach is defensible. Sandra and Rice (1995), echoing earlier criticism by Vandeloise (1990), questioned whether the semantic networks of prepositional meanings in the mental lexicon of language users are actually as fine-grained as suggested by Lakoff. They pointed out a fundamental shortcoming of *prepositional networks*, as they termed Brugman/Lakoff's methodology, which is that they are designed without the use of any explicit criteria and discovery procedures. For that reason, any prepositional network, including what constitutes its primary sense, is relatively arbitrary, since it predominantly reflects each analyst's own preferences, which makes it weak from the methodological point of view. Using results obtained with off-line and on-line psycholinguistic tasks, Sandra and Rice (1995) demonstrated that ordinary language users, as opposed to

[75] Kreitzer (1997) distinguished *over*$_1$, as the "above" sense, *over*$_2$ as inherently dynamic sense, e.g. "The cat jumped over the fence", and *over*$_3$ as occluding, i.e. egocentric and static sense e.g. "The mask is over my face" or "The clouds are over the sun". He noted that in some cases the distinction between *over*$_1$ and *over*$_2$ could be motivated by *summary scanning* involved in *fictive motion* (Langacker, 1986, 2005, 2008a; Talmy 1996, 2000a, Ch. 2; see Chapter 8).

linguists, tend to associate highly specific uses of a particular preposition with a single lexical form, still clearly distinguishing between fairly general usage types (such as spatial and temporal uses). They concluded their study by stating that empirical data are required to validate the prepositional network approach.

The framework of *principled polysemy* proposed by Tyler and Evans (2001, 2003) attempts to remedy problems pointed out by Sandra and Rice (1995) by introducing a methodology for determining distinct senses. While Tyler and Evans accept that all linguistic analyses are to some extent subjective, they propose two criteria for determining whether a particular instance of a preposition counts as a distinct sense:

> First…for a sense to count as distinct, it must involve a meaning that is not purely spatial in nature and/or in which the spatial configuration between the trajector and landmark is changed vis-à-vis the other senses associated with a particular preposition. Second, there must be instances of the sense that are context-independent, instances in which the distinct sense could not be inferred from another sense and the context in which it occurs. (Tyler & Evans, 2001, pp. 731–732).

Form this perspective, the following sentences (4) and (5) constitute distinct senses, but the sentence (6) does not. In (5) the spatial configuration between the trajector and landmark designated by *over* is not consistent with the meaning of "above" exemplified in (4). A non-spatial meaning associated with *over* appears to be that of "covering" (see Lakoff, 1987, p. 425), which illustrates the first criterion for whether an instance counts as a distinct sense.

(4) The hummingbird hovered *over* the flower.
(5) Joan nailed a board *over* the hole in the ceiling.
(6) The tablecloth is *over* the table.

Despite the fact that the sentence in (6) marks *contact* between the trajector and landmark, it still can be associated with the "above" sense in (4), because a tablecloth is typically situated higher than the top of the table from the usual vantage point. Moreover, it can be associated with the "covering" sense in (5), which can be inferred from the common knowledge that tablecloths are typically larger than tables. Therefore, it is not a distinct sense, which illustrates operation of the second criterion.

Additionally, within the framework of principled polysemy, Tyler and Evans (2001, 2003) proposed a linguistic methodology for determining which sense should be taken as primary in the prepositional polysemy. According to their proposal, a more principled method of determining the *sanctioning* sense of a preposition, as they termed it following Langacker (1987a, p. 157; 2008a), should be based on five types of linguistic evidence: (1) earliest attested meaning; (2) predominance in the semantic network; (3) use in composite forms; (4) relations to other spatial particles; (5) grammatical predictions (Tyler & Evans, 2003, p. 47) – the third and fifth criteria distinguished with reference to Langacker's (1987a) terminology.

More recently, Evans (2010) admitted that modeling the complexity of the spatial and functional relations conveyed by prepositions is more complex than initially assumed by the principled polysemy approach. He presented a proposal of refining the framework from the perspective of his theory of Lexical Concepts and Cognitive Models (Evans, 2006, 2009), which assumes a far greater complexity of interactions between lexical concepts and cognitive models understood as large-scale multi-modal knowledge structures. Evans (2009, Ch.8; 2010) suggests that the particular semantics denoted by the prepositions *in*, *on*, and *at* relates to particular *psychosomatic states*. For example, we say *in trouble* because experiencing trouble is like being "enclosed" [ENCLOSURE] (see also Turewicz, 2005), and we say *at risk* because experiencing risk is like being "located" [CO-LOCATION] near an external threat.

Szwedek (2009b) analyzes briefly a subset of prepositions including *in*, *over* and *across* in terms of their metaphoricity and polysemycity. Although it has been customary to approach prepositions as inherently polysemous elements, his analysis demonstrates that separate senses of a preposition are, at least in a good number of cases, context dependent. For example, for the sentences "The line stretches *over* the yard" and "The plane flew *over* the village" the *static* or *dynamic* aspect of meaning of the preposition is not derived from the inherent meaning of *over*, but depends on the context. The 'static' *over* appears with the static verb, and the 'dynamic' *over* appears with the dynamic verb. As put by Szwedek, "rather than talking about distinct senses of prepositions, we can only say that prepositions are open to static/dynamic, and possibly other interpretations, in the sense that they appear in such contexts" (Szwedek, 2009b, p. 174).

Demonstrating that both *over* and *in* seem to be neutral with respect to the dynamic/static opposition, Szwedek asks if prepositions lend themselves to what is usually termed as *metaphorical extension* (Lakoff & Johnson, 1980, 1999). He is skeptical about the metaphorical status of prepositions, and instead views distinctive prepositional relations as associated with a higher-order conceptual distinction between concrete (physical) and abstract entities, which he discusses with reference to his theory of *objectification* (Szwedek, 2002; 2007; 2008; 2011; see Section 2.5). According to his proposal, the process of metaphorization relates to THINGS, in the sense of abstract entities,[76] which are reduced via metaphorical extension to non-abstract objects. On the other hand, RELATIONS expressed by prepositions are not subject to metaphorization. We can, however, assume that once abstract entities have been *objectified*, relations expressed by prepositions are transferred to resulting objects. Szwedek (2009b, p. 177) calls the transfer of relations between abstract and concrete entities *inheritance of properties*.

6.3 Spatial and temporal uses of prepositions

It has been traditionally accepted that prepositions serve to express both spatial and temporal[77] relations. Studying spatial and temporal uses of prepositions has a long tradition of research in language and cognition. Almost 40 years ago Bennett (1975) published the still frequently cited analysis of spatial and temporal uses of English prepositions from the perspective of stratificational semantics. It approaches the problem of spatial and temporal prepositions in a relatively straightforward manner: nouns denote objects and events; prepositions denote more or less complex relations holding between objects and events with reference to location, dimensions, axes, proximity, etc. This model allows for application of a formal description to linguistic representation of spatial and temporal relations expressed by prepositions. For example, "x *at* y" expresses a locative relation "x [locative y]"; whereas "x *in* y" expresses a more specific relation of containment "x [locative [interior of y]]", and so on. However, this approach leaves out the cognitive

[76] Szwedek distinguishes *things* with reference to Langacker's (1987a) distinction between THINGS and RELATIONS, in which THINGS represent both concrete and abstract entities.

[77] Prepositions are viewed by some cognitive linguists, most notably Langacker (1992, 2012) and Talmy (1988b/2007, 2000a, Ch. 1) as linguistic particles that profile *atemporal relations*. It refers to an observation that, unlike verbs, prepositions do not express a relation that evolves over time. Instead, they represent a conceptualized relation holding between two entities, independent of sequentially evolving interdependencies. As put by Langacker "With *before* and *after*, time functions as the domain in which the profiled relationship is manifested. Its role is consequently analogous to that of space in the basic sense of *in*, *on* or *near*. A verb, on the other hand, is said to be temporal in a very different way… the profiled relationship is conceived as evolving through time and is scanned sequentially along this temporal axis. It is by incorporating this further level of conceptual organization that *precede* and *follow* differ from the prepositions *before* and *after*… A preposition can thus be characterized as profiling an atemporal relation that incorporates a salient landmark." (Langacker, 1992, p. 292). More recently, Langacker (2012, pp. 207–208) notes that temporal prepositions, like *before* and *after*, profile temporal configurations holistically, in gestalt-like fashion, which he attributes to *summation*. Summation predominates when verbs are subject to grammatical operations that override their sequential nature to view content holistically. Atemporality of expressions depicting static configurations of objects with *fictive motion* is discussed in Chapter 8.

relationship between objects and the language used to encode them, which was discussed in the previous section.

Around the same time, Clark (1973) observed that spatial expressions tend to appear in linguistic development of children before temporal expressions. For example, the spatial sense of the preposition *in*, e.g. *in the box*, appears to be used by children earlier than the temporal sense, e.g. *in a minute*, despite the fact that both uses are common in adult speech. Clark assumed that children spontaneously gain knowledge of physical space as a result of their early perceptual-motor experiences, and only subsequently apply this cognitively prior knowledge to representations of time. He put forward a hypothesis that the language of time is acquired as a spatial metaphor, which also refers to prepositions marking relations in space, e.g. *ahead-behind*, and relations in time, e.g. *before-after*.

Clark's hypothesis was opposed in developmental psychology by Richards and Hawpe (1981). They pointed out that despite certain semantic similarities, there are also important differences between contexts in which temporal and spatial prepositions typically occur in the natural language. They asserted that prepositions used to express spatial and temporal relations tend to have a dominant domain of reference. For example, *before* and *after* appear to be dominant in contemporary English in the temporal sense,[78] which is indicated by the fact that in spatial contexts they are restricted to marking only prepositional meanings, e.g. "I stand before the court". They are not used in adverbial meanings, e.g. "?I stand before", or to mark subordination, e.g. "?I stand before the court convenes". Similarly, the pair *ahead-behind* appears to be dominant in the spatial sense. It is indicated by explicit marking of *ahead* and *behind* for temporal usage by appending the noun *time*, e.g. *ahead of time* or *behind time*. Since explicit marking is typically used when the meaning of an expression exceeds its inherent semantics, *ahead* and *behind* appear to carry temporal meaning as a secondary sense. Richards and Hawpe (1981) suggested that the sequence of acquisition of spatial/temporal meanings of prepositions (and other words expressing spatial/temporal relations) is related directly to the context in which words tend to be predominantly used.

[78] It is noteworthy that temporal senses of both *before* and *after* have evolved from spatial uses. OED (2009) states that early occurrences of *before* and *after* denoted sequence in space. *Before* [OE. *beforan* (cogn. w. OS. *biforan*, OHG. *bifora*, MHG. *bevor*, also *bevorne*, *bevorn*)] was used to express sequence in space in the context of motion, where it meant "ahead, in advance, in front". It was also used in the context of position or direction, where it meant "in front, in or on the anterior or fore side". *After* [OE. *æfter* cogn. w. OS. and OHG. *aftar, -er*, OFris. *efter* adv. and prep., ON. *aptr* adv., *eptir* prep., Goth. *aftra* back, *aftaro* from behind, adv.] originates from compound forms that meant 'farther off, at a greater distance from the front, or from a point in front'. It was related to place or order, and meant "in the rear, behind".

Haspelmath (1997) presented an impressive study of spatial-temporal correlations in temporal adverbials, which he discussed taking into consideration data collected from fifty-three world's languages. He specifically restricted his cross-linguistic analysis to modifiers of noun phrases, which in a vast number of cases include prepositions. The main goal of his study was "to assemble cross-linguistic evidence for the hypothesis that temporal notions are conceptualized in terms of spatial notions." (Haspelmath, 1997, p. 4). By analyzing linguistic surface similarities between spatial and temporal terms, he tried to determine whether temporal terms historically originate from spatial ones, and to identify cross-linguistic patterns that indicate a conceptual dependency of temporal on spatial representations. Haspelmath concludes that while it is not possible to prove such a dependency on the basis of linguistic evidence alone, it is highly probable that such an asymmetric relationship does exist. "The systematic cross-linguistic study has thus confirmed earlier impressionistic statements concerning the ubiquity of conceptual transfer from space to time. There are no languages that depart from this general trend, and in this sense it is truly universal."[79] (Haspelmath, 1997, p 140).

Haspelmath interprets the impressive amount of cross-linguistic data analyzed in his study as evidence that provides support for the hypothesis that time is universally secondary to space, irrespective of metaphorical conceptualizations. However, Tenbrink (2007) points out that there is no language demonstrating, either synchronically or diachronically, an exact identity between spatial and temporal terms. From this perspective, data presented by Haspelmath (1997) can be interpreted as demonstrating numerous similarities between temporal and spatial expressions. As put by Tenbrink (2007, p. 14), "A closer look at Haspelmath's data and line of argumentation shows that, overwhelmingly, he simply points to existing similarities between spatial and temporal linguistic expressions." She adds that his argumentation for the conceptual priority of space is not linguistic, but rather based on intuition.

Tabakowska (2003) presents an analysis of space and time in different uses of the Polish preposition *za* and the corresponding perfectivizing verbal prefix *za-*. By pointing out that perfectivizing prefixes developed historically from adnominal elements, which later developed into prepositions, she presumes that verbal prefixes cannot be "semantically empty", and that their meaning extends beyond merely aspectual meaning. Tabakowska (2003) argues that such prefixes still carry abstract elements of meaning stemming from their original function, which plays a

[79] Haspelmath (1997, p. 140) adds, however, that "there are a few languages that have a non-spatial source for their marker of the [temporal] function. In this sense the space-to-time transfer is not universal, but only a strong tendency."

significant role in shaping and modifying construals related to space and time. Her analysis describes the semantic structure of prepositions and verbal prefixes as an inventory of inter-related usages, which demonstrates that at higher levels of abstraction particular usages of prefixes overlap with those of prepositions. The semantic relatedness of this preposition-prefix pair predicts the choice of *za-* with verbs of location and motion, while precluding its occurrence with others. Tabakowska (2003) assumes that a systematic comparison of semantic networks for verbal prefixes with corresponding prepositional networks may contribute to the understanding of verbal prefixation in contemporary Polish, which has persistently escaped earlier approaches within structuralist frameworks.

Somewhat aside from the mainstream cognitive linguistic research, Bączkowska (2011) relies on the notion of *spacetime* in her cognitive analysis of space and time in English prepositions. She illustrates the dimensions of time and space in prepositional meanings using spatial-temporal cones, i.e. geometrical representations of spacetime developed by Minkowski (1908/1964). Apparently, references to physics seem to be gaining popularity in contemporary cognitive linguistic studies. Szwedek (2011) adopts physicality (density) of objects as a uniform and simple criterion of the distinction between the material world and the phenomenological world. Different states of matter have been used by Krzeszowski's (2013) in his multidimensional approach to the meta-concept of *meaning*. Nevertheless, for reasons explained in the introductory section of Chapter 4, in spite of the innovative potential of physics in cognitive studies, this research takes a more traditional approach.

The spatial and temporal uses of prepositions are also investigated in other fields of cognitive science. The question if the space-to-time metaphorical mappings actively influence the way that people process prepositional meanings during language use was explored from a neuropsychological perspective by Kemmer (2005). He conducted a series of experiments with four left-hemisphere brain-damaged patients to determine whether spatial and temporal meanings of prepositions can be dissociated from each other by brain injury. The spatial prepositional meanings were assessed with a test based on photographs of real objects: the subjects' task was to determine which of three prepositions best describes the depicted spatial relationship. The temporal meanings of prepositions were assessed with a linguistic test: the subjects' task was to complete a sentence by selecting one of three prepositions with an appropriate temporal meaning. Pictures were not used to check the temporal meanings of prepositions because they are typically too abstract to be clearly depicted.

In the experiments, two subjects failed a test that assesses knowledge of the spatial meanings, but passed a test that assesses knowledge of the corresponding temporal meanings of the same prepositions. Moreover, two other subjects exhibited the opposite dissociation: they performed better on the spatial test than on the temporal one. Although Kemmer's (2005) study had a methodological limitation, as the design characteristics of the two tests were not perfectly matched, his findings suggest that understanding temporal meanings of prepositions does not necessarily require establishing structural alignments with their spatial counterparts.

In cognitive psychology, Kranjec, Cardillo, Schmidt, and Chatterjee (2010) used the concept of *time* to test if prepositions rigidly prescribed by grammar to abstract concepts, e.g. *at risk*, *on Wednesday*, *in trouble*, which can be assumed to serve a functional role (but see Evans, 2009, 2010), retain their semantic content in such uses. Using ambiguous questions (based on "Next Wednesday's meeting has been moved forward two days. What day is the meeting now that it has been rescheduled?"; see Section 2.7 for a review of earlier studies employing the same paradigm, e.g. McGlone & Harding, 1998; Boroditsky, 2000; Gentner, Imai & Boroditsky, 2002) they probed 180 participants' representations of temporal relations. They found strong evidence that the semantics of prescribed prepositions modulates how people think about time. Although functional uses of locative preposition are unlikely to be based directly on a core conceptual organization shared between space and time, the results suggest that the semantics of locative prepositions in grammatically prescribed uses constrains how we think about temporal concepts.

There is an apparent contradiction between the two above-discussed studies. Kemmer's (2005) findings indicate that metaphor does not play a necessary role in the on-line processing of spatial and temporal meanings of prepositions. On the other hand, prescribed prepositions affect resolving ambiguous statements based on taking a temporal perspective (Kranjec, et al., 2010). Kemmer (2005) suggests that thinking about time triggers the activation of corresponding spatial representations mostly when people are confronted with some specific tasks that involve explicit, linguistically mediated temporal reasoning, presumably because the space-to-time metaphorical mapping can serve as a useful aid to problem-solving in such tests. It is noteworthy, however, that studies examining the spatial-temporal relations with reference to disambiguation of temporal statements involve motion as the crucial element that interfaces space with time. A more recent study (Sullivan & Barth, 2012) observed that temporal perspective taking is not affected by just any spatial prime, but rather by spatial primes engaging active mental motor imagery.

6.4 Space and time in PPs expressing spatial distance

The above-discussed close relatedness of space and time in prepositions makes it difficult, at least for certain prepositions, to draw an absolute distinction between space and time because they seem to form a sort of semantic amalgamation (see Bączkowska, 2011 for an analysis from the perspective of *spacetime* representation). A plausible way of finding more information about this relationship is to gather some tangible data on their distribution in linguistic corpora. One linguistic context that appears to be particularly suitable for this purpose is the domain of distance expressions, since they happen to be articulated both in spatial and temporal terms.

According to widespread linguistic intuitions, it seems obvious that the relationship between time and space in distance expressions is predicted by the asymmetry of space and time reflected in linguistic metaphors (Lakoff & Johnson, 1980, 1999). As put by Casasanto et al. (2010):

> In English, it is nearly impossible to talk about domains like time without using words that can also express spatial ideas: Vacations can be *long* or *short*, meetings can be *moved forward* or *pushed back*, deadlines can lie *ahead* of us or *behind* us. Yet it is far less common to use temporal words to talk about space (Lakoff & Johnson, 1999). Although we could say that we live "a few minutes from the station," we could just as easily express this spatial idea in spatial words, saying "a few blocks from the station." (Casasanto, et al., 2010, p. 388).

This is, however, a purely intuitive view. As emphasized by Sinclair (1991, p. 4), "human intuition about language is highly specific, and not at all a good guide to what actually happens when people actually use the language". The benefits of corpus-based evidence in the linguistic examination of meaning associated with a word has been demonstrated, for example, by Gries (2006) in his study of various meanings of *run*. Evans (2010) acknowledges the importance of corpus-based approaches in examining the range of distinct senses associated with prepositions. On these grounds, this chapter investigates how frequently space and time occur with prepositions in adverbials used to express spatial distance in corpus data.

As discussed in the previous chapter, *corpus-based cognitive linguistics* relies on explanatory notions adopted by the cognitive linguistics framework, but approaches them in such a way that their relevance to a given linguistic phenomenon can be empirically validated in large corpora (Heylen, Tummers and Geeraerts, 2008, p. 92). This study employs specifically a *corpus-based* approach, i.e. one that examines large samples of natural language in order to test theories about language structure, as opposed to a *corpus-illustrated* approach (Tummers et al., 2005).

6.4.1 Research methodology

In order to gather tangible linguistic data on how frequently space and time are used in prepositional phrases expressing spatial distance this research employs the *British National Corpus* (henceforth, the BNC) and the *Polish National Corpus* (henceforth, the NCP). As discussed in the previous chapter, the BNC is a 100 million word collection of samples of written and spoken contemporary British English from a wide range of texts, genres, and registers (Aston & Burnard, 1998; see www.natcorp.ox.ac.uk for more information). The NCP is a 240 million word collection of samples of both spoken and written contemporary Polish, which roughly mirrors the BNC in its structure (Przepiórkowski et al., 2012; see www.nkjp.pl for more information).

This study examines distance in the sense of *topographical distance*, which refers to conceptualizations of geographical distance that separates one point from another in physical space (Tyler & Evans, 2003, p. 130). The investigation is additionally restricted to examining expressions specifying *absolute distance*, i.e. one denoted in (spatial or temporal) units, e.g. "fifteen miles from London" or "fifteen minutes from London". Although expressing distance in absolute terms is a basic way of specifying spatial extents, expressions of distance in space are not limited to information explicitly conveyed by spatial terms,[80] which was discussed in Chapter 3. Therefore, it must be emphasized that the aim of this chapter is not to examine the entirety of ways used for denoting spatial distance in language, but to observe a general proportion between space and time in prepositional phrases used to express the topographical distance.

A selection of prepositions analyzed in this study is limited to fifteen lexemes commonly used to express spatial relations: *across, ahead, along, apart, away, behind, between, beyond, from, off, over, through, to, towards*, and *within*. All prepositions included in this set happen to express temporal relations (Bennett, 1975; Huddleston & Pullum, 2002). Although different worldwide languages also employ temporal prepositions, such as *after* and *before*, to express spatial relations (Haspelmath, 1997; Tutton, 2012), they are not included in the above selection because in present-day English they are associated more directly with expressing relations in time, rather than space.[81]

[80] For example, conceptualizations of distance in space are established by the scale of mental operations: something situated "near the penny" is conceptualized as situated closer than something "near the tree" (Morrow & Clark, 1988; Carlson & Covey, 2005; see Section 3.6).

[81] An inclination to express distance with *before* and *after* can be observed particularly in *verbs of change*, such as *arrive* and *reach*, e.g. "After about fifteen minutes they arrived at their

The search for representations of the topographical distance in spatial and temporal terms in the BNC was executed by looking for frequencies of prepositional phrases with the following lexical pattern:

QUANTIFIER + SPATIAL OR TEMPORAL UNIT + SPATIAL PREPOSITION

In the above pattern, the quantifier is either a cardinal number or a determinative used with countable nouns, e.g. *a, an, few, many, several, some*, etc. Cardinal numbers are easily identifiable in the BNC thanks to *part-of-speech annotation*, which marks all cardinal numbers, spelled both in words and digits, with the <CRD> tag included in the basic C5 tagset of the corpus (Garside et al., 1997). The use of quantifier raises precision of corpus queries by essentially eliminating irrelevant matches sharing the above pattern by coincidence. Units of space measurement selected for analysis include both metric and imperial units typically used in the U.K., also in their American variants of spelling, i.e. *kilometre (kilometer), metre (meter), mile,* and *yard*. Units of time measurement include those that are typically used to express distance in space in terms of duration, i.e. *minutes, hours,* and *days*. It is noteworthy that for the preposition *within* a slightly modified pattern, with the preposition put first, was used (see Appendix to this chapter for details).

Implementation of corpus queries based on regular expression syntax enables anyone interested in attesting or expanding this study to further probe the results under the same research conditions. A listing of queries used to obtain the results together with explanatory notes is provided in the Appendix to this chapter (see also Waliński, 2012a for the listing of queries accompanied by corresponding concordances retrieved from the BNC).

6.5 Spatial and temporal representations of distance in the BNC

The above pattern implemented in corpus queries with spatial units retrieved 5,221 concordance lines from the BNC. The resulting set was carefully reviewed through a concordance analysis to eliminate irrelevant matches sharing the defined sequence of lexical items by coincidence. The review confirmed that practically all (5,215) identified examples included representations of the topographical distance. Examples spotted as coincidental hits involved mainly references to dimensions of "*a* [house] *yard*".

Parallel corpus queries implemented with temporal units retrieved 5,847 concordance lines from the BNC. However, a review of the resulting set revealed

destination" or "He reached London shortly before midnight" (Lewandowska-Tomaszczyk, personal communication, December 2012).

that most of them express distance in time rather than space. For example, a tremendous amount of examples retrieved for the preposition *to* included infinitive constructions[82] specifying temporal duration, e.g. "cook for 1 minute to soften", "it takes a minute to realize what it is". Plenty of matches identified for the preposition *off* included the set phrase "[to take] *a day/days off* [work]". Besides, numerous examples simply denoted temporal distance, e.g. "Passengers must book five days ahead", "The crimes were committed twenty-four hours apart", etc., with no direct relevance to spatial relations.

Almost all of the selected prepositions can be observed in the BNC in expressions denoting absolute topographical distance in spatial and temporal terms. However, as shown in Table 6.1, they are not equally widespread in respective contexts.

Preposition	Distance denoted in spatial terms	Other spatial relations	Distance denoted in temporal terms	Other temporal relations
across	144	0	1	6
ahead	40	0	1	27
along	85	0	4	8
apart	106	0	1	16
away	1655	0	**92**	**35**
behind	79	2	1	56
between	53	0	0	69
beyond	47	0	0	3
from	1763	0	164	612
off	137	1	3	270
over	39	0	2	88
through	48	0	5	43
to	741	3	147	2510
towards	12	0	0	9
within	266	0	61	1613
Total	**5215**	6	**482**	5365

Table 6.1 Representations of the topographical distance in spatial and temporal terms found in the BNC for selected prepositions

[82] The current infinitive descends from the Old English *inflected infinitive* form of verbal nouns, whose Dative case was preceded by the preposition *to*, which meant "toward" and indicated purpose toward which the action of the main verb was directed. Hence, the original GOAL directional meaning of that prepositional phrase was implicitly associated with time, more specifically with the future temporal perspective of the intended result of the action (Los, 2005).

Table 6.1 shows that 5,215 concordance lines retrieved from the BNC for spatial units were recognized as valid representations of spatial distance. However, only 482 concordance lines retrieved from the BNC for temporal units were recognized as valid representations of spatial distance. Although it is impossible to discuss the living organism of language in absolute numbers, the proportion of spatial vs. temporal representations of the topographical distance found in the BNC is a significant indicator that generally English speakers have a tendency to express spatial distance in spatial terms. The overall result can be used to support claims (e.g. Casasanto et al., 2010) that spatial relations are relatively rarely expressed in terms of duration. It is congruent with observations presented over 30 years ago by Lakoff and Johnson (1980) that we systematically talk and think about time in spatial terms by metaphorical extension, but not vice-versa, which was discussed in Chapter 2.

However, taking a closer look at Table 6.1 reveals that one lexical item, namely *away*,[83] stands out from the rest of analyzed prepositions in a quite particular manner: it is used more frequently with temporal units to specify distance in space (92 times) than to express temporal relations (35 times). No other preposition from the selection analyzed in this study manifests this kind of predisposition in the corpus. The number of examples retrieved from the BNC is substantial enough to indicate that the difference does not arise from a coincidental occurrence in the corpus.

6.6 Representations of topographical distance with *away* in the NCP

To check the validity of this observation for another language a similar search was conducted for Polish using the NCP. Although Polish does not have an equivalent directly correspondent to *away* in the form of a single lexical item, it conveys the meaning of disconnection in space[84] with a combination of set phrases expressing separation from/to a destination point. Hence, examples of spatial and temporal representations of the topographical distance for a parallel

[83] Traditionally, *away* is regarded in descriptive grammars of English as an adverb. However, the latest comprehensive grammar of English (Huddleston & Pullum, 2002, 2005), as discussed in the introductory section of this chapter, regards it as preposition.

[84] As noted in Oxford English and PWN-Oxford dictionaries, although predominantly associated with removal in space due to motion, *away* is also used to speak of actions, positions, directions, and of states or conditions resulting from removal, deprivation, elimination, parting, loss or extinction. It can be used to express use of time, e.g. “They danced the night away” or “He slept the day away”, and to emphasize temporal continuity of action, e.g. “He’s been painting away all morning”. These other uses, however, exceed the scope of this study.

semantic context were retrieved from the NCP with a combination of the following phrases: *drogi do* (Lit. "of way to"), *drogi z*[*e*]/*od*[*e*]) (Lit. "of way from"), and *drogi stąd* (Lit. "of way from here"). This combination represents both *Source paths* and *Goal paths*, i.e. paths *from* and *to* a destination point (Jackendoff, 1983), from both exocentric and deictic perspectives. The search in the NCP was implemented with the following lexical pattern:

SPATIAL OR TEMPORAL UNIT + SET PHRASES CORRESPONDENT TO *AWAY*

Units of time measurement selected for Polish include *minuta, godzina, dzień* [minute, hour, day] and units of space measurement *kilometr, metr, mila* [kilometer, meter, mile], which generally parallels the units used for analysis in English.[85] A listing of queries used to obtain the results together with explanatory notes is provided in the Appendix to this chapter (see also Waliński, 2012b for the listing of queries accompanied by corresponding concordances retrieved from the NCP).

Corpus queries based on the above pattern retrieved 137 concordance lines from the NCP. The resulting set was carefully reviewed through a concordance analysis. Only 6 examples were spotted to share the defined sequence of lexical items by coincidence. The proportion of valid spatial and temporal representations of distance retrieved from the NCP is shown in Table 6.2.

away in Polish	Distance denoted in spatial terms	Coincidental hits	Distance denoted in temporal terms	Coincidental hits
drogi do	7	2	3	0
drogi z(e)/od(e)	10	2	91	2
drogi stąd	0	0	20	0
Total	**17**	4	**114**	2

Table 6.2 Representations of the topographical distance in spatial and temporal terms identified in the NCP for set phrases parallel semantically to *away*

The gap between 17 spatial vs. 114 temporal representations of the topographical distance demonstrated in Table 6.2 indicates that in the context of ways from/to a destination, which partly covers the meaning of *away*, Polish speakers have a tendency to express spatial distance in temporal terms. The number of examples identified in the NCP is substantial enough to indicate that the difference does not arise from a coincidental occurrence in the corpus.

[85] Polish speakers do not normally express spatial extents with imperial units, like *yards*, however the [nautical] *mile* (*mila* [morska]) is used in the context of sea travels.

6.7 Motion as a modulator of distance expressions

The above-reported results are based on objectively verifiable frequencies of lexical patterns found in national reference corpora for two different languages. They suggest that in the semantic context of *ways* English and Polish speakers relatively frequently express the topographical distance in temporal terms. A question that arises naturally from this observation is what acts as a catalyst for conceptualizations of distance separating one point from another in physical space in terms of duration.

A plausible answer to this question is that *ways* are inherently characterized by the semantic component of motion. This can be inferred from the etymology of *away*. As noted in Oxford English Dictionary (2009), in its origin it was a phrase, ON *prep.*, and *weȝ*, WAY, i.e. *on* (his, one's) *way,* 'on' of motion (as in 'move on'), and thus also 'from this (or that) place' to a distance. Already in Old English reduced to *a-weȝ*. Moreover, *way* in the sense of Path used for motion of objects in space is the basic component of the SOURCE-PATH-GOAL image schema of motion (Lakoff, 1987; Hampe, 2005), and is an internal core component of the *basic motion event* (Talmy, 2000b, p. 25).

Hence, it is plausible to presume that it is the semantic component of motion that acts as the underlying modulator that shifts conceptualizations of distance from spatial to temporal representations. Such a presumption is by no means unusual since earlier cognitive studies have found that spatiotemporal reasoning is affected by conceptualizations of real, imagined, and fictive motion in physical and non-physical domains (Boroditsky & Ramscar, 2002; Matlock et al., 2005; Teuscher, McQuire, Collins & Coulson, 2008; see Ramscar, Matlock & Boroditsky, 2010 for a review).

It is noteworthy that Szwedek (2009b; see also Szwedek 2009a) attributes the basic distinction between static/dynamic prepositional meanings to transfer of properties between abstract entities and concrete objects. He looks at the problem of *temporality/atemporality* at a higher level ontological distinction between physical worlds and non-physical worlds. However, the scope of research presented in subsequent chapters concentrates more specifically on investigating temporality/atemporality of linguistic representations of distance in contexts involving motion or lack of thereof.

The cross-linguistic regularity of temporal conceptualizations of spatial distance observed for the semantic context of "ways separating spatial locations" in two standard reference corpora makes it possible to distinguish tentatively two functional categories of distance conceptualizations. One embraces conceptualizations of distance to be traveled between separate locations, which takes place in the semantic context of motion events[86] (Talmy, 2000a, 2000b). Since it is intrinsically associated with actual motion, it can be labeled *motion-framed distance*. A tendency to represent this type of distance in temporal terms manifested by English and Polish speakers is discussed in the following chapter. The other type embraces conceptualizations of spatial extension for static objects. A tendency to represent this type of distance in spatial terms manifested by English and Polish speakers with reference to *fictive motion* (Langacker, 1986, 2005, 2008a; Talmy 1996, 2000a) is discussed in Chapter 8.

[86] Motion in the space of navigation can be associated more specifically with *journeys*, i.e. complex motion events involving extended, often compound Paths with numerous subgoals, possibly occurring through various media (Slobin, 1996b, pp. 201–202).

Appendix to Chapter 6

1. Explanations for query listings

For English, this study is based on the BNC World edition published in 2001. The corpus was searched with SlopeQ, a part-of-speech-sensitive concordancer for the BNC with support for proximity queries. For Polish, the balanced edition of the NCP was used with the PELCRA online concordancer, which is available publicly at: http://www.nkjp.uni.lodz.pl/index_adv.jsp (see Pęzik, 2012b for an overview). The number of returned results was set to the maximum of 10000 (available via "Paging" option). All queries we implemented with the default values of 0 for SLOP factor (available via "Slop" option), and "Preserve order" option set to "yes". A single asterisk (*) replaces any number of characters, e.g. [yard*] substitutes for "yard, yards, yardstick, etc." The vertical bar or *pipe* (|) symbol stands for logical AND, which enables executing multiple queries in a single line. For example, the query [drogi od|do] substitutes for two separate queries "drogi od" and "drogi do". The PELCRA online concordancer offers an underlying Polish morphological dictionary, which allows for queries incorporating all Polish inflectional forms with the use of double asterisk (**) used as a wildcard. For example, the query [rok**] substitutes for "rok, roku… lat, lata… etc."

2. Corpus queries used to examine representations of the topographical distance in spatial and temporal terms for selected prepositions in the BNC.

a) For spatial units

[<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* across]
[<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* ahead]
[<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* along]
[<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* apart]
[<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* away]
[<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* behind]
[<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* between]
[<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* beyond]
[<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* from]
[<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* off]
[<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* over]
[<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* through]
[<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* to]
[<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* towards]
[within <CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard*]

b) For temporal units:

[CRD>|a|an|few|many|several|some minute*|hour*|day|days across]
[CRD>|a|an|few|many|several|some minute*|hour*|day|days ahead]
[CRD>|a|an|few|many|several|some minute*|hour*|day|days along]
[CRD>|a|an|few|many|several|some minute*|hour*|day|days apart]
[CRD>|a|an|few|many|several|some minute*|hour*|day|days away]
[CRD>|a|an|few|many|several|some minute*|hour*|day|days behind]
[CRD>|a|an|few|many|several|some minute*|hour*|day|days between]
[CRD>|a|an|few|many|several|some minute*|hour*|day|days beyond]
[CRD>|a|an|few|many|several|some minute*|hour*|day|days from]
[CRD>|a|an|few|many|several|some minute*|hour*|day|days off]
[CRD>|a|an|few|many|several|some minute*|hour*|day|days over]
[CRD>|a|an|few|many|several|some minute*|hour*|day|days through]
[CRD>|a|an|few|many|several|some minute*|hour*|day|days to]
[CRD>|a|an|few|many|several|some minute*|hour*|day|days towards]
[within <CRD>|a|an|few|many|several|some minute*|hour*|day|days]

3. **Corpus queries used to examine representations of the topographical distance in spatial and temporal terms for set phrases parallel semantically to the preposition *away* in the NCP.**

For spatial units: [metr**|kilometr**|mila** drogi do|z|ze|od|ode|stąd]; SLOP=1, Preserve order=YES

For temporal units: [minuta**|godzina**|dzień** drogi do|z|ze|od|stąd]; SLOP=1, Preserve order=YES

Chapter 7

Complementarity of space and time in motion-framed distance

> *If anything, language is post-kinetic. Fundamental spatio-temporal-energic concepts come from experiences of movement, both in the form of self-movement and in the form of the movement of individuals and things in one's surrounding world.*
>
> M. Sheets-Johnstone (2011) *The Primacy of Movement*

7.1 Cognitive primacy of movement

An idea of the primacy of movement in apprehension of the surrounding world can be traced back to Aristotle's insight that motion is the fundamental principle of nature. According to Aristotle, the very nature of nature is reflected in motion and change. "Nature is a principle of motion and change … We must therefore see that we understand what motion is; for if it were unknown, nature too would be unknown." (Aristotle, 350BC/1995b, *Physics*, 200b11–14) Thus, to understand the nature of the world is to understand the dynamic nature of surrounding events, by which we apprehend the sensible form of imperceptible, immaterial concepts, such as *inside–outside*, *new–old*, *close–distant*, etc., arising from consequential relationships.

Given Aristotle' recognition of this principle, it is not surprising that he thought it had an important role in understanding of *anima*, or the soul, in animate world in which humans, animals, and plants live. In his book *On the Soul* (350BC/1995c), Aristotle discusses how animate forms from the most basic invertebrates through plants and animals are structured in ways that are sensitive to movement (cf. *The Great Chain of Being* in Lakoff & Turner, 1989, pp. 167–168; Krzeszowski, 1997, p. 67). Aristotle states that "sensation depends … on a process of movement or affection from without, for it is held to be some sort of change of quality." (Aristotle, 350BC/1995c, *On the Soul*, 416b33–34). For Aristotle, a sensation is essentially a change of quality, and the change of quality is a matter of movement. The principle of motion permeates all forms of organic life and defines the fundamental way in which organic life functions (see Sheets-Johnstone, 2011, Ch. 3 for a review of the Aristotelian account on the primacy of movement).

Husserl's *phenomenology of embodiment* (see Behnke, 2011 for a review) regards *kinesthetic consciousness*, i.e. the experience of movement and its organization into kinesthetic systems, as the foundation of all consciousness and cognition. According to Husserl (as discussed by Sheets-Johnstone, 2011, Ch. 4), we come into the world moving: we are literally *not stillborn* (see also Johnson, 2007, p. 19). In this respect, primal movement defines our aliveness and marks a starting point of our departure for living in the world. Husserl argues that as we grow kinetically into our bodies,[87] we literally discover ourselves in movement as animate organisms. In that sense, movement is like primal sensibility: it is the epistemological foundation for making sense of what we are and who we are.

Moreover, learning to move is the epistemological foundation by which we come to understand the world with respect to objects that surround us. By discovering ourselves in movement, we embark on a lifelong journey of meaning-making. We gradually expand our kinetic-based repertoire of "I cans" (*I can stretch, I can reach, I can twist, I can turn over*, etc.), which is the foundation of our sense of ourselves as agents within the surrounding world (Sheets-Johnstone, 2011, pp. 116–119). Therefore, the capacity to grow kinetically into our bodies is the foundation of our conceptual understandings of the world:

> Spontaneous movement is the constitutive source of agency, of subjecthood, of selfhood, the dynamic core of our sense of ourselves as agents, subjects, selves. Kinesthetic consciousness in turn defines an emergent, progressively expanding consciousness whose structures can be thematized, i.e. analyzed phenomenologically. In particular, kinesthetic consciousness unfolds on the ground of spontaneous movement and in its initial unfolding reveals not only corporeal concepts on the order of those described above, but spatio-temporal concepts that are basically qualitative in nature and that emanate from what we discover to be the creative, i.e. freely variable, character of our movement. (Sheets-Johnstone, 2011, p. 119).

Since our fundamental kinesthetic consciousness arises on the ground of movement that comes to us spontaneously, it can be regarded as the epistemological

[87] Psychological studies on motor development of infants and young children (see Thelen, 1995 for a review) demonstrate a contextual and self-organizing nature of developmental change, with the unity of perception, action, and cognition. See Sheets-Johnstone, 2011, Ch. 5 for a discussion of how psychological findings on infancy might complement and support phenomenological theories of kinesthetic consciousness.

foundation of all consciousness, or as put by Sheets-Johnstone (2011, p. 118), "the mother of all cognition".

Mark Johnson (2007, Ch. 1) also insists that movement is the foundation of our knowledge of the world, which, at the same time, provides us with important insight on our own nature, capacities, and limitations. He emphasizes a *qualitative dimension* of movement, which means that what we experience through movement are the qualities of things, spaces, and forceful exertions. For example, by putting things in and out of containers, we learn about *containment*; by observing paths of motion we develop understanding of *trajectories* and learn concepts such us *straight*, *curved*, *vertical*; by moving objects from one place to another we learn about different *weights*; by moving ourselves between places we learn about varying *distances* in space. "Movement is thus one of the principal ways by which we learn the meaning of things and acquire our ever-growing sense of what our world is like" (Johnson, 2007, p. 21).

Johnson argues that movement is reflected in numerous *image schemas* (see Lakoff, 1987; Hampe, 2005), such as SOURCE–PATH–GOAL, INTO–OUT OF, UP–DOWN, etc. They inherently include not only their internal structures, but also distinctive *qualities* acquired from movement. For example, a walk along a forest path is defined not only by the SOURCE–PATH–GOAL structure of walking, but also by some specific dynamic qualities of movement, which can be, for example, *graceful* or *explosive*, *smooth* or *jerky*. According to Johnson (2007, p. 22), we can distinguish four qualitative dimensions of all bodily movements: *tension*, *linearity*, *amplitude*, and *projection*. These basic qualitative parameters play a crucial role in what we mean by force, effort, manner of motion, and direction of action. Johnson (2007, p. 24) suggests that these characteristics of movement form not only the meanings of movements, but more importantly the meaning of the world we move within.

7.2 Correlation of motion, time, and space

It was already pointed out by Aristotle in *Physics* (350BC/1995b) that all motion takes place in space and time: space is the potentiality, and time is the measure of motion. The ties that bind space and time together in motion are reflected in units of speed, e.g. the *kilometer/mile per hour*, or the largest unit of spatial magnitude, the *light-year*.[88] Levinson (2003, p. 219) notes that time acts as a crucial factor in

[88] Hawking (1988, pp. 22–23) points out that nowadays time is used to measure distances precisely because we can measure temporal duration more accurately than spatial length. "In effect, the meter is defined to be the distance traveled by light in 0.000000003335640952 second, as measured by a cesium clock. (The reason for that particular number is that it

estimates of distance through velocity and in the use of directional cues, e.g. a compass based on the sun position, in everyday human navigation. Tversky (2011) notes that knowledge of space on the horizontal plane is derived from motion in time, hence spatial distance is often expressed as time. She adds that since each and every motion occurs in space and takes time, space and time are interchangeable and intertwined in numerous senses.

Timing and time perception are fundamental to survival and goal reaching in animals. Triangulating a position in space by using distance to landmarks is used by bats, owls and other species to form an accurate, topographic representation of space on the basis of interaural time differences (Grothe, 2003). For these species, telling space is telling time over multiple timescales, which is possible owing to a number of functional and neural mechanisms of interval timing that have emerged from evolution (Buhusi & Meck, 2005). Radar operates on a similar principle by emitting radio waves and colleting their reflections from objects. The Global Positioning System (GPS), which is used, for example, in popular automotive navigation devices, also gathers spatial information on the basis of time measurement. It determines current position by triangulating temporal information (the difference or coincidence in phase of signals) from satellites.

Miller and Johnson-Laird (1976) pointed out that we usually know how long it takes to travel between familiar locations. And we surely do. Even if we do not know how many kilometers away from home our office is, or the skiing resort we visit each winter, we can typically answer such questions by saying how long it takes to get there—by whichever means we use to reach our usual destinations. It is because clocks and watches are simply much more widespread than instruments of distance measurement, and provide a relatively straightforward way of specifying the extent of distance traveled. Observations of *travel time* as a popular metric of spatial distance have been made for years in studies on geographical cognition, especially in the context of urban environments (Lynch, 1960; Montello, 1997; Wagner 2006). MacEachren (1980) proposed a hypothesis that it is travel time that determines conceptualizations of cognitive distance in the space of navigation.

It has also been observed that the scale of spatial conceptualization is, at least for the most part, not established by linguistic structures, but tends to be derived from the referent objects and settings (Langacker, 1993, 2008a; Miller & Johnson-Laird, 1976; Talmy, 1983; 2000a, Ch. 1 & 3). For example, talking about a place situated "near London" sets the scale of mental operations to kilometers, while an object

corresponds to the historical definition of the meter – in terms of two marks on a particular platinum bar kept in Paris.)"

"near the fridge" is likely to be conceptualized as distant in meters (Morrow & Clark, 1988; Carlson & Covey, 2005). In a similar manner, events being talked about set temporal scales. When a waiter says that a meal is "nearly ready", one can expect it in a few minutes, but a new house described as "nearly ready" by a builder typically implies at least several days of waiting (Zacks & Tversky, 2012). Spatial and temporal properties of events can be combined to structure the way we talk and think about space and time. This chapter demonstrates that spatial reasoning is sensitive to conceptualizations involving *motion events* (Talmy, 2000a, 2000b), which allows for flexible denotations of spatial distance in terms of the duration required to reach a destination.

7.3 Lexicalization patterns of motion events

Motion of an object from one location to another can be characterized in terms of the SOURCE–PATH–GOAL schema, which is one of the most common structures emerging from our constant bodily experience. As described by Lakoff (1987, p. 275), "Every time we move anywhere there is a place we start from, a place we wind up at, a sequence of contiguous locations connecting the starting and ending points, and a direction." He adds that the term *destination* as opposed to *goal* can be used when we are referring to a *spatial* end point. According to Lakoff, this schema is composed of four structural elements: a SOURCE, which is the starting point, a DESTINATION, which is the end point, a PATH, which includes a sequence of contiguous locations connecting the starting point with the end point, and a DIRECTION toward the destination[89] (see Hampe, 2005 for reviews of this schema from a variety of perspectives).

However, language provides a variety of ways for parsing even very simple motion scenes, such as a cat walking across the room. The linguistic description can potentially focus on a number of different aspects of movement, which are encoded in distinct semantic particles. For example, it is possible to refer to the figure of the cat separately from the ground of the room, to trace the cat's trajectory (along or across), to express the manner of movement (running or jumping), and to indicate whether the motion was externally caused or spontaneous. By examining patterns in which the conceptual structure of motion events is linguistically encoded in different languages, Talmy (1985, 1991, 2000a, 2000b) has demonstrated how the semantic structure of linguistic representations reflects the conceptual structure in the domain of motion. Talmy (2000b, p. 35) distinguishes two types of motion

[89] Levinson (2003, p. 96) points out that the *direction* in the context of motion events differs from the *direction* of static locations because it can be described without frames of reference or coordinate systems by referencing to two points along the trajectory.

found in motion events: *translational motion*, in which "an object's basic location shifts from one point to another in space"; and *self-contained motion*, in which "an object keeps its same, or 'average' location". Levinson and Wilkins (2006, p. 18) define the translational motion more precisely as "a durative event involving passage through an indefinite series of points in space over time", and they label it *translocation*. Additionally, Slobin (1996b, pp. 201–202) distinguishes a *journey*, i.e. a complex process that often involves an extended, compound Paths that include numerous landmarks and subgoals, possibly occurring through various media.

A *motion event* has been characterized by Talmy (2000b, p. 25) as a situation containing motion and the continuation of a stationary location alike. "The basic Motion event consists of one object (the *Figure*) moving or located with respect to another object (the reference object or *Ground*)" (see Talmy, 1975, 2000a, Ch. 5 for a discussion of *figure and ground* in language). In his analysis of motion events, Talmy analyzes the systematic relations between different aspects of meaning and surface forms of linguistic expression. Linguistic elements taken into consideration include *open* class categories, such as verbs of motion, and *closed* class categories, such as prepositions acting as *satellites*. Talmy (2000b, p. 102) defines *satellites* as immediate verbal constituents other than noun-phrase or prepositional-phrase complement that are in a sister relation to the verb root, e.g. move *toward*, move *between*, move *into*, move *up*, etc.

The core schema of *motion event* has four basic internal components, which apart from the above-mentioned Figure and Ground, include Motion and Path. The *Path* is a path followed or site occupied by the Figure object with respect to the Ground object. Jackendoff (1983) additionally distinguishes between *Source paths*, i.e. motion in which the Figure moves away from the Ground, and *Goal paths*, i.e. motion in which the Figure moves toward the Ground.[90]

The component of *Motion* refers to "the presence per se of motion or locatedness in the event" (Talmy, 2000b, p. 25). Thus, the notion of *motion event* embraces both occurrence of *translational motion* and *location*, despite the fact the in the latter translational motion does not occur. In the context of *spatial frames of reference*, Levinson (2003, p. 97) notes that motion is naturally more complex than location, since it involves the extra temporal dimension. For that reason, the description of translational motion is, at least to some extent, organized differently to the description of static locations. It involves an additional set of parameters that

[90] A number of cognitive studies (Stefanowitsch & Rohlde, 2004; Lakusta & Landau, 2005; 2012; Papafragou, 2010) have observed asymmetry between the Source and Goal paths in conceptualization of motion events, with preference given to Goal (or the endpoint), rather than Source (the beginning).

denote not only change of location, but also *manner of motion*, *instrument of motion, medium of motion,* and other attributes.

Talmy (2000a, p. 26) makes a distinction between a basic motion event and an associated co-event: "a motion event can be associated with an external Co-event that most often bears the relation of Manner or of Cause to it". Thus, besides the above-mentioned four internal components of the core schema of motion, the *Manner* component reflects the manner in which the motion takes place, and the *Cause* is the cause of its occurrence. Talmy illustrates these components with sentences presented in the following Table 7.1.

	Manner	**Cause**
Motion	The pencil rolled off the table.	The pencil blew off the table.
Location	The pencil lay on the table.	The pencil stuck on the table (after I glued it)

Table 7.1 *Manner* and *Cause* in motion events expressing *motion* and *location*

In all these sentences *the pencil* functions as the Figure, *the table* as the Ground. Prepositions *off* and *on* express Paths. The verbs in the upper row, *rolled* and *blew*, express translational motion, while the verbs *lay* and *stuck* express location. Additionally, the verbs in the left column, *rolled* and *lay*, express the Manner of motion, while the verbs *blew* and *stuck* express the Cause of motion.

Talmy (1985; 2000b, Part 1) observed that different languages conflate the semantic components of the motion event in different ways. Based on the conflation patterns, Talmy has identified three main typological patterns of the mappings between meaning and form for the expression of motion events across languages. The *Motion+Co-event* pattern (Talmy, 2000b, p. 27–29) can be illustrated with sentences, such as "The rock rolled down the hill" (Motion+Manner), or "The napkin blew off the table" (Motion+Cause). It is characteristic of the Indo-European family except Romance languages, as well as Finno-Ugric, Chinese, and others. The *Motion+Path* pattern (Talmy, 2000b, p. 49–53) can be illustrated with sentences from Spanish, such as "La botella entró a la cueva (flotando)" [Lit. The bottle MOVED-in to the cave (floating), i.e. "The bottle floated into the cave")], and "La botella salió a la cueva (flotando)" [Lit. The bottle MOVED-out to the cave (floating), i.e. "The bottle floated out of the cave")]. It is characteristic of Romance and Semitic families of languages, as well as Japanese, Korean, Polynesian, Turkish and others. The *Motion+Figure* pattern (Talmy, 2000b, pp. 57–59) expresses the fact of Motion together with the Figure. It is characteristic of American Indian languages, but can also be observed in some English sentences, e.g. “It rained in through the bedroom window” (non-agentive) or “I spat into the cuspidor” (agentive).

Based on the patterns used for mapping the semantic components of the core schema (particularly Path) and co-events (Manner and Cause) onto the surface forms, Talmy (1991; 2000b, Part 1) proposed a distinction between two main categories of languages. In his typology languages that characteristically map the core schema into the verb are referred to as *Verb-framed languages* (V-languages). They tend to conflate Motion+Path in verbs, while a co-event of Manner or Cause is typically encoded with adverbials and gerunds, or left to inference. On the other hand, languages that characteristically map the core schema onto the satellite are referred to as *Satellite-framed languages* (S-languages). Generally, S-languages, including English and Polish, tend to conflate Motion+Manner in verb roots with encoding of Path in satellites and prepositional phrases.

These patterns, however, are not absolute. V-languages, such as Greek and Spanish have motion verbs that express Manner, and English has motion verbs that express Path, e.g. *cross*, *enter*, or *exit*. The Manner/Path asymmetry is even more salient in the following compositionality restriction: while in S-languages languages manner verbs can be combined freely with different kinds of Path modifiers, in V-languages, at least some of them, e.g. Spanish, manner verbs cannot be used with *telic* path phrases, i.e. ones marking an end-of-path location of the moving object (Aske, 1989; see also Slobin & Hoiting, 1994).

Talmy’s dichotomous division has been contested as inadequate for certain Asian languages, e.g. Chinese (Slobin, 2004) and Thai (Zlatev & Yangklang, 2004), which do not seem to fall into either category. Slobin (2004, 2006) proposed extending Talmy’s typology to include a third class of *Equipollently-framed languages* (E-languages), in which “path and manner are expressed by equivalent grammatical forms” (Slobin, 2004, p. 249). However, Talmy (2009) describes such languages as having a *parallel* system, i.e. having both satellite- and verb-framing properties. He concludes that “the concept of *equipollent framing* should only be applied to cases where a constituent expressing Path and a constituent expressing the co-event together serve most or all of a main verb-like function in a sentence, not where they are both outside a third constituent that does function as a main verb” (p. 401).

Levinson & Wilkins (2006, pp. 527–541) show through a wide array of cross-linguistic comparisons that Talmy’s typology is helpful for scrutiny of European languages, but does not entirely apply to a worldwide sample. A more recent study

(Beavers, Levin & Wei Tham, 2010) suggests a possibility of a much larger number of language types than those included in Talmy's proposal. Talmy (2005b) himself emphasizes that the lexicalization patterns of motion events reflect general tendencies, not absolute differences across languages, and that the typology is open to adding further categories. Despite these criticisms Talmy's typological framework still stands as an important contribution to our understanding of the processes of form–meaning connections for the expression of motion events in cross-linguistic contexts.

Filipović (2007) demonstrates how studying lexicalization patterns provides insights into how speakers of different languages organize experiential data in their accounts of events. By comparing two S-languages, English and Serbo-Croatian, she demonstrates that speakers of these two languages use two different algorithms for the processing of sentences expressing motion events. Studying lexicalization patterns of motion events contributes not only to typological studies, but has consequences for the practice of foreign language teaching and translation (see Cadierno, 2008, 2010; Hasko, 2010 for applications in the Second Language Acquisition).

7.4 Motion events in language and cognition

Since the linguistic system of encoding motion events varies strikingly across languages, it appears to be a particularly promising test bed for examining relations between language and thought.[91] The question of how the forms and content of a particular language might influence the thought of its users is associated with the American anthropologist-linguist Edward Sapir and his student Benjamin Lee Whorf, who asked some important questions about the influence of language on cognition in relation to cultural differences mirrored in linguistic patterns. As put by Whorf:

> [Language patterns and cultural norms] are constantly influencing each other. But in this partnership the nature of the language is the factor that limits free plasticity and rigidifies channels of development in the more autocratic way. This is so because a language is a system, not just an assemblage of norms. Large systematic outlines can change to something really new only very slowly, while many other cultural innovations are made with comparative quickness. Language thus represents the mass mind; it is affected by inventions and innovations, but affected little and slowly, whereas TO inventors and innovators it legislates with the decree immediate. (Whorf, 1939/1956a, p. 156).

[91] Other related domains where such studies have been conducted include linguistic encoding of time (e.g. Boroditsky, 2001; Casasanto, 2008) and linguistic encoding of spatial relations between static objects (e.g. Levinson, 2003; Majid, Bowerman, Kita, Haun & Levinson, 2004).

And in another text written around the same period:

> We dissect nature along lines laid down by our native languages. The categories and types that we isolate from the world of phenomena we do not find there because they stare every observer in the face; on the contrary, the world is presented as a kaleidoscopic flux of impressions which has to be organized by our minds – and this means largely by the linguistic systems in our minds. (Whorf, 1940/1956b, p. 213).

A hypothesis of *linguistic determinism*, which is implied in the above quotations, assumes that natural languages shape the way we think. Although it was generally rejected by mainstream linguistic and psychological research by the end of 1970s,[92] it returned in the 1990s in a more moderate form embracing several "stronger" and "weaker" variants, which may be generally subsumed under the umbrella term of *linguistic relativity* (Lucy, 1992a; 1992b; 1997; see Gumperz & Levinson, 1996; Gentner & Goldin-Meadow, 2003 for multidisciplinary collections of studies). Despite criticisms (e.g. Pullum, 1991, Ch. 19; Bloom & Keil, 2001; Pinker, 2007a, Ch. 3), it is still actively pursued in modern cognitive research, and even appears to enjoy a sort of Renaissance in contemporary psychological and linguistic discussion (see Reines & Prinz, 2009; Boroditsky, 2011a; Wolff & Holmes, 2011 for concise up-to-date reviews; Malt & Wolff, 2010 for a recent collection of edited papers).

Because the encoding of motion is a semantic dimension fundamental to all humans, yet the patterns of encoding differ significantly between languages, there has been a number of studies investigating whether the language characteristics affect speakers' higher-level cognitive processes related to representations of motion events. This domain is a particularly convenient testing ground because motion scenes are concrete and readily observable, which means that they can be easily controlled in testing. A particular area of interest concerns differences in reasoning about motion events between speakers of Path languages, like Greek or Spanish, and

[92] Linguistic determinism was strongly opposed by the *universalist perspective*, which essentially claims that cross-linguistic differences in verbal categories or syntactic constructions do not reflect conceptual but merely linguistic differences. The universal approach emphasizes that conceptual structures are identical across languages, attributing it to our shared human nature. As put by Noam Chomsky, the leading explicator of the universal approach "Language is a mirror of mind in a deep and significant sense. It is a product of human intelligence… By studying the properties of natural languages, their structure, organization, and use, we may hope to learn something about human nature; something significant, if it is true that human cognitive capacity is the truly distinctive and most remarkable characteristic of the species" (Chomsky, 1975, p. 4). See Hauser et al., 2002 for a contemporary outlook on the faculty of language.

Manner languages, like English. The Path/Manner distinction parallels, though not exactly, Talmy's (1991, 2000b) distinction between Verb-framed and Satellite-framed languages, discussed in the previous section.

Gennari, Sloman, Malt, and Fitch (2002) compared performance of English and Spanish speakers on a linguistic task with their performance on two non-linguistic tasks involving recognition memory and similarity judgments. Experiments were conducted with videotaped motion events in which the Manner or Path of the target event had been altered. Participants encoded the events while describing them verbally or not. Four options were taken into consideration. "*Strong*" *linguistic relativity* hypothesis (Lucy, 1992a; 1992b) holds that habitual thought[93] patterns are shaped by language used to represent the environment, which is acquired during language learning. *Thinking for speaking* hypothesis, developed by Slobin (1987, 1996a, 2003), is a more cautious reformulation of the linguistic relativity hypothesis. It holds that "there is a special kind of thinking that is intimately tied to language—namely, the thinking that is carried out on-line, in the process of speaking."[94] (Slobin, 1996a, p. 75). Slobin argues that on-line processes of language production and interpretation are influenced by those aspects of events that are made salient by their encoding in linguistic descriptions.[95] *Language as strategy* hypothesis is another "weak" variant of the linguistic relativity, which was suggested by Kay and Kempton (1984) in the context of recognition of boundaries between colors. It proposes that people are influenced by language only when performing certain tasks, for example, classification or judgments of similarity, but the influence of linguistic characteristics on mental representations disappears when people are not using language. As a fourth option, the experimenters took into consideration a possibility that conceptual organization is independent from linguistic patterns.

[93] Since Whorf (1939/1956a) did not state precisely what he meant by "habitual thought", it has been interpreted quite flexibly in different studies.

[94] Although Slobin uses the label "thinking for speaking" his hypothesis ultimately includes all forms of linguistic production (speaking, writing) and reception (listening, reading), as well as a range of mental processes, such as understanding, imaging, and remembering (Slobin, 2003).

[95] According to Slobin (1996a, 1996b, 1997), for speakers of English, the habitual target of attention is Manner, since it is encoded directly in the verb. Because of that, it is more frequently expressed, and thus more cognitively salient. In contrast, for Spanish speakers Manner is less cognitively available because it is less frequently expressed as not being as readily encodable in verbs. This difference in language production and processing predisposes speakers of English and Spanish to pay attention to different aspects of experience. English speakers are presumed to make finer distinctions of Manner.

The study did not find any evidence that language was mediating or influencing recognition performance. No effect of language in the recognition memory task was observed after either linguistic or non-linguistic encoding. However, a linguistic effect was observed in the similarity task: it prompted responses consistent with the linguistic patterns, but only after verbal description. There was no effect of language in the similarity task after non-linguistic encoding. The results indicate that certain non-verbal tasks such as similarity judgments may be influenced by language, which lends some support to the *language as strategy* hypothesis. The results are also partly consistent with the *thinking for speaking* hypothesis, but remotely since linguistic encoding did not have a detectable effect in the recognition task. Despite lending some support to "weaker" variants of the linguistic relativity hypothesis, the results did not bring a definite answer. Conflicting pieces of evidence that were collected in the study allow as well for the interpretation that conceptual representations of motion events are universal and relatively independent of linguistic representations.

Papafragou, Massey and Gleitman (2002) designed two studies to compare the performance of English and Greek children and adults. In one experiment participants solved nonlinguistic tasks involving motion events. In a corresponding experiment linguistic descriptions of the same motion events were compared. The study found that even though the two linguistic groups differed significantly in terms of their linguistic preferences, their performance in the nonlinguistic tasks was identical. A subsequent study (Papafragou, Massey & Gleitman, 2006) also compared motion descriptions produced by English and Greek children and adults. It found that Greek speakers mentioned the manner of motion in their descriptions of motion events significantly more frequently when it was not inferable. By contrast, inferability of manner had no measurable effect on motion descriptions in English, where Manner is already encoded in verbs. The results demonstrated that Greek speakers actively monitor and presuppose the manner of motion, even though their language favors the use of Path verbs.

An eye-tracking study (Papafragou, Hulbert & Trueswell, 2008) compared eye movements of Greek and English adults as they viewed motion events. One experiment examined how speakers of different languages visually inspect a motion scene as they prepare verbal descriptions (a linguistic task). Another monitored shifts in eye movements as participants were memorizing a motion scene (a nonlinguistic task). During the linguistic task, speakers' eyes followed the event components typically encoded in their native language. While watching motion scenes in the nonlinguistic task, participants allocated attention in a similar manner, regardless of their native language. However, when the motion scenes stopped in the nonlinguistic task, differences between language groups arose: as participants were committing facts to memory they spontaneously studied those aspects of the scene that their language does not routinely encode in verbs. The results indicate that effects of language on mental representations of motion events arise when linguistic forms are recruited to achieve the task at hand, which lends some support to Slobin's (1996a, 2003) *thinking for speaking* hypothesis.

Papafragou and Selimis (2010) compared categorization preferences for motion events by English and Greek adults and 5-year-olds. The study explored linguistic effects observed earlier in similarity judgments by (Gennari et al., 2002). Language-congruent categorization preferences emerged in tasks that implicitly encouraged the use of linguistic stimuli during event apprehension. The results suggest that there exist on-line linguistic intrusions that correspond to language-specific event encoding preferences, but these effects are temporary and task-dependent. They do not reflect a permanent reorganization of the underlying cognitive representation of motion.

As summarized by Gleitman and Papafragou (2012) cognitive studies of motion representation between speakers of Satellite- and Verb-framed languages suggest that the conceptual organization of space and motion is independent of language specific patterns. Just as obvious, however, is that language influences on-line thought in many ways. Although cross-linguistic differences do not overrun event apprehension, language can be recruited to help event encoding, particularly in tasks that involve heavy cognitive load. These patterns are temporary in the sense that they do not change the nature of motion apprehension itself. In some cases, they emerge in the course of handling linguistic instructions for a cognitive task. In other cases, linguistic information is used on-line to recode non-linguistic stimuli for a task that requires no language use. However, "in neither case of linguistic intrusion does language reshape or replace other cognitive formats of representation, but it does offer a mode of information processing that is often preferentially invoked during cognitive activity" (Gleitman & Papafragou, 2012, p. 559).

7.5 Space and time in motion-framed distance

This study investigates what is termed in this paper as *motion-framed distance* (cf. *motion-framed location* discussed by Tutton, 2012). It refers to a distance that separates one point from another in space in the semantic context of motion events. The research aims to observe a proportion of temporal vs. spatial representations of the motion-framed distance in everyday language of English and Polish speakers.

To investigate how frequently it is denoted with spatial vis-à-vis temporal representations this research employs *corpus-based cognitive linguistics*, which is an approach to language study that brings together the descriptive framework of cognitive linguistics with the methodological workbench of corpus linguistics.

Corpus-based cognitive linguistics, as discussed in Chapter 5, relies on explanatory notions adopted by the cognitive linguistics framework, but approaches them in such a way that their relevance to a given linguistic phenomenon can be empirically validated in large corpora, frequently with an aid of advanced statistical techniques (Heylen et al., 2008, p. 92). More specifically, this study employs a *corpus-based* approach, i.e. one that relies upon quantitative analysis applied to a large corpus regarded as a representation of natural language (Tummers et al., 2005).

7.5.1 Research methodology

In order to verify how natural it is to express the motion-framed distance with spatial vis-à-vis temporal representations in everyday language this study employs the *British National Corpus* (henceforth, the BNC) and the *Polish National Corpus* (henceforth, the NCP). The BNC is a 100 million word collection of samples of written and spoken contemporary British English from a wide range of texts, genres, and registers (Aston & Burnard, 1998; see www.natcorp.ox.ac.uk for more information). The NCP is a 240 million word collection of samples of both spoken and written contemporary Polish, which loosely mirrors the BNC in its structure (Przepiórkowski et al., 2012; see www.nkjp.pl for more information). They have an important advantage of being *standard reference* corpora (McEnery & Wilson, 2001, p. 32). Both have been extensively used by researchers in a variety of contexts, including applications of the BNC in research on motion events (e.g. Filipović, 2007).

The search for representations of the motion-framed distance in spatial and temporal terms was implemented by looking for frequencies of *spatial* and *temporal adverbials* (Lyons, 1977; Haspelmath, 1997). Adverbials examined in this study express *absolute distance*, i.e. denoted in spatial, e.g. "4,348 kilometers across Australia", or temporal units, e.g. "fifteen minutes from York". Although the use of adverbials represents a fundamental way of denoting spatial extension, it is far from being exhaustive of the entirety of ways used for representing distance in language. Therefore, it must be emphasized that the aim of this study is not to examine the full array of linguistic means available for denoting spatial extents, but to observe a general proportion between spatial and temporal expressions of distance in the context of motion events.

This study is additionally restricted to examining representations of the motion-framed distance for two semantic aspects of *manner* and *instrument* of motion. It has long been recognized that instrument and manner are not easily disentangled. Instrumentality plays a fundamental role in processing semantic primes of actions, events, movement, and contact (Goddard & Wierzbicka, 2009; Wierzbicka, 1996). Essentially, instrument and manner share common conceptual ground and participate in the action described by the verb simultaneously in a coordinate manner (see Mari, 2006; Mari & Saint-Dizier, 2006). Goddard and Wierzbicka (2009) demonstrate that semantics of physical activity verbs in English, Polish, and Japanese ties the kind of instruments used in the action with the manner in which the instrument is used.

A close relatedness of manner and instrument occurs for motion verbs, too. For instance, the verb *drive* expresses a certain manner of motion, which can be additionally specified by an instrumental adverbial, e.g. *drive by car*. However, in sentences such as "Every day John drives to work through the suburbs of London", unless additionally specified, the meaning of *drive* entails instrumentality, since it is generally understood as *traveling by car*. And vice-versa, motion verbs derived from nouns denoting vehicle names, e.g. *bicycle*, essentially denote the instrument of motion, but also specify a certain manner in which the motion takes place (*overland self-propelled locomotion* in this case). Therefore, at least for certain motion verbs, it is impossible to make an absolute distinction between instrument and manner because they form a kind of semantic continuum.

7.6 Motion-framed distance in the BNC

English as an S-language marks semantically the manner of motion in verb roots (Talmy, 2000b, Part 1). For that reason, the search for representations of motion-framed distance for the semantic aspect of motion manner was implemented by looking for distance expressions involving verbal roots. Eight verbs marking different manners of pedestrian motion, locomotion, aquamotion, and aeromotion were taken into consideration: *cruis(e), driv(e), fly, march, rid(e), sail, tour,* and *walk*. This selection is far from being exhaustive, since English has an enormous variety of motion verbs of manner (Levin, 1993, Ch. 51; Slobin, 2004; Filipović, 2007). The search was implemented with the following lexical pattern:

QUANTIFIER + SPATIAL OR TEMPORAL UNIT + MOTION VERB ROOT + SPATIAL PREPOSITION; SLOP FACTOR=3, PRESERVE ORDER=NO

Because one cannot expect lexical items from this lexical pattern to always follow directly one after another in everyday language, searching was implemented with *proximity queries* to afford for occurrence of additional modifiers between the query terms. Essentially, proximity queries (Bernard & Griffin, 2009) allow for searching with a *slop* factor, which specifies how far apart lexical items included in a query can be from one another to be still returned as a result to the query. It can be used in combination with a binary (yes/no) *preserve order* option, which indicates whether the original order of query terms should be preserved in results. For the purpose of this research, queries were implemented in a relaxed manner with the *slop* value of 3, and the *preserve order* option set to "no".

To boost precision of proximity queries, quantifiers (cardinal numbers and determinatives used with countable nouns) were incorporated in the pattern. It was possible thanks to the part-of-speech annotation of the BNC, which marks cardinal numbers, spelled both in words and digits, with the <CRD> tag (Garside et al., 1997). Units of space measurement selected for analysis include both metric and imperial units typically used in the U.K., also in their American variants of spelling, i.e. *kilometre (kilometer), metre (meter), mile,* and *yard*. Units of time measurement selected for investigation include ones typically used to express duration of traveling, i.e. *minutes, hours,* and *days*. The adverbial pattern was finally specified with a set of fifteen prepositions conveying spatial relations: *across, ahead, along, apart, away, behind, between, beyond, from, off, over, through, to, towards, within*.

Since the *preserve order* option is set to "no", this pattern identifies expressions with the preposition both in the initial, e.g. "He lives in a flat within two minutes walk of his office", and the final position, e.g. "The sandy beach is an easy 160 metre walk from the hotel". Unfortunately, proximity queries increase the recall of the result sets at the expense of their precision (see Pęzik, 2011). For that reason, the resulting set was carefully reviewed to eliminate matches sharing the defined sequence/proximity of lexical items by coincidence, e.g. "A boy who looked about sixteen walked from his front yard to the car". Out of 1297 concordance lines retrieved from the corpus, 967 were recognized as valid representations of the motion-framed distance in spatial or temporal terms. The results found for the selected verb roots are presented in Table 7.2.

Manner of motion	Denoted in spatial terms	Denoted in temporal terms
cruis(e)	3	12
driv(e)	68	156
fly	10	20
march	10	23
rid(e)	26	28
sail	11	15
tour	3	19
walk	209	354
Total	**340**	**627**
Proportion	**35%**	**65%**

Table 7.2 Representations of motion-framed distance in spatial and temporal terms found in the BNC for the semantic aspect of motion manner

Table 7.2 shows that for the semantic aspect of motion manner the number of temporal representations 627 (65%) of the motion-framed distance significantly exceeds the number of representations in spatial terms 340 (35%). This tendency is particularly conspicuous for verbs amply represented in the corpus, i.e. *drive* and *walk*, which indicates that the overall result does not arise from a coincidental occurrence in the BNC.

A similar procedure was implemented for the semantic aspect of motion instrument. The pattern was modified to include, instead of verb roots, prepositional phrases marking the instrument of motion (Talmy, 2000b, Part 1). A selection of instruments was restricted to eight common means of private and public transportation, which are typically marked semantically in English with set prepositional phrases: *by bike, by boat, by bus, by car, by coach, by plane / jet, by train*, and *on foot*. This selection is far from being exhaustive and is dictated by availability of relevant examples in the corpus. For instance, the word *plane* yields only a single valid representation of distance from the BNC, therefore it was coupled with *jet*. The following lexical pattern was used in queries:

QUANTIFIER + SPATIAL OR TEMPORAL UNIT + PREPOSITIONAL INSTRUMENTAL PHRASE; SLOP FACTOR=3, PRESERVE ORDER=NO

The search was implemented in a similarly relaxed manner using *proximity queries* with the *slop* value of 3, and the *preserve order* option set to “no”. Again, quantifiers were employed to boost the precision of proximity queries. Identical selections of space and time measurement units were used.

The resulting set of examples was carefully reviewed to eliminate irrelevant matches sharing the defined sequence/proximity of lexical items by coincidence. Out of 131 concordance lines retrieved from the corpus, 94 were recognized as valid representations of the motion-framed distance in spatial or temporal terms, e.g. "The Brighton Motel is situated 15 minutes from Brighton centre by car". The results found for the selected prepositional phrases are presented in Table 7.3.

***Instrument* of motion**	**Denoted in spatial terms**	**Denoted in temporal terms**
by bike	0	2
by boat	1	4
by bus	1	13
by car	4	18
by coach	0	6
by plane/jet	0	3
by train	4	22
on foot	7	9
Total	**17**	**77**
Proportion	**18%**	**82%**

Table 7.3 Representations of motion-framed distance in spatial and temporal terms found in the BNC for the semantic aspect of motion instrument

Table 7.3 shows that for the analyzed instruments of motion the number representations of motion-framed distance in temporal terms 77 (82%) significantly exceeds the number of representations in spatial terms 17 (18%). Although the overall number of examples identified for the instrument is not as ample as for the manner of motion, it is substantial enough to presume that the proportion is not coincidental. A listing of queries used to obtain the results for English together with explanatory notes is provided in the Appendix to this chapter (see also Waliński, 2013a for the listing of queries accompanied by corresponding concordances retrieved from the BNC).

7.7 Motion-framed distance in the NCP

In order to check whether the tendency observed for English occurs cross-linguistically, a parallel investigation for the same semantic aspects of motion was conducted for Polish using the NCP. Polish also belongs to the *Satellite-framed* group of languages (Talmy, 2000b, Part 1), which generally mark manner of motion in verb roots. Slavic languages use Motion+Manner conflation rather less specifically than English, relying instead on additional prepositional phrases and nominal forms (see Hasko & Perelmutter, 2010). As an inflectional language Polish relies more heavily on morphology for marking specific aspects of motion semantics. In Polish representations of motion-framed distance for the semantic aspect of motion manner are frequently marked with the genitive case of deverbal nouns derived from motion verbs. As noted by Janda (2009, p. 106), "the genitive case in Russian and Czech (and probably Polish) can be described as a network of meanings all of which describe a trajectory at or near a landmark".

Corresponding lexical items for Polish were identified with the help of the *PWN-Oxford English-Polish Dictionary* (2004). For the manner of motion, the following set of genitive deverbal nominal forms was used: *rejsu* [cruise, voyage, flight], *jazdy* [drive, ride, cruise], *lotu* [flight], *marszu* [march], *żeglugi* [sail], *spaceru* [walk], *zwiedzania* [tour, cruise], *podróży* [journey]. Since it is impossible to find perfectly overlapping *semantic maps* across languages (Haspelmath, 2003; Janda, 2009), it is impossible to find exhaustive one-to-one correspondences between English and Polish motion verbs[96] (see Kopecka, 2010). Despite the fact that the mappings across selections are fairly convoluted, it is plausible to assume that both sets mark correspondent semantic fields. The following lexical pattern was used for queries:

SPATIAL OR TEMPORAL UNIT + GENITIVE CASE OF DEVERBAL MOTION NOUN; SLOP FACTOR=1, PRESERVE ORDER=YES

[96] Kopecka (2010, p. 241) notes that "Polish does not exploit the slot of the main verb as productively as English does. In Polish, the size of the Manner verb lexicon, although still substantial, appears to be smaller, and the sorts of fine-grained semantic components of Manner lexicalized in the verbs are less diverse". Correspondences between English and Polish verbs of motion appear to be rather convoluted. For example, verbs *ride* and *drive* are largely subsumed in the Polish verb *jechać*, which is used for all sorts of overland means of transportation. The English verb *tour* is partly subsumed in the Polish transitive verb *zwiedzać*, and partly in the Polish intransitive verb *podróżować*, but their combination is probably far from being a complete representation of its meaning. The verb *walk* is to some extent subsumed in the Polish verb *spacerować*, but it can be rendered in the opposite direction by numerous English verbs, such as *amble, mosey, perambulate, promenade, saunter,* and *stroll*. The verbs *march* (*maszerować*), *fly* (*latać*), and *sail* (*żeglować*), seem to be largely correspondent at first glance, but they also have uses which are not compatible, e.g. *latać po zakupy - to run around shopping*. The topic of correspondences between English and Polish verbs of motion manner deserves a separate publication.

Because the PELCRA concordancer does not support part-of-speech tags, quantifiers could not be used to boost precision of proximity queries. For that reason, a more restricted pattern was used, with the *slop* value of 1, and the *preserve order* option set to "yes", to prevent excess of coincidental matches. Since the NCP is over twice as large as the BNC, it yields a comparable number of examples even with this more restricted search specification. Units of time measurement selected for Polish include *minuta, godzina, dzień* [minute, hour, day], and units of space measurement *kilometr, metr, mila* [kilometer, meter, mile].

Corpus queries found altogether 1406 examples matching the query terms in the NCP. The resulting set was reviewed to exclude coincidental hits. In the outcome, 1096 concordance lines were recognized as valid representations of the motion-framed distance in spatial or temporal terms. The results found for the genitive forms of deverbal nouns derived from motion verbs are presented in Table 7.4.

***Manner* of motion**	**Denoted in spatial terms**	**Denoted in temporal terms**
rejsu	0	22
jazdy	34	391
lotu	8	138
marszu	16	213
żeglugi	4	30
spaceru	2	44
zwiedzania	0	17
podróży	7	177
Total	**64**	**1032**
Proportion	**6%**	**94%**

Table 7.4 Representations of motion-framed distance in spatial and temporal terms found in the NCP for the semantic aspect of motion manner

Table 7.4 shows that the inclination to express motion-framed distance in temporal terms for the semantic aspect of motion manner can also be observed in Polish. The number of representations in temporal terms 1032 (94%) significantly exceeds the number of representations in spatial terms 64 (6%). The difference in proportion is even greater than that observed for English. Since the tendency occurs consistently for each analyzed deverbal form, in particular for those amply represented in the corpus, i.e. *jazdy, marszu* and *podróży*, it indicates that the overall proportion does not arise from a coincidental occurrence in the corpus.

A parallel investigation was executed for the semantic aspect of motion instrument. Polish typically marks the instrumentality of motion with the instrumental case of transportation means and/or prepositional phrases. The pattern was modified to include instrumental forms of transportation means instead of genitive forms of deverbal nouns. A selection of instruments was restricted to the same means of transportation that were investigated for English: *rowerem* [by bike], *łodzią* [by boat], *autobusem* [by bus], *samochodem* [by car], *autokarem* [by coach], *samolotem / odrzutowcem* [by plane / jet], *pociągiem* [by train], piechotą [on foot]. The pedestrian motion was additionally specified with the prepositional phrase *na piechotę* [on foot], which is frequently used in this context. Despite the fact that it is impossible to find exhaustive semantic one-to-one correspondences between English and Polish expressions, it seems that both sets mark parallel semantic fields. The following lexical pattern was used in queries:

SPATIAL OR TEMPORAL UNIT + INSTRUMENTAL CASE OF TRANSPORTATION MEANS; SLOP FACTOR=1, PRESERVE ORDER=YES

Corresponding lexical items for Polish were identified with the help of the *PWN-Oxford English-Polish Dictionary* (2004). For the aspect of motion instrument, the corpus search for spatial and temporal representations of the motion-framed distance was implemented in a parallel manner using proximity queries with the *slop* value of 1, and the *preserve order* option set to "yes". The same selection of spatial and temporal units of measurement was used.

Corpus queries implemented for Polish found altogether 397 examples matching the query terms in the NCP. The resulting set was reviewed to exclude coincidental hits. In the outcome, 279 concordance lines were recognized as valid representations of the motion-framed distance in spatial and temporal terms. The results found for the instrumental forms of transportation means are presented in Table 7.5.

Instrument of motion	Denoted in spatial terms	Denoted in temporal terms
rowerem	8	8
łodzią	0	5
autobusem	3	36
samochodem	10	82
autokarem	0	5
samolotem / odrzutowcem	2	11
pociągiem	1	44
piechotą / na piechotę	24	30
Total	**48**	**221**
Proportion	**18%**	**82%**

Table 7.5 Representations of motion-framed distance in spatial and temporal terms found in the NCP for the semantic aspect of motion instrument

Table 7.5 shows that for the semantic aspect of motion instrument the inclination to express motion-framed distance in temporal terms can also be observed in Polish. The number of representations in temporal terms 221 (82%) significantly exceeds the number of representations in spatial terms 48 (18%). The proportion matches that observed for English. It is noticeable that it is more conspicuous for some instruments, e.g. *samochodem, pociągiem* than for others, e.g. *rowerem, na piechotę*, where it is more balanced. However, since the number of examples retrieved from the NCP for this semantic aspect is quite substantial, it is plausible to assume that the overall proportion does not arise from a coincidental occurrence in the corpus. A listing of queries used to obtain the results for Polish together with explanatory notes is provided in the Appendix to this chapter (see also Waliński, 2013b for the listing of queries employed in this research accompanied by corresponding concordances retrieved from the NCP).

7.8 Findings for *manner* and *instrument* of motion

The above-reported results indicate that in the semantic context of motion events English and Polish speakers have a tendency to express motion-framed distance both in spatial and temporal terms, with temporal representations being used more frequently. Since the inclination to express motion-framed distance in temporal terms occurs cross-linguistically, it appears to be modulated by the presence of the semantic element of motion, rather than by lexical patterns alone. The results suggest that in the semantic context of motion events space and time can be regarded as complementary to one another, rather than being asymmetrically dependent. This complementarity can be observed more directly in certain instances of language use found through a concordance analysis, e.g. "[Apartments are] situated only 200 metres from the beach and within a three minute walk from the shops and nightlife" (found in the BNC) or "I visited Kadyny – located one kilometer away from the Vistula Lagoon and half an hour away from Elbląg" [PL: odwiedziłam Kadyny – kilometr od Zalewu Wiślanego, pół godziny drogi od Elbląga] (found in the archive of the National Corpus of Polish). Such examples demonstrate that spatial and temporal representations can act on an equal footing in expressions of distance and location in space (see also Tutton, 2012).

Although it is impossible to discuss linguistic tendencies in absolute numbers, the proportions of spatial vs. temporal representations found in the corpora for two different (though closely related) semantic aspects of motion indicate that expressing spatial distance in temporal terms is the preferred way of denoting spatial extents in the semantic context of motion events. The inclination to conceptualize spatial distance in temporal terms can be conceptually motivated by the fundamental difference between static configurations of objects and energetic interactions conceptualized as events.

Each event is embedded in a *spatial–temporal framework*, which acts as the basic organizing factor for mental representations of events in mental models (Radvansky & Zaacks, 2011). In the *canonical event model* proposed by Langacker (1991, Ch. 7; 2008a, Ch. 11; see Section 4.7), for static objects the primary domain of instantiation is space, but for force-dynamic interactions, which are conceptualized as events, the primary domain of instantiation is time (see Rappaport Hovav et al., 2010, pp. 2–4 for an overview of various temporal dimensions involved in *event structure*). According to Langacker, any force-dynamic event unfolds primarily in time, where it is temporally bounded and has its own temporal location. Accordingly, motion events are naturally more complex than spatial objects, and inherently involve the temporal dimension as the primary domain of their conceptualization. For that reason, it is natural for temporal representations to frequently figure in linguistic expressions of the motion-framed distance.

7.9 Complementarity of space and time in motion-framed distance

Language reflects *topological* cognition of space, which abstracts away the metric properties of shape, size, angle, and distance, but focuses instead on relative relationships rather than absolutely fixed quantities (Talmy, 2000a, Ch. 1 & 3). Since the linguistic representation of space is largely relativistic and approximate, rather than Euclidean and quantitative, it comes naturally to language users to express spatial distance in terms of the time required to execute a motion event. This way of expressing distance is highly versatile. It can be used to express a distance unknown precisely in spatial terms, e.g. "The village centre is about seven minutes walk away", and allows for expressing a distance from the speaker's subjective point of view as a particularly short/long way to a destination, e.g. "The station's only five minutes away" (which may equal to about 10 kilometers, if traveling by fast train), "The main camp must be nearly two days march away" (which may also equal to about 10 kilometers, if marching in a particularly difficult mountain/arctic terrain). Denoting spatial distance in terms of travel time is particularly convenient in urban environments, where reaching usual destinations depends not as much on the spatial separation as on the traffic intensity at different times of the day (Wagner, 2006, p. 16).

It is noteworthy that temporal representations of the motion-framed distance are practically always vague, at least to some extent. For example, the sentence "The two university towns of Cambridge and Oxford are within an hour's driving distance" (from the BNC) does not indicate the distance precisely. The Google Maps service indicates that the shortest route between these towns by A421 road stretches for 84.1 miles, which in practice can possibly take about an hour of driving time. Representations of the motion-framed distance in temporal terms reflect the inherently ubiquitous vagueness of natural language (Tuggy, 1993; Keefe, 2000), and demonstrate that conceptualizations of the environmental space in everyday situations are largely rough and schematic (Montello, 1997, 2009; Tversky, 2005a, 2009).

Because our perception of time cannot be attributed to any particular sensory modality, it seems that all of us are highly susceptible to a cognitive illusion (cf. A. Tversky & Kahneman, 1974; Kahneman, 2011), which makes us generally approach time as more abstract than space. However, as shown in this study, in semantic contexts involving motion it is absolutely natural for us to specify the distance to Mars in months of space traveling, or the distance to Mt. Everest peak in days of climbing, without even noticing the conceptual shift from spatial to temporal domain of representation. This indicates that in dynamic contexts space and time are closely tied and neither can be regarded as the metaphorical extension of the other (see also Engberg-Pedersen, 1999; Langacker, 2012).

Consequently, it appears that the relationship between the cognitive domains of space and time in language depends, at least to some extent, on the underlying structures of objects and events, rather than space and time as such. This can be observed further in linguistic representations of spatial extension with *fictive motion* (Langacker, 1986; 2008a, Ch. 14.2; Talmy, 1996; 2000a, Ch. 2), which has been disregarded in this study and is discussed in the following chapter.

Appendix to Chapter 7

1. Explanations for query listings

For English, this study is based on the BNC World edition published in 2001. The corpus was searched with SlopeQ, a part-of-speech-sensitive concordancer for the BNC offering support for proximity queries. For Polish, the balanced edition of the NCP was used with the PELCRA online concordancer (see Pęzik, 2012b for an overview), which is available publicly at: http://www.nkjp.uni.lodz.pl/index_adv.jsp with full support for proximity queries. The number of returned results was set to the maximum of 10000 (available via "Paging" option). The values used for SLOP factor (available via "Slop" option), and "Preserve order" option are indicated separately for each set of queries listed below. A single asterisk (*) replaces any number of characters, e.g. [driv*] substitutes for "drive, driving, driven, etc." The vertical bar symbol a.k.a. *pipe* (|) stands for logical AND, which enables executing multiple queries in a single line. For example, the query [by plane|jet] substitutes for two separate queries "by plane" and "by jet". The PELCRA online concordancer offers an underlying Polish morphological dictionary, which allows for queries incorporating all Polish inflectional forms with the double asterisk (**) used as a wildcard. For example, the query [rok**] substitutes for "rok, roku… lat, lata… etc."

2. Corpus queries used to examine representations of motion-framed distance in spatial and temporal terms for the semantic aspect of motion *manner* in the BNC.

a) For spatial units [SLOP=3, Preserve order=NO]

cruis(e): [<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* cruis* across|ahead|along|apart|away|behind|between|beyond|from|off|over|through|to|towards|within]

driv(e): [<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* driv* across|ahead|along|apart|away|behind|between|beyond|from|off|over|through|to|towards|within]

fly: [<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* fly* across|ahead|along|apart|away|behind|between|beyond|from|off|over|through|to|towards|within]

march: [<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* march* across|ahead|along|apart|away|behind|between|beyond|from|off|over|through|to|towards|within]

rid(e): [<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* rid* across|ahead|along|apart|away|behind|between|beyond|from|off|over|through|to|towards|within]

sail: [<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* sail* across|ahead|along|apart|away|behind|between|beyond|from|off|over|through|to|towards|within]

tour: [<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* tour* across|ahead|along|apart|away|behind|between|beyond|from|off|over|through|to|towards|within]

walk: [<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* walk* across|ahead|along|apart|away|behind|between|beyond|from|off|over|through|to|towards|within]

b) For temporal units [SLOP=3, Preserve order=NO]

cruis(e): [<CRD>|a|an|few|many|several|some minute*|hour*|day|days cruis* across|ahead|along|apart|away|behind|between|beyond|from|off|over|through|to|towards|within]

driv(e): [<CRD>|a|an|few|many|several|some minute*|hour*|day|days driv* across|ahead|along|apart|away|behind|between|beyond|from|off|over|through|to|towards|within]

fly: [<CRD>|a|an|few|many|several|some minute*|hour*|day|days fly* across|ahead|along|apart|away|behind|between|beyond|from|off|over|through|to|towards|within] *march:* [<CRD>|a|an|few|many|several|some minute*|hour*|day|days march* across|ahead|along|apart|away|behind|between|beyond|from|off|over|through|to|towards|within]

rid(e): [<CRD>|a|an|few|many|several|some minute*|hour*|day|days rid* across|ahead|along|apart|away|behind|between|beyond|from|off|over|through|to|towards|within]

sail: [<CRD>|a|an|few|many|several|some minute*|hour*|day|days sail* across|ahead|along|apart|away|behind|between|beyond|from|off|over|through|to|towards|within]

tour: [<CRD>|a|an|few|many|several|some minute*|hour*|day|days tour* across|ahead|along|apart|away|behind|between|beyond|from|off|over|through|to|towards|within]

walk: [<CRD>|a|an|few|many|several|some minute*|hour*|day|days walk* across|ahead|along|apart|away|behind|between|beyond|from|off|over|through|to|towards|within]

3. Corpus queries used to examine representations of motion-framed distance in spatial/temporal terms for the semantic aspect of motion *instrument* in the BNC.

a) For spatial units [SLOP=3, Preserve order=NO]

by bike: [<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* by bike]

by boat: [<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* by boat]

by bus: [<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* by bus]

by car: [<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* by car]

by coach: [<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* by coach]

by plane/jet: [<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* by plane|jet]

by train: [<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* by train]

on foot: [<CRD>|a|an|few|many|several|some kilomet*|metre*|meter*|mile*|yard* on foot]

b) For temporal units [SLOP=3, Preserve order=NO]

by bike: [<CRD>|a|an|few|many|several|some minute*|hour*|day|days by bike]

by boat: [<CRD>|a|an|few|many|several|some minute*|hour*|day|days by boat]

by bus: [<CRD>|a|an|few|many|several|some minute*|hour*|day|days by bus]

by car: [<CRD>|a|an|few|many|several|some minute*|hour*|day|days by car]

by coach: [<CRD>|a|an|few|many|several|some minute*|hour*|day|days by coach]

by plane/jet: [<CRD>|a|an|few|many|several|some minute*|hour*|day|days by plane|jet]

by train: [<CRD>|a|an|few|many|several|some minute*|hour*|day|days by train]

on foot: [<CRD>|a|an|few|many|several|some minute*|hour*|day|days on foot]

4. Corpus queries used to examine representations of motion-framed distance in spatial and temporal terms for the semantic aspect of motion *manner* in the NCP.

a) For spatial units [SLOP=1, Preserve order=YES]

rejsu: [kilometr**|metr**|mila** rejsu]

jazdy: [kilometr**|metr**|mila** jazdy]

lotu: [kilometr**|metr**|mila** lotu]

marszu: [kilometr**|metr**|mila** marszu]

żeglugi: [kilometr**|metr**|mila** żeglugi]

spaceru: [kilometr**|metr**|mila** spaceru]

zwiedzania: [kilometr**|metr**|mila** zwiedzania]

podróży: [kilometr**|metr**|mila** podróży]

b) For temporal units [SLOP=1, Preserve order=YES]

rejsu: [minuta**|godzina**|dzień** rejsu]
jazdy: [minuta**|godzina**|dzień** jazdy]
lotu: [minuta**|godzina**|dzień** lotu]
marszu: [minuta**|godzina**|dzień** marszu]
żeglugi: [minuta**|godzina**|dzień** żeglugi]
spaceru: [minuta**|godzina**|dzień** spaceru]
zwiedzania: [minuta**|godzina**|dzień** zwiedzania]
podróży: [minuta**|godzina**|dzień** podróży]

5. Corpus queries used to examine representations of motion-framed distance in spatial/temporal terms for the semantic aspect of motion *instrument* in the NCP.

a) For spatial units [SLOP=1, Preserve order=YES]

rowerem: [kilometr**|metr**|mila** rowerem]
łodzią: [kilometr**|metr**|mila** łodzią]
autobusem: [kilometr**|metr**|mila** autobusem]
samochodem: [kilometr**|metr**|mila** samochodem]
autokarem: [kilometr**|metr**|mila** autokarem]
samolotem/odrzutowcem: [kilometr**|metr**|mila** samolotem|odrzutowcem]
pociągiem: [kilometr**|metr**|mila** pociągiem]
piechotą/na piechotę: [kilometr**|metr**|mila** piechotą|piechotę]

b) For temporal units [SLOP=1, Preserve order=YES]

rowerem: [minuta**|godzina**|dzień** rowerem]
łodzią: [minuta**|godzina**|dzień** łodzią]
autobusem: [minuta**|godzina**|dzień** autobusem]
samochodem: [minuta**|godzina**|dzień** samochodem]
autokarem: [minuta**|godzina**|dzień** autokarem]
samolotem/odrzutowcem: [minuta**|godzina**|dzień** samolotem|odrzutowcem]
pociągiem: [minuta**|godzina**|dzień** pociągiem]
piechotą/na piechotę: [minuta**|godzina**|dzień** piechotą|piechotę]

Chapter 8

Atemporality of coextension paths

> *Objects, particularly physical objects, look deceptively easy to handle from a cognitive point of view . . . Events, on the other hand, have never deceived. In terms of categorization and cognition, they are hard to handle from the beginning.*
>
> William Croft (1998) *The Structure of Events*

8.1 Fictive motion

A number of cognitive linguistic studies discuss a particular use of motion verbs in sentences such as:

(1) The road goes downhill steeply into the valley.
(2) This wire fence goes all the way down to the wall.

These examples, found in the BNC, demonstrate that the meaning of motion verbs can be semantically extended to express spatial relations that do not involve motion *per se* nor change of state. Figurative representations of motion attributed to immobile material states, objects, or abstract concepts are regarded as *fictive motion*[97] (Langacker, 1986; 2005; 2008a, Ch. 14.2; Talmy 1996; 2000a, Ch. 2). Fictive motion embraces a wide range of linguistic expressions in which actual physical motion is backgrounded, and another information is foregrounded to convey a metaphorical image.

The above sentences (1) and (2) illustrate a specific category of fictive motion used in representations of static spatial relations, which is termed by Talmy (2000a, Ch. 2) *coextension paths*. "A coextension path is a depiction of the form, orientation,

[97] This type of motion was labeled in earlier cognitive linguistic studies as "abstract motion" and "subjective motion" (Langacker, 1986; Matsumoto, 1996). However, later publications (Langacker, 2005, 2008a, 2008c; Talmy, 1996, 2000a) use the term "fictive motion", which reduces terminological confusion.

or location of a spatially extended object in terms of a path over the object's extent" (Talmy, 2000a, p. 138). The object is stationary and there is no entity traversing the depicted path, however, it is represented as moving along or over its spatial configuration, like in the above-examples.

Matsumoto (1996) points out some intriguing characteristics of fictive motion expressions from the perspective of a cross-linguistic comparison between English and Japanese. He makes a distinction between *travelable paths*, i.e. paths that can be traveled by people, e.g. roads, paths, etc., as in (1); and *non-travelable paths*, i.e. paths embracing objects that do not normally act as media of human motion, e.g. walls, wires, fences, etc., as in (2). Matsumoto (1996, pp. 213–217) reports that while English expresses both these types, in Japanese some non-travelable entities, such as *walls* and *fences*, cannot be described with fictive motion. Some other non-travelable entities, such as *borders* and *wires*, take a restricted set of motion verbs. This is motivated by the fact that certain Japanese motion verbs cannot be used to describe movement over a path that does not involve a sensorimotor basis. Rojo and Valenzuela (2009, Exp. 1) do not observe this distinction to occur as vividly in Spanish, but detect that it takes longer for Spanish speakers to process fictive motion sentences with non-travelable entities than those with travelable ones.

Moreover, Matsumoto (1996) introduces two basic conditions that apply to fictive motion expressions. The *path condition* states that in fictive motion "some property of the path of motion must be expressed" (Matsumoto, 1996, p. 194). As illustrated by sentences in (3), fictive motion expressions must always include some path-related information, encoded either directly in the verb (3a) or conveyed by an adverbial or adpositional phrase (3b).

(3) a. The road began to *ascend*/*descend*.
b. The road *runs* along the coast.
c. ? The road began to *run*. / ? The road *runs*.

Comparing sentences in (3b) and (3c) shows that because the verb *run* does not express any specific property of the path, it requires an adverbial complementation to be used in fictive motion. However, if a verb includes some information about the path, as the verbs *ascend* and *descend* in (3a), no complement is required. This condition can be explained by Langacker's (1986, 2005, 2008a, 2008c) model of fictive motion (discussed in detail below), which assumes that comprehending fictive motion expressions involves summary mental scanning of the object in question. The linguistic presence of a path is necessary for the mental scanning of the path to occur in the first place.

The *manner condition* states that if a manner-conflating verb is used in a fictive motion expression, the information on manner conveyed by the verb must be related to some specific property of the path. As put by Matsumoto (1996, p. 194), "no property of the manner of motion can be expressed unless it is used to represent some correlated property of the path". This is illustrated in (4):

(4) a. The path *zigzagged* up the hill.
b. The road *plunged* downhill.
c. ? The path *slid* / *rolled* up the hill.

In (4a) the information about the manner of motion enables us (by virtue of mental scanning) to infer the overall shape of the path. In (4b) the information about the manner of motion enables us to mentally map the speed associated with the verb *plunge* onto the slope of the path: we infer that the road was very steep. However, the manner of motion encoded in the verbs *slide* and *roll* in (4c) is difficult to relate to any specific property of the path, therefore they are less natural in such contexts. Rojo and Valenzuela (2009, Exp. 2) do not observe the manner condition to function as rigidly in Spanish, but detect that it takes longer for Spanish speakers to process non-path-related manner verbs than path-related manner verbs in fictive motion sentences.

Langacker (1986, 2005, 2008a, 2008c) argues that fictive motion reflects subjective imaginative mental constructions used to discuss actual existence of objects in real-life situations. It involves *mental scanning*, i.e. a partial reactivation of the original experience conceptualized along the imagined trajectory. Depending on the particular situational context, it can either be *imperfective*, as in (5a), or *perfective*, as in (5b):

(5) a. The narrow path *climbs* steeply up to the fell.
b. The narrow path *is climbing* steeply up to the fell.

The perfective use in (5a) can be attributed to a *global view*, in which the entire configuration of the path is apprehended as a single *gestalt*, while the imperfective use in (5b) can be attributed to a *local view*, which indicates that the path changes position vis-à-vis the terrain as the conceptualizer experiences a specific stretch of the path (Langacker, 2005, p. 176; 2008c, pp. 69–70).

Talmy (2000a, p. 70) distinguishes between the adoption of a stationary distal perspective point with the global scope of attention, which he terms *synoptic mode*, and the adoption of a moving proximal perspective point with the local scope of attention, which he terms *sequential mode*. Matsumoto (1996, p. 204) distinguishes two types of fictive motion expressions. *Type* I includes sentences in which the motion is arbitrary in the sense that it does not occur at any specific time. *Type* II is associated with an actual experience of motion of the person uttering the sentence. However, Matsumoto (1996, p. 205) adds that "perspective mode and scope of attention are not necessarily correlated with the distinction between the motion of a particular entity at a particular time and the motion of an arbitrary entity that can be evoked at any time".

Langacker (2005, pp. 175–182) notes that although fictive motion is imagined, it is *grounded* in experience (see Barsalou, 2008). He views fictive motion as a common but varied linguistic phenomenon, and argues that fictive motion should be viewed as a specific case of *fictive scanning* in the broader context of *linguistic fictivity* (see Langacker, 2008a, Ch. 14.2). Talmy (1996, 2000a, Ch. 2) views the phenomenon of fictive motion in terms of *dynamicity*, which also embraces concepts of orientation, perception, radiation, and emanation. According to Talmy (2000a, p. 171–172), fictive motion can be explained in terms of a cognitive bias towards *dynamism* in language and cognition. We tend to focus on the dynamic aspects of reality: the static and unchangeable is less conspicuous.

8.2 Cognitive linguistic models of fictive motion

Talmy (1996, 2000a, Ch. 2) notes that an explanation of fictive motion in terms of metonymy would be inadequate, since numerous cases of non-travelable paths cannot be associated with motion, e.g. *fences* do not move. He considers fictive motion as *non-veridical*, and attributes the discrepancy between static and dynamic interpretations of fictive motion expressions to the distinction between *fictive* and *factive* modes of cognition (Talmy, 2000a, pp. 100–104). The former is more perceptually salient but less veridical, while the latter is more veridical but less perceptually salient. Thus, the "ception"—the neologism coined by Talmy to refer both to perception and conception—of fictive mode requires perceptual veridicality to be overridden, which occurs naturally due to a general preference for dynamism in linguistic, perceptual, and conceptual semantics.

According to Langacker (2008a, p. 529), both expressions of actual and fictive motion involve scanning along a path. As shown in Figure 8.1a, in actual motion we conceptualize events by tracking a mover's progress along a spatial path. An inherent aspect of the conception of actual motion is that a *conceptualizer*, i.e. the language user who makes a conceptualization, performs *sequential scanning* along the same path which the mover traverses physically. In *processing time* (T), the mover is successively conceptualized as occupying a series of locations that collectively constitute the path. Since movement happens in *conceived time* (t), time is inherently involved in any event (see Radvansky & Zacks, 2011). The event is apprehended by the conceptualizer by mentally accessing the successive locations in the same order that the mover reaches them.

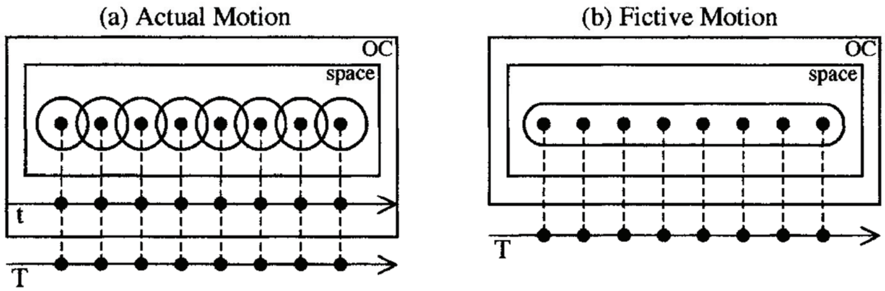

Figure 8.1 Image schemas of conceptualization of actual and fictive motion events

Langacker (2008a, p. 529) argues that basically the same mental operations are applied to a static scene in fictive motion. As shown in Figure 8.1b, conceptualization of fictive motion occurs in a manner generally parallel to conceptualization of an actual motion event. The analog of a mover is a spatially extended object, e.g. a road, fence, scar, etc. Instead of tracking an object's movement, the conceptualizer scans mentally along the path, by which he/she invokes the constitutive locations to build up to a full conception of the object's spatial configuration. The *conceived time* (t) has no significant role in the expression's objective content (OC), because the object occupies all spatial locations on a path simultaneously.

Langacker (2008a, pp. 83 & 111–112) proposes to term this more holistic mode of building up *gestalts* manipulabe as simultaneously available wholes as *summary scanning.*[98] He adds that mental scanning proceeds in a particular direction: the hill can either *rise from* the bank of a river or *fall* to it. However, the direction does not arise from a difference in conceptual content, but rather form the order in which the spatial configuration of an object is build up by *mental summation* (see also Langacker, 2005, p. 168; 2012, p. 212).

[98] Broccias and Hollmann (2007) attacked *summary* and *sequential scanning* as a convincing cognitive explanation for structuring of complex scenes by demonstrating that complementation patterns of causatives, e.g. *get*, *make*, do not seem to reconcile with the two scanning modes. In his reply, Langacker (2008b) admitted that more experimental evidence for the two scanning modes would be desired, but found their argumentation to be invalid.

Jackendoff (1983, 2002) questions whether any sort of motion scanning is involved in processing fictive motion sentences. He notes that although the sense of an observer scanning the extended object has some intuitive appeal, it does not account for the difference in inference patterns used in formal decomposition of state-functions. Jackendoff (1983, p. 173; 2002, pp. 360–362) argues that conceptualization of fictive motion expressions is associated with static representations of Paths, which designate directions, shapes, orientations, etc. Paths themselves are atemporal and can appear as arguments of *state-functions*. From this perspective, coextension path expressions should be viewed as instances of the state variant of GO-function, namely *non-temporal extension*, in which all points of the object's spatial configuration are activated simultaneously (see also Iwata, 1996 for a detailed analysis of motion/extent as two semantic variants of GO-function).[99]

Fauconnier (1997, pp. 177–181) views fictive motion as a form of *conceptual blending*, which conveys motion and immobility at the same time. Since in fictive motion objective immobility is expressed along with perceptual or conceptual motion, the blended space establishes a set of correspondences between the features of the shape of an object and the shape of the motion. Thus, fictive motion blends the shape of a movement through space with the spatial shape of an object to produce a temporal sequence of attention to the shape of the object. In the presence of the object, it guides the perceiver's attention. In the absence of the object, it constructs the shape of the imagined object by giving shape to the conceptualizer's mental scan. Fauconnier and Turner (2002, pp. 92–102) classify such examples as involving *conceptual compression*. A fictive entity in a blended space has distinct counterparts related to one another via a vital relation[100] from multiple input spaces. Fictive motion in a blended space simultaneously compresses all of its counterparts from the various input spaces in a conceptual integration network (see Coulson and Oakley, 2005 for a discussion of blending in fictive motion from the perspective of *virtual change*).

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[99] Jackendoff (1983, 2002) suggests two possibilities concerning the relationship between GO and GO_{EXT}. Either they are not distinct functions and the difference depends on whether the GO-function is a feature of an [EVENT] or a [STATE], or alternatively they are distinct functions, but share a common internal structure. Iwata's (1996) analysis provides support for the latter option.

[100] According to Fauconnier and Turner (2002, Ch. 6) *compression* in blending operates on a restricted set of *vital relations* rooted in fundamental human neurobiology and shared social experience, such as: Change, Time, Space, Analog, Category, Identity, Representation, Cause-Effect, Part-Whole, etc. They operate in blending and define essential topology within mental spaces.

8.3 Fictive motion as a cognitive simulation

Recognition of mental simulation in the process of language understanding has been gaining an increased attention over the last 15 years (see Bergen, 2012 for a review). Mental simulation fits into a broader framework of *grounded* cognition (see Pecher & Zwaan, 2005; Barsalou, 2008 for reviews), which proposes that bodily states, situated action, and mental simulations underlie cognitive processing. More specifically, theories of *mental simulation* (Barsalou, 1999, 2003; Glenberg, 1997; Zwaan, 2004) propose that cognition, including language comprehension, involves partial reenactments of sensory-motor states from embodied experiences gained earlier. Barsalou (2008, p. 618) defines mental simulation as "the re-enactment of perceptual, motor and introspective states acquired during experience with the world, body, and mind". We do not have *direct access*, i.e. we are not consciously aware of, to the simulation processes that are going on in our brains (see Barsalou, 2009 for a sketch of how the brain implements situated simulations).

A mental simulation for a particular instance of a concept is assumed to be *situated* in a particular environmental setting (Barsalou, 2003; Yeh & Barsalou, 2006). For example, to represent a chair, people simulate the multimodal experience of its shape, size, color, aesthetics, comfort, etc., but also actions taken toward chairs in the context of the surrounding space, as well as any agents, objects, and events relevant to a particular situation. The theories of mental simulations are supported by a large number of experimental studies (Glenberg & Kaschak, 2002; Zwaan, Madden, Yaxley & Aveyard, 2004; Kaschak et al., 2005; Zwaan & Taylor, 2006; see Zwaan & Pecher, 2012 for a recent review with replicated experiments). They indicate that when processing linguistic expressions of motion events people unconsciously simulate a variety of implied perceptual and motor details, such as the orientation and shape of the described object, as well as the axis, direction or rotation of movement.

A question if comprehension of fictive motion involves mental simulation was addressed in a series of cognitive studies conducted by Teenie Matlock. She started with on-line experiments examining how long it takes for participants to make a decision about fictive motion sentences (Matlock, 2001; 2004b). In the experiments, participants read stories about traveling in physical space, for example, fast versus slow movement, short versus long distance, and easy versus difficult terrain. Then, they had to make a timed decision about fictive motion sentences related to the story. Generally, faster decision times were observed for stories in which travel involved fast rates, short distances, and easy terrains. The results suggest that in understanding fictive motion sentences people mentally simulate various aspects of motion, including speed, distance, and the terrain across which the movement occurs.

Mental simulation of fictive motion was also studied in offline experiments. Participants drew pictures representing their conceptions of fictive motion scenes (Matlock, 2006). The experiments were designed as a non-linguistic measure of testing whether mental simulation plays a role in understanding fictive motion expressions. In one experiment, a group of participants was asked to think about and draw non-artistic, free-style representations of sentences depicting scenes described with fictive motion, e.g. "The footpath goes along the creek", while another group of participants thought about and drew representations of the same scenes depicted by sentences without fictive motion, e.g. "The footpath is next to the creek". Overall, testing showed that participants drew more elongated or extended shapes for fictive motion sentences.

In another experiment (Matlock, 2006, Study 3), participants drew longer lines for fictive motion sentences with verbs representing fast manners of movement, e.g. "The road *jets* through the city", than with slow manners of movement, e.g. "The road *creeps* through the city". A corresponding trend was observed for actual motion sentences with the same verbs, which indicates that fictive motion construal occurs in a manner similar to actual motion construal. The drawing results provide indirect support for the idea that when conceptualizing static fictive motion scenes people construct a dynamic simulation that mirrors motion depicted by fictive motion expressions.

Further evidence indicating that processing fictive motion sentences includes mentally simulated motion was obtained in eye-movement tracking experiments. In one experiment (Matlock & Richardson, 2004), participants viewed simple two-dimensional drawings of static spatial scenes while they heard either fictive or non-fictive motion sentences of equivalent length and meaning, e.g. "The palm trees run along the highway vs. "The palm trees are next to the highway". Gaze tracking demonstrated that participants spent more time inspecting figures described with fictive motion sentences. In a subsequent study (Richardson & Matlock, 2007) participants were presented with pictures and descriptions of easy or difficult terrains, and then fictive motion sentences or non-fictive motion sentences. Inspection times and eye movements scanning along the path increased during fictive motion descriptions when the terrain was first described as difficult as compared to easy. Such effects were not observed for descriptions with non-fictive motion sentences.

Moreover, Matlock et al. (2005) conducted experiments examining whether abstract conceptions of time and comprehension of fictive motion sentences share a common experiential basis derived from the concrete experience of actual motion in space. The experiments demonstrated that participants tend to take *ego-moving* or *time-moving* temporal perspective depending on the content of fictive motion sentences. It suggests that fictive motion sentences engage structures involved in understanding actual motion, and that those actual aspects of fictive motion influence temporal reasoning.

Taken together, the above-reviewed evidence from decision time latencies, drawing studies, eye-tracking, and the influence on temporal reasoning suggests that fictive motion processing evokes mental simulations. Using numerous examples, Matlock (2004a) argues that verbs of motion used in fictive motion expressions are related to the size and shape of the described objects, the direction and ease of motion, as well as the speed at which an imagined traveler moves across the path. She notes that fictive motion typically refers to spatially extended or elongated entities. Sentences such as: "The small round ashtray goes from the cup to the newspaper" sound rather peculiar because mental scanning is minimal or completely absent in such cases (see also Gibbs & Matlock, 2008 for a discussion of fictive motion within the framework of *embodied simulation*).

Additional support for the hypothesis of mental simulations involved in comprehending fictive motion sentences comes from brain studies using fMRI (functional Magnetic Resonance Imaging). Wallentin et al. (2005) found that fictive motion sentences activate the left posterior middle temporal cortex, which is the brain area responsible for visual processing of complex action knowledge. It is sensitive, for example, to visual perception of motion implied by still pictures or mental navigation. In the study participants were presented with four types of sentences including both animate and inanimate subjects with both static and dynamic readings, e.g., *the man/pipe goes into/lies within the house*. Activation in motion sensitive visual areas of the brain observed for fictive motion may be attributed to mental scanning of the scenarios conveyed by fictive motion sentences. A more recent fMRI study (Saygin, McCullough, Alac & Emmorey, 2010) investigated activation of motion-sensitive visual brain areas during audio-visual presentation of fictive motion sentences. It found that fictive motion sentences engage motion-sensitive visual areas, however, to a lesser extent than actual motion sentences.

Another recent brain study (Cacciari et al., 2011) used TMS (Transcranial Magnetic Stimulation) to see whether reading fictive motion sentences modulates the activity of the motor system brain areas, not only of motion-sensitive visual areas probed in the above-discussed fMRI studies. The study found that fictive motion sentences induce motor system activation, which indicates that readers mentally scan the space described by fictive motion. However, the responses recorded for fictive sentences were weaker than for actual motion sentences, but stronger than for metaphorical motion sentences.

In a recent article, Blomberg and Zlatev (2013) argue from a phenomenological perspective that neither account for fictive motion in terms of mental simulation proposed by Matlock, nor cognitive linguistic models proposed by Talmy and Langacker adequately explain the experientialist and linguistic complexity of the phenomenon. Blomberg and Zlatev (2013) point out that the view of fictive motion as mental simulation does not make it clear what is actually simulated. For example understanding a sentence such as "The highway crawls through the city" (from Matlock 2004a, p. 232) can refer to any of the following four variants:

(1) the subject's imagined motion through the city along a highway;

(2) the subject's imagined motion of some external object, such as a car, along a highway;

(3) the motion of something animate such as a snake, which resembles a highway;

(4) the viewpoint of someone who is visually "scanning" a highway.

Although variants (1–4) basically correspond to experiences of actual motion, they are in fact distinctly related at least three different features of human consciousness: *enactive perception*, *visual scanning*, and *imagination*, which potentially constitute experiential motivation for such sentences.

Moreover, Blomberg and Zlatev (2013) point out an important aspect of sedimentation of fictive motion expressions through acquisition and social transmission of language. Woelert (2011; following Husserl's (1939/1970) idea)[101] defines *sedimentation* as a consolidating process of linguistic conceptualization, in the course of which the evident cognitive structures originally given in embodied sense-experience have certain persisting linguistic conceptualizations superimposed on them by language acquisition and cultural transfer. Consequently, they "become more and more an immediately available, unquestioned (and sometimes even unquestionable) element of the language user's conceptual repertoire" (Woelert, 2011, p. 119). A similar view has been expressed by Pinker (2007, p. 37), who notes that "language is not just whatever set of ways people can think of to get a message across. Children, in the long run, end up with a fastidious protocol that sometimes rules out perfectly good ways of communicating" (see also *conceptual layering* in

[101] For Husserl (1939/1970, pp. 361–362) *sedimentation of meaning* relates to "mental products in the form of persisting linguistic acquisitions, which can be taken up again at first merely passively".

Langacker, 2012). Because explanation of fictive motion in terms of mental simulation obscures these aspects, Blomberg and Zlatev (2013) postulate that a full explanation of fictive motion should be grounded in the broader phenomenological-linguistic framework of *consciousness-language interactionism* (Zlatev, Blomberg & Magnusson, 2012), which takes into account a reciprocal relation between pre-linguistic experience and linguistic meaning.

8.4 Temporality in conceptions of fictive motion

Our apprehension of space is dynamic and interactive. Classic studies in narratives of space (Linde & Labov, 1975; Levelt, 1982, 1989) observed that when describing spatial environments, people tend to use a dynamically unfolding linear structure, as if from the perspective of traveling through space. Levelt (1989) suggests that imposing a temporal order on space accounts corresponds to a natural way of experiencing the world: we learn the spatial configuration both of the house and the city we live in by moving around and learning how to get from one place to another, which happens through time (see also Langacker, 2012, pp 210–213). Levelt argues that ordering messages in narratives follows non-linguistic linearization strategies, including the *principle of natural order*, which employs temporal sequencing to describe spatial environments according to the dynamic SOURCE-PATH-GOAL schema (see Lakoff, 1987; Hampe, 2005). Subsequent research (Taylor & Tversky, 1992a; 1992b; 1996; see Tversky, 2004 for a review) found that people have a tendency to describe various spaces both indoor and outdoor, large and small, learned from exploration or from maps in a linear manner, by processing landmarks one after another in a temporal sequence, which indicates that temporal order serves as the organizer for describing multidimensional spatial relations, which was discussed in Section 3.7.

Temporality is also involved in construction of *spatial situation models* (Rinck, 2005; see Section 3.7), which are mental representations of spatial information constructed by people from texts and stories. Radvansky and Zaacks (2011) emphasize that a situation model is first of all defined by a *spatial–temporal framework*, which combines the location in space where the situation unfolds with the span of time in which it takes place. It underlies all event models constructed in memory, and acts as the basic organizing factor for mental representations of events. Zwaan (2009, p. 15) provides the following distinction between *situation model theories* and *simulation theories*: "Whereas situation-model theories tend to treat events as empty nodes, simulation theories go 'inside the node'. (…) The former [perspective] provides insights into the flow between event representations and their interconnectedness in memory, whereas the latter provides insights into the internal structure of the event representations."

Because temporality plays an important role in the interpretation of linguistic descriptions of space both in situation models and mental simulations (Zwaan, 2009), it can be reasonably presumed to act in conceptions of fictive motion. Matsumoto (1996, pp. 186–187) demonstrates that in sentences such as "The highway runs along the coast for a while" the temporal phrase *for a while* denotes the duration of the process of motion along the coast, which is directly correlated to the length of the relevant section of the highway in question. He emphasizes that in such sentences temporality cannot be attributed to any particular duration of the state of location, which indicates that conceptualizations of fictive motion cannot be explained without assuming some sort of motion processing.

Matlock (2004b, p. 1390) argues that fictive motion sentences frequently incorporate words and phrases that communicate physical movement, which can be denoted in terms of duration, such as *for 10 minutes* in "The road runs along the coast for 10 minutes". Additionally, the natural temporality of physical movement is implied by those fictive motion expressions that include verbs communicating fast or slow manners of motion in their literal uses, e.g. "The freeway *races* past the city" or "Interstate 5 *crawls* through Los Angeles" (Matlock, 2006, Study 3).

The assumption of temporality of fictive motion expressions is elaborated further in Matlock's (2004a) discussion on the conceptual motivation of fictive motion constructions. She argues that objects depicted by fictive motion expressions must be sufficiently long to dynamically construe over time for the *mental scanning* to occur. Matlock (2004a, p. 229) uses examples presented in (6) to argue that sentences such as (6a) are much more natural than (6b), because of the temporality that reflects a substantially longer object involved in sequential scanning along the path.

(6) a. The road runs along the coast for 2 hours.
b. ? The road runs along the coast for 2 seconds.

However, she adds that sentences like (6b) are reasonably plausible, if the intention of the speaker is to contrast a particularly short part of a road running along the coast with other sections of the same road.

8.5 Temporality of coextension paths

Research discussed in this chapter aims to observe from an empirical linguistic perspective how the assumption of temporality in fictive motion expressions fits into the reality of everyday language of English and Polish speakers. To answer this question the study seeks to find how natural it is to denote an extension of objects in space in spatial vis-à-vis temporal terms with coextension path expressions. This investigation follows the assumption that if cognitive processing of coextension paths resembles processing of actual motion, enunciations of distance in both types of motion expressions should feature a similar proportion of spatial vs. temporal representations. The use of temporality in representations of the motion-framed distance was discussed in the previous chapter.

8.5.1 Research methodology

For the purpose of this research the *British National Corpus* (BNC) and the *Polish National Corpus* (NCP) were employed. They both have an important advantage of being *standard reference* corpora (McEnery & Wilson, 2001, p. 32). Both have been extensively used by researchers in a variety of contexts, including applications of the BNC in research on motion events (e.g. Filipović, 2007). As discussed in Chapter 5, corpus-based cognitive linguistics relies on explanatory notions adopted by the cognitive linguistics framework, but approaches them in such a way that their relevance to a given linguistic phenomenon can be empirically validated in large corpora, frequently with an aid of advanced statistical techniques (Heylen et al., 2008, p. 92).

Coextension path expressions are problematic to pick out from corpora because at the syntactic level they are practically indistinguishable from actual motion expressions. For that reason, this research was implemented with a procedure that involves looking for combinations of landmarks that can potentially feature in coextension paths with an ample selection of motion verbs.

Selecting suitable landmarks followed observations that coextension paths typically describe extended or elongated stationary spatial entities (Langacker, 2005; Matlock, 2004a). Starting with a few prototypical ones, such as “road”, “wire”, “fence”, “coast”, etc., the online version of *WordNet* 3.1 (Fellbaum, 2006; see wordnet.princeton.edu for more information) was consulted to review hyponyms, meronyms, and sister terms in order to identify other spatially extended objects potentially fit for descriptions with coextension paths.

In the outcome, for the purpose of the present study the following four basic categories of landmarks were distinguished:

(1) *Travelable paths*: "avenue, bridge, flyover, footpath, highway, lane, overpass, passage, path, pavement, railway, road, route, street, thoroughfare, track, trail, tunnel, viaduct, way". These spatial entities are distinguished by Matsumoto (1996) as paths intended for traveling by people.

(2) *Travelable environmental entities*: "beach, canyon, cliff, coast, desert, field, forest, glacier, hill, island, land, mountain, plateau, ridge, valley". These typically extended or elongated landmarks can also be traveled, however, they were not built intentionally for this purpose.

(3) *Non-travelable connectors*: "cable, line, pipe, pipeline, wire". These elongated objects are not normally traveled by people, therefore they are classified by Matsumoto (1996) as *non-travelable paths*. This list includes objects that are typically used for transmitting energy or transporting substances over long distance.

(4) *Non-travelable barriers*: "dam, fence, hedge, wall". These spatially extended entities typically serve as barriers and are not normally used for traveling, but they often stretch over a relatively long distance, too.

Altogether, 44 landmarks were selected for analysis. The range of objects that can be described with coextension path expressions is practically unlimited. The above selection does not include some shorter objects discussed in the literature on fictive motion, e.g. *cord, scar, tattoo*, which due to their relatively insubstantial length are less likely to be discussed in temporal terms (see Matlock, 2004a, p. 229 for a motivation).

A list of English verbs of motion was taken from Levin (1993, Ch. 51). For the purpose of the present study the following categories of verbs were selected for investigation:

(1) *Verbs of inherently directed motion*: "advance, arrive, ascend, climb, come, cross, depart, descend, enter, escape, exit, fall, flee, go, leave, plunge, recede, return, rise, tumble". Levin (1993, Ch. 51.1) notes that the meaning of these verbs specifies the direction of motion, even if an overt directional complement is not present. For some of them the specification of direction is deictic, for others it is in non-deictic. However, none of these verbs specifies the manner of motion.

(2) In contrast, *verbs of motion manner*, as distinguished by Levin (1993, Ch. 51.3), describe motion that typically (though not always) involves displacement, however, they do not indicate the direction of motion as an inherent part of their meaning. Since they express different manners or means of motion, they can be subdivided into two categories:

a) *Roll verbs*: "bounce, drift, drop, float, glide, move, roll, slide, swing, coil, revolve, rotate, spin, turn, twirl, twist, whirl, wind". These verbs generally relate to manners of motion characteristic of inanimate entities. None of them indicates the direction of motion without an additional prepositional phrase. Many of the *roll verbs* that describe motion around an axis take a restricted range of prepositions describing the path of motion (Levin, 1993, Ch. 51.3.1).

b) *Run verbs*: "amble, backpack, bolt, [bounce], bound, bowl, canter, carom, cavort, charge, clamber, [climb], clump, coast, crawl, creep, dart, dash, dodder, [drift], file, flit, [float], fly, frolic, gallop, gambol, [glide], goose-step, hasten, hike, hobble, hop, hurry, hurtle, inch, jog, journey, jump, leap, limp, lollop, lope, lumber, lurch, march, meander, mince, mosey, nip, pad, parade, perambulate, plod, prance, promenade, prowl, race, ramble, roam, [roll], romp, rove, run, rush, sashay, saunter, scamper, scoot, scram, scramble, scud, scurry, scutter, scuttle, shamble, shuffle, sidle, skedaddle, skip, skitter, skulk, sleepwalk, [slide], slink, slither, slog, slouch, sneak, somersault, speed, stagger, stomp, stray, streak, stride, stroll, strut, stumble, stump, swagger, sweep, swim, tack, tear, tiptoe, toddle, totter, traipse, tramp, travel, trek, troop, trot, trudge, trundle, vault, waddle, wade, walk, wander, whiz, zigzag, zoom". Levin (1993, Ch. 51.3.2) notes that most of these verbs describe different manners of motion of animate entities, but some of them may be used to describe the movement of inanimate entities, too. Generally they describe displacement in a particular manner or by a particular means without specifying any specific direction of motion, unless they are accompanied by an explicit directional phrase. Levin adds that this category probably requires a further subdivision.

(3) *Chase verbs*: "chase, follow, pursue, shadow, tail, track, trail". These verbs are typically transitive, with the chaser as subject and the entity of pursuit as object. Some of them allow an intransitive use, with a prepositional phrase headed by *after* expressing what is being chased (Levin, 1993, Ch. 51.6).

(4) *Accompany verbs*: "accompany, conduct, escort, guide, lead, shepherd". These verbs basically relate to one person taking another from a place to place. As noted by Levin (1993, Ch. 51.7), their meaning is differentiated by the nature of the relation between the two participants.

Altogether, 170 different motion verbs were selected for investigation (duplicates between categories are listed above in square brackets). Although some of them, e.g. *backpack* or *sleepwalk*, are perhaps less likely to appear in coextension path expressions, a discussion to what extent each of these verbs is conceptually fit for fictive motion exceeds the scope of this study.[102] Enumerating all verbs that can potentially feature in this context is impossible, if only for the creativity of linguistic expression. Although the above selection is not exhaustive, it seems to be adequate for the purpose of examining temporality of coextension paths.

For English, the search for coextension paths in the BNC was implemented by looking for combinations of the above-listed landmarks with third-person singular simple present and past forms of the above-listed motion verbs. It gives 14,960 different combinations (44 landmarks × 340 verb forms), which when implemented in corpus queries identifies 2206 sentences[103] in the BNC. However, since this study aims more specifically to identify examples of coextension paths denoting spatial configuration in terms of either absolute duration, e.g. "The road runs along the coast for 10 minutes" or absolute spatial distance, e.g. "The road runs along the coast for 10 kilometers", a unit of space/time measurement was additionally incorporated in the following lexical pattern implemented in the investigation:

LANDMARK (noun sing.) + MOTION VERB (3rd sing. present/past tense) + TEMPORAL UNIT OR SPATIAL UNIT; SLOP=5, PRESERVE ORDER=YES

Units of time measurement selected for analysis involve those that are typically used to express duration, i.e. *moments, seconds, minutes, hours,* and *days* together with commonly used abbreviations. Units of spatial distance measurement selected for

[102] Some categories of verbs distinguished by Levin (1993, Ch. 51) were excluded from analysis. *Waltz verbs*, i.e. ones that are zero-related to names of dances and mean roughly "perform the dance", e.g. "boogie, polka, rumba, tango" (Levin, 1993, Ch. 51.5) were excluded as too idiosyncratic. Two others, namely "abandon" and "desert", which are discussed by Levin (1993, Ch. 51.2) as *leave verbs*, were disregarded, because their direct object cannot be expressed with a prepositional phrase, which indicates that they are less likely to be used in descriptions of spatial configurations. *Verbs of motion using a vehicle* (Levin, 1993, Ch. 51.4) are discussed in a separate paper (Waliński, in press), which explains conceptual motivation for avoiding instruments of motion in coextension paths.

[103] Obviously this set includes some coincidental hits, e.g. "Mr. Field followed his talk with a film".

investigation involve both metric and imperial units used in the U.K., also in their American variants of spelling, i.e. *kilometer (kilometre), meter (metre), mile,* and *yard* together with their abbreviations.

Because one cannot expect lexical items in the above lexical pattern to follow directly one after another, searching was implemented with *proximity queries* (Bernard & Griffin, 2009). They allow for searches with a *slop* factor, which specifies how far apart lexical items included in a query can be from one another to be still returned as a result to the query. The slop factor can be used in combination with a binary (yes/no) *preserve order* option, which indicates whether the original order of query terms should be preserved in results.[104] To afford for occurrence of multiple lexical items, e.g. numerals, prepositions, adverbs, etc., between query terms specified by the above pattern, searching was implemented in a relaxed manner with the *slop* value of 5, but the *preserve order* option set to "yes" in order to prevent coincidental hits.

This study investigates coextension path expressions that denote *absolute distance* expressed in spatial or temporal units. The use of relative linguistic means for structuring spatial relations expressed with coextension paths exceeds the scope of this study. Implementation of queries based on regular expression syntax enables anyone interested to attest or expand this research. A listing of queries used to obtain the results together with explanatory notes is provided in the Appendix to this chapter (see also Waliński, 2013c for a listing of queries employed for this research accompanied by corresponding concordances retrieved from the BNC).

8.6 Temporality of coextension paths in the BNC

Corpus queries based on the above pattern retrieved altogether 104 sentences matching the query terms from the BNC. However, the use of proximity queries with a large slop value is not without consequences. As it increases the number of returned sentences, it at the same time decreases the precision of results. For that reason, the resulting set had to be reviewed to eliminate matches sharing the defined sequence/proximity of lexical items by sheer coincidence. In the outcome, 42 sentences were recognized as examples of coextension path expressions denoting absolute distance. The results found for selected categories of motion verbs are presented in Table 8.1.

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[104] This study makes use of SlopeQ – a Lucene based search engine which allows for proximity queries in the BNC. For more information, see *Reference materials* section.

Category of verbs	Coextension path denoted in spatial terms	Coextension path denoted in temporal terms
Inherently directed motion verbs	21	0
Roll verbs	4	0
Run verbs	13	0
Chase verbs	2	0
Accompany verbs	2	0
Total	**42**	**0**

Table 8.1 Coextension path distance denoted in either spatial or temporal terms in the BNC

As shown in Table 8.1, all examples of spatial extension expressed with coextension paths identified in the BNC are denoted in spatial terms. It is noteworthy that coextension path expressions denoted in spatial terms were found for each selected category of verbs, but no examples of coextension paths denoted in temporal terms were found in the corpus. This is not to claim that they are non-existent in English, or even in the BNC. It just states that they could not be identified with the above-described procedure.

8.7 Temporality of coextension paths in the NCP

To check if the tendency observed for English occurs in another language, a parallel examination was conducted for Polish using the NCP. Essentially, the same set of landmarks was used. Corresponding lexical items for Polish were identified with the help of the *PWN-Oxford English-Polish Dictionary* (2004) and *SłowoSieć* 2.1 – the online interface to Polish wordnet (Piasecki et al., 2009; see plwordnet.pwr.wroc.pl for more information).

(1) *Travelable paths*: “aleja, alejka, autostrada, chodnik, droga, dróżka, estakada, jezdnia, korytarz, most, mostek, pas, pasaż, przejście, szlak, szosa, ścieżka, tor, tory, trasa, trotuar, tunel, ulica, uliczka, wiadukt”.

(2) *Travelable environmental entities*: “bezdroża, brzeg, dolina, grań, grzbiet, góra, kanion, las, lodowiec, plaża, pole, pustynia, puszcza, płaskowyż, urwisko, wybrzeże, wysepka, wyspa, wzgórze, łąka”.

(3) *Non-travelable connectors*: “drut, instalacja, kabel, linia, przewód, rura, rurociąg”.

(4) *Non-travelable barriers*: "mur, ogrodzenie, płot, siatka, tama, wał, zapora, żywopłot".

Although it is impossible to find disjunctive and exhaustive semantic one-to-one correspondence between English and Polish lexical items selected for analysis, it is plausible to assume that both sets embrace overlapping semantic fields for the distinguished categories of landmarks. It is noteworthy that the Polish set is larger (60 items) for two reasons. Firstly, it includes diminutive nominal forms commonly used by Polish speakers to refer to less significant ways and paths, e.g. *alejka, dróżka, uliczka, mostek* [Lit. short/petite: avenue, path or way, street, bridge]. Secondly, it includes lexicalizations of certain landmarks that are marked in English with modifiers, e.g. *ogrodzenie, płot, siatka* [fence, wooden fence, wire fence]. This selection is far from being exhaustive, since the range of physical objects that can be described using coextension path expressions is practically unlimited.

A selection of motion verbs used for investigation in the NCP was also identified with the help of the PWN-Oxford English-Polish Dictionary (2004) and the Polish WordNet. The same categories as distinguished for English were selected:

(1) *Verbs of inherently directed motion*: "dochodzić, iść, krzyżować, mijać, obniżać, odchodzić, oddalać, opadać, podchodzić, przechodzić, przecinać, schodzić, spadać, uciekać, umykać, wchodzić, wracać, wspinać, wzbijać, wznosić, zagłębiać, zawracać".

(2) *Verbs of motion manner*:

a) *Roll verbs*: "kołysać, kręcić, obracać, odbijać, okręcać, opuszczać, owijać, posuwać, skręcać, sunąć, szybować, toczyć, turlać, unosić, wirować, zakręcać, zawijać".

b) *Run verbs*: "biec, brnąć, błądzić, błąkać, cwałować, czmychać, czołgać, człapać, defilować, dreptać, galopować, gnać, gramolić, halsować, hasać, koziołkować, kuleć, kuśtykać, lecieć, łazić, maszerować, mknąć, mozolić, paradować, pełzać, pełznąć, podkradać, podróżować, pognać, pomknąć, pomykać, potykać, powłóczyć, przebiegać, przechadzać, przedzierać, przelatywać, przemierzać, przemykać, przeskakiwać, przetaczać, płynąć, pędzić, rzucać, skakać, skradać, smyrgać, spacerować, stąpać, szarżować, słaniać, śmigać, śpieszyć, truchtać, utykać, wałęsać, wdzierać, wić, wlec, wymykać, wyskakiwać, wślizgiwać, włóczyć, wędrować, zakradać, zasuwać, zataczać, zbaczać, ześlizgiwać, zjeżdżać".

(3) *Chase verbs*: "ciągnąć, dążyć, podążać, ścigać, śledzić, tropić".

(4) *Accompany verbs*: "kierować, odprowadzać, prowadzić, towarzyszyć, wieść".

The list of Polish verbs of motion is noticeably shorter (120 items). As observed by Kopecka (2010, p. 241), in comparison to English, semantic components of motion Manner lexicalized in Polish verbs of motion are less diverse since Polish does not appear to exploit the slot of the main motion verb as productively. The verbs were implemented in queries in imperfective aspectual forms,[105] which are more characteristic of the *global view* (Langacker, 2005, p. 176; 2008c, pp. 69–70) and the related *Type* I (Matsumoto, 1996) of fictive motion expressions. Despite the fact that it is impossible to find disjunctive and exhaustive one-to-one correspondences between English and Polish verbs of motion, it is plausible to assume that both sets embrace overlapping semantic fields for the distinguished categories of verbs. Although the above selection is far from being exhaustive, it seems to be adequate for the purpose of investigating temporality of coextension paths.

At a glance, it may seem that the above sets allow for checking only 7,200 different *landmark + motion verb* combinations (60 landmarks × 120 verb forms). However, because the NCP offers an underlying morphological dictionary, which allows for querying all inflectional forms (both declensional forms for nouns and conjugational forms for verbs), the number of combinations checked for Polish is significantly greater. The same units of measurement were selected for analysis in Polish, i.e. *moment, sekunda, minuta, godzina, dzień* [moment, second, minute, hour, day] for time, and *kilometr, metr, mila* [kilometer, meter, mile] for space together with their commonly used abbreviations. The corpus search for coextension path expressions in Polish was implemented in a parallel manner using *proximity queries* with the *slop* value of 5, and the *preserve order* option set to "yes". A listing of queries used to obtain the results together with explanatory notes is provided in the Appendix to this chapter (see also Waliński, 2013d for the listing of queries employed in this research accompanied by corresponding concordances retrieved from the NCP).

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[105] It must be noted that in Polish the verbal category of *aspect* cannot be compared on the basis of one-to-one correspondence to *aspect* in English. As explained by Fisiak, Lipińska-Grzegorek and Zabrocki (1987, p. 96), "The Polish aspectual forms of verbs distinguish various types of the same activity. The main semantic factors determining the aspectual oppositions are the following ones: completed vs. non-completed action, one occurrence vs. repeated occurrence of the same action, the temporal range of the activity: short vs. long, stress on the initial or final phase of the activity, etc." (see also Janda, 2004 for a discussion on the categories of Slavic aspect from a cognitive perspective).

Corpus queries implemented for Polish found altogether 584 sentences matching the query terms in the NCP. The resulting set was reviewed to exclude coincidental hits, since the search was implemented using proximity queries with a large value of slop factor, which while increasing the recall, substantially decreases the precision of results (see Pęzik, 2011). In result, 96 sentences were recognized as coextension path expressions denoting extension of spatial entities. The results found for the selected categories of verbs of motion are presented in Table 8.2.

Category of verbs	**Coextension path denoted in spatial terms**	**Coextension path denoted in temporal terms**
Inherently directed motion verbs	13	0
Roll verbs	4	0
Run verbs	37	0
Chase verbs	38	0
Accompany verbs	4	0
Total	**96**	**0**

Table 8.2 Coextension path distance denoted in either spatial or temporal terms in the NCP

As shown in Table 8.2, all examples of coextension paths identified in the NCP are denoted in spatial terms. Such examples were found for each selected category of verbs, but no examples of coextension paths denoted in temporal terms were found in the corpus. Obviously, it does not mean that coextension paths are not denoted using temporal terms in Polish, or even in the NCP. It merely states that they were not found with the above-described procedure.

The results indicate that we cannot assume on the basis of linguistic intuition that fictive motion expressions frequently incorporate phrasing that communicates physical movement in terms of duration (cf. Matsumoto, 1996; Matlock, 2004a; 2004b). The evident absence of temporal representations in coextension paths identified with the above-discussed procedure in the national corpora of English and Polish suggests that in everyday language they tend to be rather occasional. This is particularly conspicuous when the absence of temporality in coextension paths is compared to a high proportion of temporal representations found in the same corpus for the *motion-framed distance*, which was discussed in the previous chapter.

8.8 Conceptual motivation of atemporality in coextension paths

This study demonstrates a peripheral role of the *conceived time* in the mental processing of coextension path expressions (Langacker, 2005; 2008a, p. 79 & 529). Of course, the *processing time* is still involved, since even atemporal conceptions of static relations in space are conceptualized through mental processing, which requires time to occur in the first place. In more general terms, the findings confirm the *non-veridical* nature of fictive motion (Talmy, 1996; 2000a, Ch. 2), despite involvement of practically identical verbs and syntactic structures as actual motion expressions. Although the surface linguistic structure of fictive motion expressions reflects a cognitive bias towards *dynamism*, the atemporality of coextension paths in everyday language indicates that at the conceptual level they are often processed as figurative representations of non-temporal states of spatial extension (Jackendoff, 1983, p. 173; 2002, pp. 360–362; see also Iwata, 1996).

The apparent absence of temporality in coextension paths can be attributed to the basic conceptual difference between descriptions of relatively static physical objects and force-dynamic interactions between objects in space conceptualized as events (Engberg-Pedersen, 1999; Langacker, 2012), which was discussed in Section 4.7. Because all events occur dynamically along the temporal axis as well as along the spatial axis (Radvansky & Zaacks, 2011), it is natural for temporal representations to frequently figure in linguistic expressions of distance involving actual motion, which was demonstrated in the previous chapter. For the same reason, because static objects in space can exist independently of the temporal axis, it is not overly surprising that temporality does not feature prominently in depictions of spatially extended entities articulated with coextension paths. Since space is fundamentally static and globally accessible in nature (Galton, 2011, Langacker, 2012), descriptions of static objects with fictive motion hardly ever require temporal representations.

The basic conceptual difference between fictive and actual motion events can be illustrated with examples in (7). Although all sentences (7a–c) can be regarded as acceptable representations of distance in either spatial or temporal terms, the objectively verifiable frequencies of linguistic patterns found in the BNC indicate that sentences such as (7a), in which fictive motion expresses distance in spatial terms, are much more natural in everyday language than ones like (7b), in which fictive motion expresses distance in temporal terms.

(7) a. The road to London runs for 100 miles.
b. The road to London runs for 2 hours.
c. It takes 2 hours to get to London / to reach London.

Denoting spatial extension in temporal terms is more natural with structures such as (7c), which were found multiple times in the BNC.[106] They enable us to mentally substitute the initial "It" with a conception of actual traveling, e.g. by train or by car, which is associated with an actual motion event. As a result, coextension path expressions denoting spatial extension in terms of duration appear to be the least preferred form of expressing distance in everyday speech.

8.9 Fictive and factive processing of coextension paths

Although linguistic representations can only serve as an indication of the dynamic spatial-temporal relations in the conceptual structure (Langacker, 2012), the absence of temporal representations in coextension path expressions found in empirical linguistic data suggests that there exist two cognitive modes of processing fictive motion, which fits into the *overall framework of fictivity* proposed by Talmy (2000a, pp. 99–103). It seems that the results obtained in psycholinguistic experiments (Matlock, 2004b, 2006; Matlock & Richardson, 2004; Richardson & Matlock, 2007), and brain studies (Wallentin et al., 2005; Saygin et al., 2010; Cacciari et al., 2011) demonstrate the *fictive mode*, in which processing of fictive motion takes place in a manner somewhat parallel to actual motion. This mode has arguably a greater potential for denoting spatial extension in terms of duration, since it evokes an association with physical movement. On the other hand, the atemporality of coextension paths found in language corpora points at the *factive mode*, in which coextension paths are processed as atemporal expressions of spatial extension. The use of temporality in this mode is potentially restricted due to the above-discussed conceptual reasons.

However, the link between linguistic structuring and evocation of an actual sense or conceptualization of motion is difficult to draw precisely. As emphasized by Talmy (2000a, pp. 104–105), for the same instance of fictive motion expression some speakers will report a strong semantic evocation of motion, while others will report that there is none at all. Even the same speaker may deal with the same instance differently on different occasions. Moreover, in situations when an experience of motion does occur for a fictive motion expression, there is a range of differences as to its strength and character, its clarity and homogeneity, and what is conceptualized as moving (see variants listed by Blomberg & Zlatev, 2013).

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[106] A simple search in the BNC for "It takes|took <CRD> hours|minutes|days to get|reach" (Slop=1; Preserve Order=YES) identifies 22 valid representations of spatial distance in temporal terms in the BNC. See Waliński, 2013c for a listing.

Apart form the above-discussed conceptual reasons, the choice of either *factive or fictive mode* of conceptualization is likely to be related to the dynamic potential of the linguistic structure, which may far exceed the scope of a single sentence. Cognitive studies have shown that activation of motor imagery in natural language comprehension does not simply result from the lexical semantics of constituent words, but occurs due to the interpretation of an utterance as a whole (Bergen, 2012). It seems that coextension path expressions used in depictions of spatial scenes,[107] which are inherently dynamic and multidimensional, have a greater potential to engage the fictive mode than a single sentence used every now and then to express the spatial extension of an object.

Moreover, the factive mode of processing can be attributed to *sedimentation of meaning* (Woelert, 2011; Blomberg & Zlatev, 2013), which makes coextension path expressions immediately available means of denoting spatial relations in the conceptual repertoire of language users. Since fictive motion constructions are acquired naturally through language acquisition and social transfer, in numerous cases coextension path expressions are likely to be used to describe spatial configurations of objects in a parrot fashion dissociated from movement.

[107] Studies demonstrating processing of fictive motion with mental simulations (Matlock, 2004b; Matlock, 2006; Matlock & Richardson, 2004; Richardson & Matlock, 2007) analyzed sentences depicting entire spatial scenes, which in some cases were additionally incorporated into elaborate spatial scenarios (see Matlock, 2004b, Appendix). Isolated terse fictive motion sentences were not observed to trigger vivid visual imagery with motor content in more restrained experimental settings (Bergen, Lindsay, Matlock & Narayanan, 2007).

Appendix to Chapter 8

1. Explanations for query listings

For English, this study is based on the BNC World edition published in 2001. The corpus was searched with SlopeQ, a part-of-speech-sensitive concordancer with support for proximity queries for the BNC. For Polish, the balanced edition of the NCP was used with the PELCRA online concordancer. It is available publicly at: http://www.nkjp.uni.lodz.pl/index_adv.jsp with full support for proximity queries (see Pęzik, 2012b for more information). All queries were implemented for the full contents of the corpora. The number of returned results was set to the maximum of 10000 (available via “Paging” option). All queries we implemented with the value of 5 for SLOP factor in proximity queries (available via “Slop” option), and “Preserve order” option set to “yes”. A single asterisk (*) replaces any number of characters, e.g. [yard*] results in “yard, yards, yardstick, etc.” The vertical bar symbol or *pipe* (|) used in queries indicates logical AND, which enables executing multiple queries in a single line. For example, the query [road runs|ran] substitutes for two separate queries “road runs” and “road ran”. The PELCRA online concordancer offers an underlying Polish morphological dictionary, which allows for queries incorporating all Polish inflectional forms with the use of double asterisk (**) as a wildcard. For example, the query [rok**] substitutes for “rok, roku… lat, lata… etc.”

2. Corpus queries used to examine temporal vs. spatial representations of extension in coextension paths for English in the BNC:

a) The following landmarks have been used consistently in all queries:
avenue|beach|bridge|cable|canyon|cliff|coast|dam|desert|fence|field|flyover|footpath|fo rest|glacier|hedge|highway|hill|island|land|lane|line|mountain|overpass|passage|path|pa vement|pipe|pipeline|plateau|railway|ridge|road|route|street|thoroughfare|track|trail|tun nel|valley|viaduct|wall|way|wire

b) The following lexical forms for the selected 170 verbs of motion were used. They were divided into the following batches to prevent problems related to processing too expansive queries.

Verbs of inherently directed motion:

advances|advanced|arrives|arrived|ascends|ascended|climbs|climbed|comes|came| crosses|crossed|departs|departed|descends|descended|enters|entered|escapes|escaped| exits|exited|falls|fell|flees|fled|goes|went|leaves|left|plunges|plunged|recedes|receded| returns|returned|rises|rose|tumbles|tumbled

Roll verbs:

bounces|bounced|drifts|drifted|drops|dropped|floats|floated|glides|glided|moves| moved|rolls|rolled|slides|slid|swings|swung|coils|coiled|revolves|revolved|rotates|rotated| spins|spun|turns|turned|twirls|twirled|twists|twisted|whirls|whirled|winds|wound

Run verbs A-E:

ambles|ambled|backpacks|backpacked|bolts|bolted|bounds|bound|bowls|bowled|canters|cantered|caroms|caromed|cavorts|cavorted|charges|charged|clambers|clambered|clumps|clumped|coasts|coasted|crawls|crawled|creeps|crept|darts|darted|dashes|dashed|dodders|doddered

Run verbs F-L:

files|filed|flits|flitted|flies|flew|frolics|frolicked|gallops|galloped|gambols|gambolled|goose-steps|goose-stepped|hastens|hastened|hikes|hiked|hobbles|hobbled|hops|hoppe|hurries|hurried|hurtles|hurtled|inches|inched|jogs|jogged|journeys|journeyed|jumps|jumped|leaps|leapt|limps|limped|lollops|lollopped|lopes|loped|lumbers|lumbered|lurches|lurched

Run verbs M-R:

marches|marched|meanders|meandered|minces|minced|moseys|moseyed|nips|nipped|pads|padded|parades|paraded|perambulates|perambulated|plods|plodded|prances|pranced|promenades|promenaded|prowls|prowled|races|raced|rambles|rambled|roams|roamed|romps|romped|roves|roved|runs|ran|rushes|rushed

Run verbs Sa-Sk:

sashays|sashayed|saunters|sauntered|scampers|scampered|scoots|scooted|scrams|scrammed|scrambles|scrambled|scuds|scudded|scurries|scurried|scutters|scuttered|scuttles|scuttled|shambles|shambled|shuffles|shuffled|sidles|sidled|skedaddles|skedaddled|skips|skipped|skitters|skittered|skulks|skulked

Run verbs Sl-Sz:

sleepwalks|sleepwalked|slinks|slinked|slithers|slithered|slogs|slogged|slouches|slouched|sneaks|sneaked|somersaults|somersaulted|speeds|speeded|staggers|staggered|stomps|stomped|strays|strayed|streaks|streaked|strides|strode|strolls|strolled|struts|strutted|stumbles|stumbled|stumps|stumped|swaggers|swaggered|sweeps|swept|swim|swam

Run verbs T-Z:

tacks|tacked|tears|tore|tiptoes|tiptoed|toddles|toddled|totters|tottered|traipses|traipsed|tramps|tramped|travels|travelled|treks|trekked|troops|trooped|trots|trotted|trudges|trudged|trundles|trundled|vaults|vaulted|waddles|waddled|wades|waded|walks|walked|wanders|wandered|whizzes|whizzed|zigzags|zig-zags|zigzagged|zig-zagged|zooms|zoomed

Chase verbs:

chases|chased|follows|followed|pursues|pursued|shadows|shadowed|tails|tailed|tracks|tracked|trails|trailed

Accompany verbs:

accompanies|accompanied|conducts|conducted|escorts|escorted|guides|guided|leads|led|shepherds|shepherded

c) **The following spatial units and their abbreviations were used in queries:**
yard*|yds|mile*|meter*|metre*|m|kilomet*|km

d) **The following temporal units and their abbreviations were used in queries:**
moment*|second*|minute*|min|hour*|hrs|h|day|days

e) **An example of a full query for fictive motion expressions involving chase verbs with temporal representations of spatial configuration implemented for searching the BNC:**
[avenue|beach|bridge|cable|canyon|cliff|coast|dam|desert|fence|field|flyover|footpath|forest|glacier|hedge|highway|hill|island|land|lane|line|mountain|overpass|passage|path|pavement|pipe|pipeline|plateau|railway|ridge|road|route|street|thoroughfare|track|trail|tunnel|valley|viaduct|wall|way|wire
chases|chased|follows|followed|pursues|pursued|shadows|shadowed|tails|tailed|tracks|tracked|trails|trailed moment*|second*|minute*|min|hour*|hrs|h|day|days]

3. **Corpus queries used to examine temporal vs. spatial representations of extension in coextension paths for Polish in the NCP:**

a) **The following landmarks have been used consistently in queries:**

For travelable paths:
aleja**|alejka**|autostrada**|chodnik**|droga**|dróżka**|estakada**|jezdnia**|korytarz**|most**|mostek**|pas**|pasaż**|przejście**|szlak**|szosa**|ścieżka**|tor**|tory**|trasa**|trotuar**|tunel**|ulica**|uliczka**|wiadukt**

For travelable environmental entities:
bezdroża**|brzeg**|dolina**|grań**|grzbiet**|góra**|kanion**|las**|lodowiec**|plaża**|pole**|pustynia**|puszcza**|płaskowyż**|urwisko**|wybrzeże**|wysepka**|wyspa**|wzgórze**|łąka**

For non-travelable connectors:
drut**|instalacja**|kabel**|linia**|przewód**|rura**|rurociąg**

For non-travelable barriers:
mur**|ogrodzenie**|płot**|siatka**|tama**|wał**|zapora**

b) **The following verbs of motion were used. They were divided into batches according to categories to prevent problems related to processing too expansive queries.**

Verbs of inherently directed motion:
dochodzić**|iść**|krzyżować**|mijać**|obniżać**|odchodzić**|oddalać**|opadać**|podchodzić**|przechodzić**|przecinać**|schodzić**|spadać**|uciekać**|umykać**|wchodzić**|wracać**|wspinać**|wzbijać**|wznosić**|zagłębiać**|zawracać**

Roll verbs:
kołysać**|kręcić**|obracać**|odbijać**|okręcać**|opuszczać**|owijać**|posuwać**|skręcać**|sunąć**|szybować**|toczyć**|turlać**|unosić**|wirować**|zakręcać**|zawijać**

Run verbs:
biec**|brnąć**|błądzić**|błąkać**|cwałować**|czmychać**|czołgać**|człapać**|defilować**|dreptać**|galopować**|gnać**|gramolić**|halsować**|hasać**|koziołkować**|kuleć**|kuśtykać**|lecieć**|łazić**|maszerować**|mknąć**|mozolić**|paradować**|pełzać**|pełznąć**|podkradać**|podróżować**|pognać**|pomknąć**|pomykać**|potykać**|powłóczyć**|przebiegać**|przechadzać**|przedzierać**|przelatywać**|przemierzać**|przemykać**|przeskakiwać**|przetaczać**|płynąć**|pędzić**|rzucać**|skakać**|skradać**|smyrgać**|spacerować**|stąpać**|szarżować**|słaniać**|śmigać**|śpieszyć**|truchtać**|utykać**|wałęsać**|wdzierać**|wić**|wlec**|wymykać**|wyskakiwać**|wślizgiwać**|włóczyć**|wędrować**|zakradać**|zasuwać**|zataczać**|zbaczać**|ześlizgiwać**|zjeżdżać**

Chase verbs: ciągnąć**|dążyć**|podążać**|ścigać**|śledzić**|tropić**

Accompany verbs: kierować**|odprowadzać**|prowadzić**|towarzyszyć**|wieść**

c) **The following spatial units and their abbreviations were used in queries:**
kilometr**|km|metr**|m|mila**

d) **The following temporal units and their abbreviations were used in queries:**
moment**|sekunda**|minuta**|min|godzina**|godz|h|dzień**

e) **An example of a full query for fictive motion expressions for non-travelable connectors involving chase verbs with temporal representations of spatial configuration implemented for searching the NCP:**
[drut**|instalacja**|kabel**|linia**|przewód**|rura**|rurociąg**
ciągnąć**|dążyć**|podążać**|ścigać**|śledzić**|tropić**
moment**|sekunda**|minuta**|min|godzina**|godz|h|dzień**]

Chapter 9

Temporal horizon

Time perspective is the mind's way of parsing the flow of human experience into zones of past, present and future. In an optimally balanced time perspective, these components blend and flexibly exchange, depending on a situation's demands and our needs and values.

Philip Zimbardo (2002) Time to take out time

9.1 Spatialization of time

Different currents of the 20th century phenomenology put emphasis on different aspects of temporality. Bergson (1889/2001) stressed a crucial role of the past in the psychological perception of self in time. Although he admitted that the future gives us hope and drive for activity, his thesis was that true meaning of time resides in the past. He claimed that a true insight into the nature of temporality is opened up to us only when our present becomes permeated with the past, and the two are experienced as an immediate unity, the *temps-durée*, as he termed the continuous flow of time. Thus, for Bergson it is the past time that allows true understanding of self through memories and reflection.

Heidegger (1927/2002) and other existential philosophers, though not denying the union of self with the past, insisted that the most important aspect of existence lies in the constant process of becoming and developing in time.[108] This view was reflected in existential psychology, which put a particular attention to perpetual emergence of self with forward looking to the future. From that perspective the future is the primary meaning of existence in time and the perception of self in time (May, Angel & Ellenberger, 1994).

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[108] Important sections of Heidegger's *Being and Time* are devoted to the notion of being-toward-death [*Sein-zum-Tode*] (see Magurshak, 1979 for a review).

Husserl (1917/1991) insisted that the consciousness of time functions in the subjective present. For that reason, neither reflective returns to the past (*retentions*) nor anticipations of future events (*protentions*) can violate our immediately accessible temporal intuitions (Dainton, 2010a, M. Kelly, 2008). It is noteworthy that while for Bergson the involvement in the past conflicted with present activity, for Husserl past and futurity in the temporal experience are fully reconcilable within the framework of subjective present. From this outlook, it is ultimately the present that embraces all aspects of temporality (see also Droege, 2009).

Those three philosophical orientations to time demonstrate that temporality has advocates for the future, past, or present dominance. This is not necessarily irreconcilable antagonism, but rather a testimony to the fact that philosophers and psychologists recognize the division of time into three temporal zones of past, present, and future, which as pointed out by St. Augustine's (398AD/1978) resides ultimately in the human psyche.

Thomas Cottle, who developed a series of ingenious tests and inventories of psychological time measurement in the 1960s (e.g. Cottle, 1967, 1968; Cottle & Pleck, 1969), notes that the idea of subjective time measurement is illusory:

> Some might like to take refuge in a position that like heat, light, and sound, time may be defined as that which is measured by some appropriate instrument or gauge. Thus, a clock or calendar, or even biological and cultural cycles, may be likened to thermometers, photometers and audiometers. But likeness is not literalness and while they capture a certain essence of objectivity, such scientific tools of measurement rarely grasp for even a moment the evanescent qualities of so-called subjective time. (Cottle, 1968, p. 130).

This observation points out that the scientific approach to temporality strips away the evanescent (or *transient*, see Galton, 2011) essence of time, and transforms it into a static, calculable model. Bergson (1922/1999) describes the transition of temporal thought into spatial language and mathematical codification, with reference to Einstein's (1916/1952a) theory, in the following manner:

> Immanent in our measurement of time, therefore, is the tendency to empty its content into a space of four dimensions in which past, present, and future are juxtaposed or superimposed for all eternity. This tendency simply expresses our inability mathematically to translate time itself, our need to replace it, in order to measure it, by simultaneities which we count. (Bergson, 1922/2002, p. 215)

He adds (ibid.) that spatialization of time is possible because our consciousness "infuses living duration into a time dried up as space". Hence, by defining subjective zones of the present, past, and future we address only a convenience aspect of temporal definitions. The psychological correlates of attitudes toward the perception of time transcend the data obtained with scientific instruments of time measurement.

Organization of temporality derived from the subjective perception of time into logical categories can be observed in studies of *temporal horizon*, which divide time according to traditionally distinguished categories of past, present, and future experiences. Research in psychology has identified fundamental dimensions of the temporal horizon, the way it is developed, and the influence it exerts on individual and social behavior. This chapter demonstrates a linguistic, corpus-based cognitive approach to temporal horizon investigation. The following study shows how the structure of temporal horizon emerges from a systematic examination of the frequency of expressions denoting *absolute temporal distance*, i.e. duration between the present moment and a past or future event (Trope & Liberman, 2003), in spontaneous linguistic performance.

9.2 Time and the socializing process

In the 1920s the French pioneer psychologist Pierre Janet (discussed in Fraisse, 1963) started examination of time perception from the point of view of human social behavior. Janet observed a strong connection between the perception of time and the socializing process, which he regarded as a reciprocal relationship: on the one hand, people adapt to time; on the other hand, they create time in their minds. The concept of *time perspective* was discussed in a similar context by Frank (1939), another pioneer psychologist emphasizing the role of the total mental representation of past, present, and future in the study of human behavior.

The problem of how we adapt to time and create temporal conditions was persistently investigated by Paul Fraisse (1963), who maintained that we have no direct experience of time as such, but only of particular sequences and rhythms (Fraisse, 1978, 1994). Therefore, it is not time as such, but what happens in time that creates temporal effects, which are subsequently turned into psychological temporal perspectives reflecting personal life experience. Fraisse (1963) views the construction of time structure as an effort of adaptation to the changing world. He distinguishes three levels of psychological reaction to time: (1) physiological time; (2) perception of time; (3) speculation on time. With reference to the last level Fraisse introduced the concept of *temporal horizon*, in which cognitive and motivational factors interact in real life conditions.

As emphasized by Fraisse (1963, 1984) and Kastenbaum (1964, 1994), the study of *time perception* should be distinguished from the study of *time perspective*, which attempts to examine how and why people turn beyond the present moment. Over the years a number of studies described the concept of time perspective somewhat differently. For example, Fraisse (1963, p. 153) defined *temporal horizon* as "the way in which we behave in relation to three aspects of time: the past, the present, and the future", while Ornstein (1969, p. 23) referred to *time perspective* as "philosophical, social, cultural constructions of the world and their effects on the interpretation of time experience". Block (1990, p. 1) defined *temporal perspective*, as "an individual experience and conceptions concerning past, present, and future time". It has been noticed (Drake, Duncan, Sutherland, Abernethy & Henry, 2008) that an increased interest in studying cognitive aspects of time results in a proliferation of terminology used in this domain of studies. Apart from *temporal perspective, time perspective*, and *temporal horizon* other terms used in a very similar meaning include *time attitudes, temporal beliefs,* and *temporal orientation*.

9.3 The concept of temporal horizon (time perspective)

Temporal horizons reflect the way in which people relate to issues concerning the past, present, and future. Fraisse (1963) asserts that individual temporal horizons are constructed on the basis of personal life experience. They change with age and tend to reflect one's developmental history and individual position in the society. As human life progresses, time perception is systematically turned into the temporal horizon, hence as we grow older our temporal horizons become broader and more multifaceted due to the increasingly wider experience, which is additionally supported by observations in developmental psychology (Friedman, 2003; see also Piaget, 1946/1969).

The impact of time on human condition was researched by Kurt Lewin (1939, 1948, 1951), who developed a *life-space* model, in which a person's life-space is influenced not only by the geographical and social environment, but also by *temporal dimension*. This temporal dimension involves the influence of both the past and the future on an individual's present behavior. Lewin (1951, p. 75) defines *time perspective* as "the totality of the individual's views of his (or her) psychological future and psychological past existing at a given time". He asserts that the time perspective is influenced by personal social background and plays a crucial role in motivation.

Nuttin (1964, 1985) supports Lewin's life-space model. He notes that "future and past events have an impact on present behavior to the extent that they are actually present on the cognitive level of behavioral functioning" (Nuttin, 1985, p. 54). He strongly emphasizes a motivational aspect of *future time perspective* by stressing its crucial role in human intentions and motivation. Nuttin also distinguishes essential dimensions of future time perspective, which are largely congruent with earlier observations of Kastenbaum (1961) and Doob (1971). These insights were summarized by Kastenbaum (1994), who specifies the following basic *properties of time perspective*:

- *protension* – the cognitive temporal extension in which we think ahead into the future;
- *retrotension* – the cognitive temporal extension in which we think back into the past;
- *density* – the number of past or future events that we think about;
- *coherence* – the degree of organization within cognitive past-present-future matrix;
- *directionality* – the sense of perceived rate of movement toward the future.

Furthermore, Seligman (1975, cited in Roeckelein, 2000, p. 55) provides certain generalizations concerning temporal perspectives, for example:

- people tend to project further into the future as they move from childhood to adulthood;
- the stereotype that older people "live in the past" seems to be false;
- time perspectives become more alert and effective when individuals have a sense of control in usefulness of their lives;
- time perspectives tend to shrink in economic recession when jobs are hard to find.

Cross-cultural research on differences in perception and representation of the past, present, and future (Block, Buggie &Matsui, 1996; Hill, Block & Buggie, 2000; Ji, Guo, Zhang & Messervey, 2009) show that temporal perspectives vary to some extent across countries and ethnic groups, which suggests cultural influence.

The temporal perspective has been viewed as a *cognitive schema* (e.g. Kastenbaum, 1963, 1964), or a *personality trait* (e.g. Zimbardo & Boyd, 1999, 2008). Block (1990, p. 27) emphasizes that the temporal perspective is a uniquely psychological, *tensed* phenomenon. This conception of time is not accounted for in physics, where fundamental time-related equations concern only the *tenseless* relative ordering of events as happening earlier or later, which was discussed in Section 1.5 (see Le Poidevin, 2003, 2007 for comprehensive reviews of the distinction between *tensed* and *tenseless* series of time).

9.4 Measurement of time perspective in psychology

One of the early methods of measuring time perspective is the *Future Time Perspective* test (Wallace, 1956), which measures individual abilities to conceptualize the future in terms of the timing and ordering of personalized future events. Other psychological tests used for time perspective measurement either focus on its full complexity, e.g. *Time Reference Inventory* (Roos & Albers, 1965), *Thematic Apperception Test* (Wohlford, 1966), *Lines Test* (Cottle & Pleck, 1969), *Circles Test* (Cottle, 1976), and *Time Attitude Scale* (Nuttin, 1985), or they concentrate only on a single dimension, such as present or future, which includes *Sensation Seeking Scale* (Zuckerman, 1994), *Consideration of Future Consequences Scale* (Strathman, Gleicher, Boninger & Edwards, 1994), and *Future Anxiety Scale* (Zaleski, 1996). However, none of these tests has gained wider popularity because of their questionable psychometric properties and scoring problems.

In the 1990s Philip Zimbardo with colleagues at Stanford University conducted an extensive series of studies (e.g. Boyd & Zimbardo, 1997; Keough, Zimbardo & Boyd, 1999; Zimbardo & Boyd, 1999; Zimbardo, Keough & Boyd, 1997), which presented an innovative approach to temporal perspective research. Zimbardo developed the Stanford Time Perspective Inventory (STPI) test, which provides a straightforward way of measuring multiple time perspectives as individual temporal profiles. As summarized in a later study (D'Alessio, Guarino, De Pascalis & Zimbardo, 2003), the STPI test addressed shortcomings of the above-mentioned one-dimensional scales by providing consistent evaluation of various dimensions within individual temporal profiles. Because of that, the STPI test has gained a widespread acceptance in psychology as a standard measure of personal characteristics concerning time perspective with clearly distinguished psychometric properties and a potential of application in diverse research paradigms.

Zimbardo et al. (1997, p. 1008) define time perspective as "the manner in which individuals, and cultures, partition the flow of human experience into distinct temporal categories of past, present and future". Essentially, Zimbardo (2002; Zimbardo & Boyd, 1999, 2008) concurs in his views with the above-mentioned Lewin's position that the temporal perspective plays a fundamental role in a variety of individual and social contexts. He points out that time perspective variations between individuals are modified by a variety of personal, social, and institutional influences, such as one's cultural values, social background, religion, education, etc.

An individual's time perspective is a relatively firm personality trait that plays a leading-connective role in the relationship between personal/social experiences and provides characteristic meaning and order to everyday life events. From this standpoint, the time perspective can be viewed as a cognitive temporal bias that leads people to overemphasize the past, present, or future (Zimbardo & Boyd, 1999). Since it is used in forming individual expectations, goals, and decisions taken in the immediate life-space, the time perspective exerts pervasive and powerful influence on the human behavior.

> A positive past orientation connects us with our roots, heritage, family, religion and national rituals. It gives us a sense of stability, of our self over time; it's where positive self-esteem is nourished. A future orientation gives us wings to soar to new destinations, to seek challenges and opportunities by envisioning scenarios of possible future selves. A present time perspective allows spontaneity, sensation seeking, openness to novelty, being in the moment and fully experiencing and expressing emotions. (Zimbardo, 2002, p. 64).

Results of the STPI test make it possible to assign individuals to specific categories manifesting different behavioral and social characteristics in real life situations. For that reason, time perspective indices can be used as predictors for discovering psychological patterns of behavior or potential pathological inclinations, and in turn developing appropriate remedial strategies in a variety of social contexts. For example, the results of the STPI test have been used as a predictor of risky driving (Zimbardo et al., 1997), substance use (Keough et al., 1999), or to determine how faithfully students are likely to meet their obligations (Harber, Zimbardo & Boyd, 2003). A broader outlook on the role of time perspective in a variety of personal and social contexts has been discussed in the book *The Time Paradox* (Zimbardo & Boyd, 2008), which demonstrates how past-, present- and future-oriented ways of perceiving time can be used to the advantage of the whole psychological well-being (see also Drake et al., 2008).

9.5 Reflection of temporal horizon in linguistic performance

This study investigates properties of a general cognitive schema of temporal horizon that is reflected in linguistic performance. It must be emphasized that in this study the term *cognitive schema* is used in the Piagetian sense of image-schematic model representing an aspect of cognition with a diagram that helps interpret and organize abstract concepts (see Lakoff, 1987; Hampe, 2005; Talmy, 2011), not in the sense of a cognitive structure distinguished in clinical contexts of psychology (cf. Riso & McBride, 2007).

The investigation of the cognitive schema of temporal horizon is conducted with a systematic examination of references to temporal perspectives in transcriptions of impromptu conversations conducted among a wide demographic diversity of Polish speakers in various informal personal contexts. It demonstrates how the cognitive schema of temporal horizon emerges from a systematic frequency of *temporal adverbials* (Haspelmath, 1997). This study follows the model of *representational space* proposed by Langacker (2012) for processing time in human cognition. On the grounds of that model, the cognitive schema of temporal horizon emerges from temporal linguistic manifestations created in the human mind as the *interpreted experience*, i.e. a product of cognition in the socio-cultural context reflected in spontaneous linguistic performance.

Language and time are related in cognition in many reciprocal ways, which was discussed in Section 1.5. Language is used and has been developed in time, and it serves as a principal means for understanding time, i.e. its structuring, representing, and conceptualizing, which is discussed in ample literature on this topic (e.g. Boroditsky, 2011b; Jaszczolt, 2009; Lewandowska-Tomaszczyk, 2014). As emphasized by Jaszczolt (2012), languages afford a wide variety of ways of referring to the past, present, and future as well as conveying relative temporal ordering of events. There exists an array of linguistic devices for referring to time, including overt means expressed with lexical markers of time (e.g. temporal adverbs, temporal connectives), and grammatical markers of time (e.g. tense, aspect, modality).

Moreover, languages offer indirect ways of expressing relative temporal relations, which is achieved with pragmatic devices, i.e. automatic assignment of tensed interpretations to overtly tenseless expressions. They are either salient and default for particular constructions in a given language or depend on the active inference of the temporality from the speech situation that is common to the interlocutors in the particular context. Not only the conceptualization of time has both universal and culture-dependent aspects, but also linguistic devices used to express temporal relations can be both universal and specific to the particular language and culture (Allwood, 2002; Jaszczolt, 2012; Lewandowska-Tomaszczyk, 2014).

The aim of this research is threefold. Firstly, it demonstrates how the temporal horizon is reflected in spontaneous linguistic performance across a wide demographic variety of speakers, which enables us to identify certain properties of the temporal horizon, such as *density*, *extension*, and *alterations* across demographic groups. Secondly, it demonstrates that empirical linguistic data make it is possible to identify some novel aspects in the cognitive schema of temporal horizon. Additionally, following these two observations, this study validates the use of cognitive-corpus linguistics methodology as a highly objective, robust approach to cognitive research that enables us to avoid certain biases naturally occurring in psychological testing (Jensen, 1980) and allows judgments grounded on verifiable results.

9.5.1 Research methodology

This study is based on the 2010 edition of the PELCRA Spoken Conversational Corpus of Polish (henceforth, PELCRA SCCP), which is the largest collection of impromptu conversational Polish currently available. It is composed of meticulously transcribed spontaneous speech recordings that were annotated with demographic information about age, gender, and education of speakers (see Pezik, 2012a for a general description of the corpus data). This edition of the PELCRA SCCP is available publicly free of charge with full access to the corpus data through a user-friendly online concordancer (see Waliński & Pęzik, 2007) at: www.nkjp.uni.lodz.pl/spoken.jsp as an offshoot of the National Corpus of Polish project, which makes it a *standard reference* (see McEnery and Wilson, 2001, p. 32).

It is noteworthy that none of the conversations in the PELCRA SCCP is devoted specifically to the topic of time. Moreover, the conversations were recorded with most of the speakers being unaware of being taped (although they were informed about it later and eventually granted their permission to publish the recordings). The only difference between original conversations and their transcriptions is that some sensitive personal details, e.g. surnames, addresses, security numbers, etc. mentioned in the conversations were anonymized in the process of transcription, i.e. replaced with fictitious counterparts. The exclusive use of this particular type of linguistic data yields results that reflect spontaneous personal references to temporal perspectives. It effectively reduces the number of instances when the temporal perspective is expressed from abstract, impersonal, and projected viewpoints, and eliminates biases resulting from the typical affectedness of language in written and formal-spoken linguistic data, where the spontaneity of expression is largely restricted by the pragmatics of public communication with impersonal audiences.

This research employs a corpus-based approach, i.e. one that relies upon quantitative analysis applied to a whole corpus (Tummers et al., 2005). Corpus queries implemented in this study are based on a fundamental linguistic pattern characteristic of temporal adverbials, which is composed of a *temporal preposition*, e.g. *in, from, on, since, for, before, after, through, etc.* (Polish: "o, z, w, na, za, przez, przed, po, od") preceding in certain proximity a time unit. This pattern identifies a vast majority of expressions denoting *absolute temporal distance*, i.e. one expressed in time units. A set of time units selected for examination includes those that are *commonly* used to express duration, e.g. *moment, second, minute, hour, day, today, tomorrow, yesterday, week, month, year, etc.* (Polish: "moment, chwila, sekunda, minuta, godzina, dzień, dziś, dzisiaj, jutro, wczoraj, tydzień, miesiąc, rok").

The distance between the preposition and the following time unit was adjusted by application of *proximity queries* (Bernard & Griffin, 2009), which are implemented in the web interface to the corpus. They allow for specifying the value of *slop* factor, which essentially expresses how far apart the lexical items included in a query can be from one another to be still returned as a result to the query. For periods measured in tens, hundreds, and thousands of years the slop value was increased appropriately to account for compound numerals. The additional *preserve order* option, which specifies whether the original order of lexical items should be retained, was set to "yes" in each case, to prevent coincidental hits. The lexical pattern implemented in this study can be summarized as follows:

TEMPORAL PREPOSITION + TEMPORAL UNIT; SLOP=[2–5],
PRESERVE ORDER=YES

This combination represents a fundamental way of articulating protensive and retrotensive temporal distances with temporal adverbials, e.g. "for a moment", "since yesterday", "in a week", "after two years", etc. Such a specification of linguistic temporal expressions is not exhaustive, since it leaves out indirect temporal discourse markers. Therefore, it must be emphasized that the aim of this paper is not to study the full variety of linguistic means used to express temporal relations, but to observe fundamental properties of the cognitive schema of temporal horizon by examining expressions that denote the absolute temporal distance.

Application of queries based on simple regular expression syntax enables anyone interested in attesting or expanding this study to recreate exactly the same research conditions with noting else than a web browser. All observations discussed in this study are accompanied by listings of queries used to obtain the results. They are provided with explanations of their syntax as well as notes on normalization procedures in Appendix to this chapter. Additionally, all language samples retrieved from the corpus are also available for download as a research report (Waliński, 2012c).

9.6 Density of temporal horizon

The following chart presents frequencies of temporal adverbials for the selected time units found in the whole corpus, i.e. 513 conversations held among 1712 speakers.

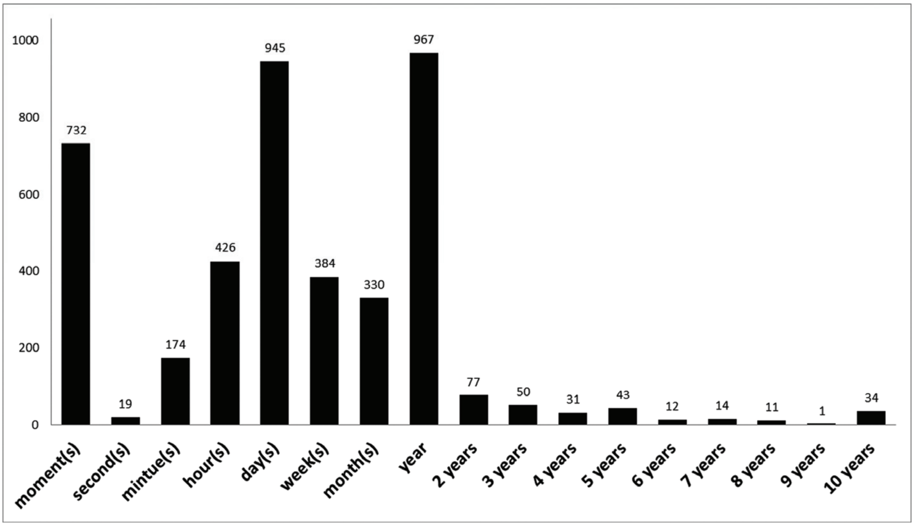

Figure 9.1 Density of temporal horizon observed in the corpus data

(1) Frequencies observed in the corpus data show that in the spontaneous conversations temporal perspectives are most frequently talked about with adverbials referring to *moments*, *days* and a *year*. As shown in Figure 9.1, the difference in frequency between these three common units of temporal distance and the rest of temporal adverbials is so distinctive that it puts moments, days, and a year ahead of other temporal units. Their distinctively higher frequencies indicate that they function as fundamental constituents in the cognitive schema of temporal horizon. It is noteworthy that the high frequency of expressions referring to *moments* suggests their prominent role in temporal cognition (cf. Pöppel, 2009; Wittmann, 2011). Moreover, the *day* and the *year* have been found to have a critical impact on human experience and behavior based on neuropsychological and psychophysical evidence (Wittmann & Paulus, 2009).

(2) The outstanding frequency of certain temporal adverbials makes it possible to partition the temporal horizon into corresponding regions. The first bracket of the temporal horizon that can be observed in the corpus data extends to the region of one day, which includes adverbials incorporating lexemes *today*, *yesterday*, and *tomorrow* (Polish: “dzisiaj”, “wczoraj”, “jutro”). Temporal adverbials referring to one day or shorter periods occur most frequently in spontaneous linguistic performance, which indicates their prominent significance in mental operations required for functioning in a variety of immediate life-space contexts. It must be noted that this observation does not distinguish between the protensive and retrotensive aspect of time perspective.

(3) Another bracket of the temporal horizon discernable in the linguistic data extends between the frequencies of adverbials expressing periods measured in days and adverbials denoting the period of one year. The frequency of adverbials expressing the temporal distance of one year appears to mark a significantly meaningful range in the human mind between an immediate temporal vicinity and longer time spans. It indicates that our cognition typically operates within the temporal horizon of one year.

(4) The third bracket of temporal horizon that can be distinguished on the basis of frequencies found in the conversations extends beyond the span of one year. It is particularly easy to discern in Polish, which uses distinct morphological forms for a single year ("rok, roku, rokiem") and multiple years ("lata, lat, latach, laty"). Examination of the corpus data for longer periods reveals that the density of references to temporal perspective decreases progressively beyond this range.

9.7 Extension of temporal horizon

The following chart presents frequencies of temporal adverbials for the range from eleven to multiple thousand years found in the whole corpus.

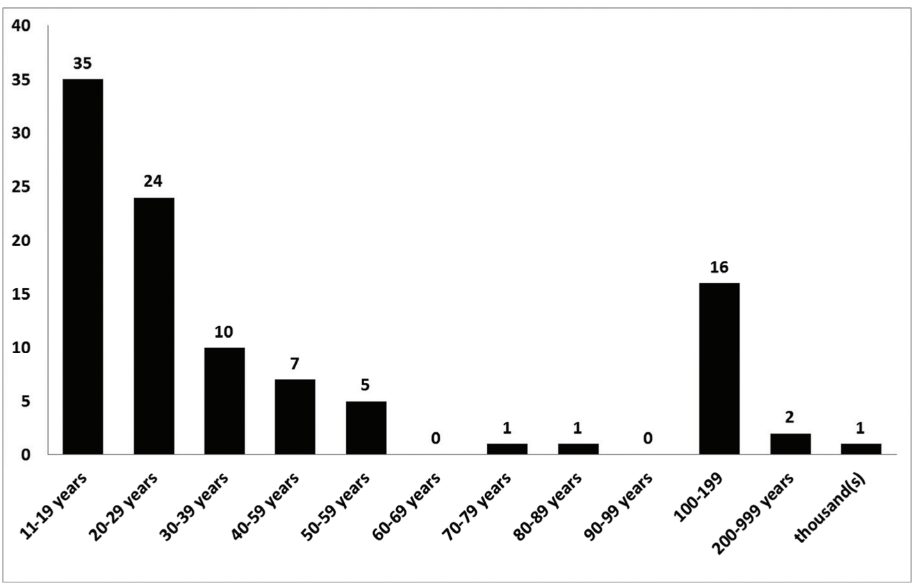

Figure 9.2 Extension of temporal horizon observed in the corpus data

(5) The corpus data show that beyond the one year region the longer temporal perspective is, the less frequently it is mentioned in the conversations. This

observation is largely congruent with Construal Level Theory (Trope & Liberman, 2003, 2010), which essentially assumes that the greater the temporal distance is, the more likely events are to be represented in terms of abstract and decontextualized characteristics. The theory implies that events temporally distant are less likely to play an important role in the immediate life-space. Figure 9.2 illustrates how evidently the frequency of temporal adverbials in the conversations declines as time periods become progressively longer.

(6) Another interesting tendency, but for the frequency of references to rise occurs for round number periods, e.g. 5, 10, 20, and 100 years (see Figures 9.1 and 9.2). It confirms psychological conclusions (Lewin, 1951; Fraisse, 1963; Doob 1971; Zimbardo & Boyd, 1999, 2008) that human time perspective is significantly influenced by a variety of *socio-cultural frames* (see Goffman, 1974), which results in its mental partitioning according to some common ideas and patterns widely-held in the society.

(7) There is a clearly apparent drop in the frequency of temporal adverbials for periods exceeding 50 years. It was examined closer through a concordance analysis of individual examples (see Waliński, 2012c for a listing). The analysis revealed that the longest temporal perspective expressed from a personal point of view occurs at the distance of 55 years. The remaining 25 examples for periods exceeding 50 years that crop up in concordances do not refer to temporal perspectives from a personal point of view. They specify age of elderly individuals, historic events, and abstract truths. They also occur in a variety of set phrases (especially "sto lat" [100 years]). The corpus data show that references to the temporal distance beyond that period are hardly ever used in impromptu conversations to discuss matters reflecting personal experiences or expectations, which indicates that in practice *personal* time perspective stops at the boundary of around 50 years. Beyond that region the frequency of temporal adverbials observed in the data is so random and immaterial, that it is impossible to discern any further consistent temporal horizon functioning systematically in the human mind from the personal perspective.

(8) On the other hand, the analysis of retrieved language samples shows that an *abstract* time perspective is practically unlimited. The longest time periods mentioned in the conversations extend to 5,000 years (a remark about Chinese culture) and 200,000,000 years (a remark about the history of the Solar System), which shows that in everyday speech it is absolutely not unusual to refer to some transcendental facts occurring in potentially infinite periods back and ahead in time (see Boyd & Zimbardo, 1997; Suddendorf & Corballis, 2007).

9.8 Alterations of temporal horizon across age groups

The following chart presents frequencies of temporal adverbials found for five year brackets distinguished for the age of speakers. For periods shorter than or equal to one day, the results are based on 2124 examples found in 420 different conversations. For periods longer than or equal to one week, the results are based on 2130 examples found in 389 different conversations. This corresponding amount of linguistic material was normalized in the analysis proportionally both to the number of analyzed examples and to the number of utterances recorded in the corpus for each distinguished age bracket (see Appendix to this chapter for details). Frequencies for speakers younger than 21 and older than 75 are not discussed in this study, since these age groups are relatively underrepresented in the corpus.

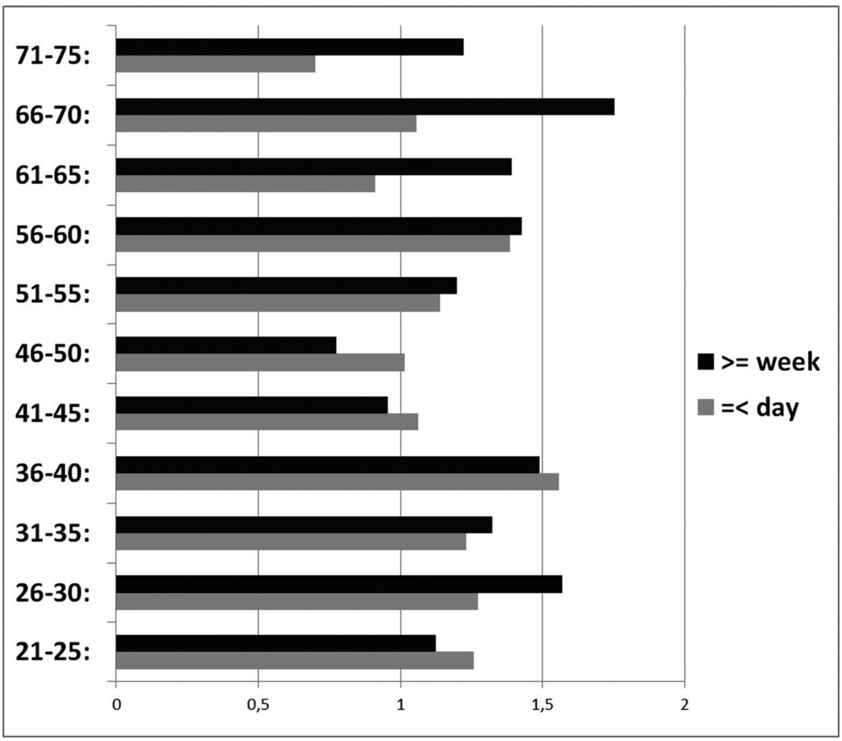

Figure 9.3 References to periods shorter than or equal to one day vs. periods longer than or equal to one week observed in the corpus across different age groups

(9) Figure 9.3 presents frequencies of temporal adverbials for the distinguished five year brackets, separated into periods shorter than or equal to one day, and periods longer than or equal to one week. As shown in the chart, corpus data indicate that

the temporal horizon plays an important role in the human mindset throughout the whole lifetime, which is congruent with psychological conclusions (Fraisse, 1963; Seligman, 1975; Hendricks, 2001) that the time perspective never ceases to exert an influence on our functioning in the life-space.

(10) What is also noticeable in the chart is that members of certain age brackets manifest the tendency to refer to temporal perspectives more frequently than others. This can be observed in the 31 to 40 age brackets. For this age group, both shorter and longer time perspectives appear to be similarly important. On the other hand, a drop in the frequency of adverbials expressing both shorter and longer temporal distances can be observed among 41–50 year olds. Interestingly, when speakers cross the threshold of retirement (61 to 75 age brackets) the frequency of adverbials referring to temporal distance, especially longer ones, remains at levels similar to those observed in younger groups, and even increases in the 66 to 70 age bracket, which confirms that temporal horizons tend to change dynamically over the life span, but do not dissipate as we grow older (Kastenbaum, 1963; Rakowski, 1986; Hendricks, 2001).

(11) Moreover, the data suggest that speakers belonging to certain age groups have a tendency to refer more frequently to longer temporal distances, i.e. longer than or equal to one week. As demonstrated in Figure 9.3, this inclination can be observed in 26 to 30 age bracket, and among speakers who passed the 60th year of their lives. Statistical significance of these differences for the distinguished age groups was checked with the test of logistic regression GLMEM (Generalized Linear Mixed-Effects Model), which was found by Gries (2011) to yield a relatively higher accuracy in linguistic studies examining frequencies of lexemes than standard tests used in psycholinguistics (F_1/F_2 and quasi-F statistics or ANOVAs). All analyses were conducted in R software (R Foundation for Statistical Computing, 2012)

Testing shows that statistical significance of the difference in frequency between longer and shorter temporal horizons exists for the distinguished 26–30 age bracket, $Pr(>|z|) = 0.000381$. Statistical significance also emerges in the distinguished groups of older speakers: the 61–65 age bracket, $Pr(>|z|) = 0.066349$, and the 65–70 age bracket, $Pr(>|z|) = 0.055072$, which when analyzed together as a 10 year bracket manifests statistical significance, $Pr(>|z|) = 0.0232$. Validation of the above-listed results with a test of independence based on chi-square, confirmed the statistical significance of the whole set of data ($\chi^2 = 23.6$, $df = 10$, $P(>\chi^2) = 0.0087$).

The difference observed for the distinguished 26–30 age bracket indicates that longer temporal perspectives can be attributed to early adulthood. This is congruent with observations by Fingerman and Perlmutter (1995), who found that younger adults (aged 20 to 37) tend to think frequently of more distant future periods, because they view time from longer perspectives of their individual, social, and professional development at that stage of life. The differences observed in the distinguished 61 to 75 age brackets indicate that as we enter the autumn of our lives we tend to consider time from relatively longer perspectives, i.e. measured in weeks and longer periods, rather than short temporal spans, i.e. measured in days and shorter periods. It goes in line with psychological observations (Kastenbaum, 1963; Rakowski, 1986; Hendricks, 2001) that in later adulthood time is as important as for younger generations, but we tend to approach it from a broader outlook.

(12) Generally, temporal perspectives observed though a lens of the conversational corpus data manifest a tendency to alter dynamically across age groups. These changes are related to subjective importance attached by people in different stages of life to shorter and longer time perspectives. The course of alterations observed in the corpus data is generally congruent with psychological findings on differences in time perspectives across the life span. Parallel examinations conducted for other demographic variables registered in the corpus, i.e. gender and level of education or speakers, did not reveal statistically significant correlations (see also Hancock & Rausch, 2010).

9.9 A cognitive schema of temporal horizon

The above-discussed properties of the temporal horizon observed in spontaneous everyday language of Polish speakers can be summarized into a general cognitive schema of temporal horizon based on Lewin's (1939) field theory and Langacker's (2012) representational space model of processing time in human cognition. The image schema that emerges from the frequency of adverbials denoting temporal distance found in the corpus data is depicted in Figure 9.4. The extension of temporal horizon, i.e. the aggregated frequency of references to temporal perspective in each distinguished temporal region, is represented by the radius length. The density of temporal horizon, i.e. the average frequency of references to temporal perspective in each distinguished temporal region, is represented by the density of dots. The emergent image schema indicates that the temporal horizon does not function in the human mindset as homogeneous circular zones of the past, present, and future time (cf. *Circles Test* in Cottle, 1967), or evenly spreading centrifugal circles, but is more likely to operate in three fundamental temporal brackets corresponding to *one day*, *one year*, and *up to about 50 year* periods.

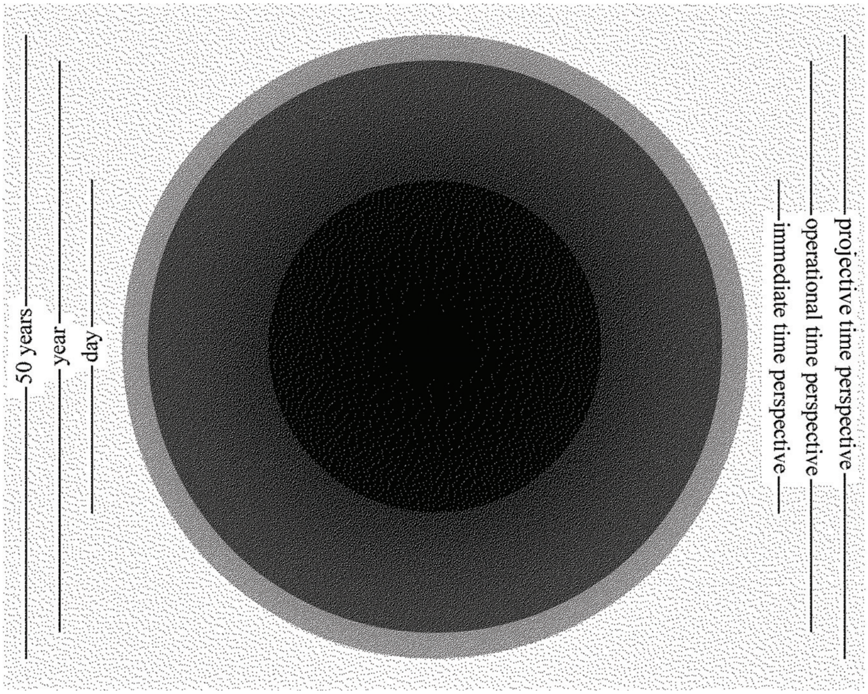

Figure 9.4 Cognitive schema of temporal horizon emergent from the corpus data

Figure 9.4 illustrates how the temporal horizon is partitioned in the human mind into three distinctive regions. The central part of the chart (characterized by the greatest frequency of references to the temporal distance observed in spontaneous conversations) represents one day span. It can be labeled *immediate* time perspective. Since expressions referring to one day or shorter temporal perspectives are mentioned most frequently in the conversations, this temporal region is likely to be most relevant to our daily coping in the immediate life-space.

The next emergent area (also characterized by a very high frequency of references to temporal distance observed in the conversations) extends to the region of one year. The frequency of references found in the corpus data indicates that it is almost as important in the daily activity. Because of its significant influence on the daily coping in the immediate life-space, it can be labeled *operational* time perspective.

Beyond the region of one year the data show a clear tendency for the frequency of references to temporal perspective to decline progressively as time periods become increasingly longer. Each consecutive year is characterized by a noticeably lower frequency of references to temporal distance (except for systematic increases observed for round year periods), which occurs to the boundary of about 50 years. The analysis of the corpus data demonstrates that in this region references to temporal perspectives are used mainly for projecting ourselves in a variety of past and future situations. They are not directly relevant to our functioning in the immediate life-space, thus this region can be labeled *projective* time perspective. Overall, the results indicate that the *personal* time perspective, which reflects personal life experience, should be distinguished from the *abstract* time perspective (cf. *transcendental* in Boyd & Zimbardo, 1997). The latter is practically unlimited, and can be observed, for example, in mental time traveling (Suddendorf & Corballis, 2007).

Moreover, the frequencies found in the linguistic data across age groups indicate that personal temporal horizons have a tendency to alter dynamically throughout the lifetime. Therefore, the cognitive schema of time perspective represented in the above chart is not static, but acts somewhat like a human iris (which it resembles): it adjusts dynamically to conditions that people experience in their life-space at a given stage of life. Although we can presume that the distinguished: immediate, operational, and projective temporal horizons are universally characteristic of the population of speakers represented in the corpus (cf. Block et al., 1996; Hill et al., 2000; Ji et al., 2009), their significance to an individual's functioning in the immediate life space is indisputably influenced by a multitude of specific personal factors (Fraisse, 1963; Zimbardo & Boyd, 2008).

The results obtained in this study do not arise from a subjective interpretation of linguistic declarations, but reflect objectively verifiable frequencies found in the corpus data, which validates the credibility of findings. However, despite the fact that the PELCRA SCCP is among the largest repositories of demographically annotated transcriptions of spontaneous conversations available currently in the world, it is not unusual for a single person to produce thousands spoken words every day, at the rate of two to three per second in a normal fluent conversation (Levelt, 1999). Billions of words are spoken in impromptu conversations every day, which shows how modest assets of spoken conversational corpora are available globally, even in linguistic resources with "national" in their name. Since in reality no corpus can ever hope to be representative of a language (McEnery and Wilson, 2001, pp. 77–78), the PELCRA SCCP must be approached as a rough approximation of the actual linguistic reality. For that reason, findings presented in this paper should be treated as likely indicators of certain aspects of cognition recognizable in empirical linguistic data, not irrefutable truths.

Moreover, there are much more sophisticated data mining algorithms used in identification of various types of linguistic patterns in conversations (Garside, Leech & Sampson 1987; Carenini, Murray & Ng, 2011), which means that the results presented in this study can be further refined to exclude cases coincidentally identified by the employed algorithm as belonging to a given temporal perspective. For example, some utterances referring to "that year" are obviously situated in a further perspective than one year, though it still indicates that the past period is perceived from a year's perspective. However, preliminary concordance analyses that have been conducted to that end show that such adjustments effectuate in changes that are fairly insubstantial to the overall results presented in this study.

Appendix to Chapter 9

1. Explanations for query listings

The PELCRA Spoken Conversational Corpus of Polish (2010 edition) is available via PELCRA online concordancer at: http://www.nkjp.uni.lodz.pl/spoken.jsp. All queries were implemented only for the *conversational* type of linguistic data (available via "Typ: typ_konwers" option). The number of returned results was set to the maximum of 10000 (available via "Wyniki" option). Each proximity query is presented with the value of *slop* factor (available via "Maks. odstęp" option). The PELCRA online concordancer offers an underlying Polish morphological dictionary, which allows for queries incorporating all Polish inflectional forms with the use of double asterisk (**)as a wildcard. For example, the query [rok**] substitutes for "rok, roku, rokiem… etc." A single asterisk (*) replaces any number of characters, e.g. [*naście] results in "jedenaście, dwanaście, kilkanaście, etc." The *pipe* (|) indicates logical AND. For age demographics the results were normalized proportionally to the number of utterances for each distinguished age bracket: 21-25: 69203, 26-30: 24719, 31-35: 13070, 36-40: 4413, 41-45: 7179, 46-50: 13931, 51-55: 13461, 56-60: 4079, 61-65: 1551, 66-70: 1339, 71-75: 1076. Statistics were computed using R software, a language and environment for statistical computing, available for download at: http://www.R-project.org

2. Corpus queries used to examine the density and extension of time perspective:

moment(s): [o|z|w|na|za|przez|przed|po|od moment**|momencik**|chwila**|chwilka**], SLOP FACTOR=2

second(s): [o|z|w|na|za|przez|przed|po|od sekunda**|sekundka**], SLOP=2

minute(s): [o|z|w|na|za|przez|przed|po|od minuta**|minutka**], SLOP=2

hour(s): [o|z|w|na|za|przez|przed|po|od godzina**|godzinka**], SLOP=2

day(s) (incl. 'today', 'tomorrow', and 'yesterday'): [o|z|w|na|za|przez|przed|po|od dzień**|dziś**|dzisiaj**|jutro**|wczoraj**], SLOP=2

week(s): [o|z|w|na|za|przez|przed|po|od tydzień**], SLOP=2

month(s): [o|z|w|na|za|przez|przed|po|od miesiąc**], SLOP=2

1 year: [o|z|w|na|za|przez|przed|po|od rok|roku|rokiem], SLOP=2

2 years: [o|z|w|na|za|przez|przed|po|od dwa** lat|lata|latach|laty], SLOP=2

3 years: [o|z|w|na|za|przez|przed|po|od trzy** lat|lata|latach|laty], SLOP=2

4 years: [o|z|w|na|za|przez|przed|po|od cztery** lat|lata|latach|laty], SLOP=2

5 years: [o|z|w|na|za|przez|przed|po|od pięć** lat|lata|latach|laty], SLOP=2

6 years: [o|z|w|na|za|przez|przed|po|od sześć** lat|lata|latach|laty], SLOP=2

7 years: [o|z|w|na|za|przez|przed|po|od siedem** lat|lata|latach|laty], SLOP=2

8 years: [o|z|w|na|za|przez|przed|po|od osiem** lat|lata|latach|laty], SLOP=2

9 years: [o|z|w|na|za|przez|przed|po|od dziewięć** lat|lata|latach|laty], SLOP=2

10 years: [o|z|w|na|za|przez|przed|po|od dziesięć** lat|lata|latach|laty], SLOP=2

11-19 years: [o|z|w|na|za|przez|przed|po|od *naście|*nastu lat|lata|latach|laty], SLOP=2

20-29 years: [o|z|w|na|za|przez|przed|po|od dwadzieścia** lat|lata|latach|laty], SLOP=3

30-39 years: [o|z|w|na|za|przez|przed|po|od trzydzieści** lat|lata|latach|laty], SLOP=3

40-49 years: [o|z|w|na|za|przez|przed|po|od czterdzieści** lat|lata|latach|laty], SLOP=3

50-59 years: [o|z|w|na|za|przez|przed|po|od pięćdziesiąt** lat|lata|latach|laty], SLOP=3

60-69 years : [o|z|w|na|za|przez|przed|po|od sześciesiąt** lat|lata|latach|laty], SLOP=3

70-79 years: [o|z|w|na|za|przez|przed|po|od siedemdziesiąt** lat|lata|latach|laty], SLOP=3

80-89 years: [o|z|w|na|za|przez|przed|po|od osiemdziesiąt** lat|lata|latach|laty], SLOP=3

90-91 years: [o|z|w|na|za|przez|przed|po|od dziewięćdziesiąt** lat|lata|latach|laty], SLOP=3

100-109 years: [o|z|w|na|za|przez|przed|po|od sto** lat|lata|latach|laty], SLOP=4

200-990 years: [o|z|w|na|za|przez|przed|po|od
dwieście**|trzysta**|czterysta**|pięćset**|sześćset**|siedemset**~
|osiemset**|dziewięćset** lat|lata|latach|laty], SLOP=4

thousand(s) years: [o|z|w|na|za|przez|przed|po|od tysiąc** lat|lata|latach|laty], SLOP=5

3. Corpus queries used to probe alterations of time perspective across age groups:

Time perspective >= 1 day: [o|z|w|na|za|przez|przed|po|od moment**|chwila**|minuta**|godzina**|jutro**|wczoraj**|dzień**], SLOP FACTOR=3

Time perspective =< week: [o|z|w|na|za|przez|przed|po|od tydzień**|miesiąc**|kwartał**|rok**], SLOP FACTOR=3

Results for particular age brackets were obtained by sorting of the resulting concordances by age.

Conclusions

It would be unwise to draw hard and fast conclusions about the reciprocal relationship between space and time in the human mind from research so restricted in its scope. However, it seems plausible to presume that the results of studies presented in this book are indicators of certain properties of the entanglement between space and time in cognition.

One observation that emerges from this study is that the cognitive entanglement of space and time is not universally unidirectional. Instead, it appears that the relationship between space and time in cognition hinges, at least to some extent, on the underlying semantic context in which a particular conceptualization takes place. As demonstrated in Chapters 6–7, the semantic element of motion can act as a modulator that shifts conceptualizations of distance in space from spatial to temporal terms. It is also indicated by the results of research discussed in Chapter 8, which demonstrated that the lack of motion contributes to a perceptible atemporality of linguistic representations of distance in spatial contexts.

Taken together, the results of this study suggest that in certain cognitive contexts, namely motion-framed scenarios, space, time, and motion can be viewed as elements of a unified conceptual frame, which dictates the relationship between space and time in a complementary fashion. Kövecses (2005, p. 53) discusses the TIME-MOTION schema, within which elements can stand for each other in the form of metonymies. He notes that in English one can say, for example, "I slept for *fifty miles* while she drove" (DISTANCE FOR TIME-DURATION), as well as "San Francisco is *half an hour* from Berkeley" (TIME-DURATION FOR DISTANCE). He argues that this unified literal frame of universal experiences can be viewed as the experiential basis for the TIME IS MOTION metaphor in different variants discussed in Chapter 2. In the light of this study, it is plausible to presume that in the semantic contexts of motion events the scope of universal experiences extends to embrace the conceptualization of spatial relations, as well. As demonstrated in Chapter 7, in such contexts both time *and* space are literally correlated with motion in a single conceptual frame, or a schema of SPACE-TIME-MOTION. It was already pointed out by Aristotle in *Physics* (350BC/1995b) that *both* space and time are required for motion to occur in the first place. Even a spindle revolving in one location requires a certain amount of space: once squeezed tight, it will stop spinning.

The metonymical relationship between space and time in motion has been noticed by Engberg-Pedersen (1999), who points out that we can use names of places, which are primarily spatial words, to denote punctual moments in time in terms of spatial locations, e.g. "I haven't had a drink since London". This also indicates that in the context of motion events cognition of space and time is tightly bound to the SPACE-TIME-MOTION schema, within which any two elements can stand for the third one: time elapsed in motion can be used to express spatial distance; space traversed in motion can be used to identify duration, which is commonly used for telling the time by the Sun's position in the sky; a punctual moment in time can be used to specify a location passed while traveling; and a specific location passed during traveling can be used to refer to a specific moment in time. This complementarity of space and time in motion is likely to be related to the unity of time, space, and motion observed by Aristotle in the surrounding world, or perhaps, even to the spatial–temporal relativity assumed by Einstein's (1916/1952a) General Relativity Theory (see Hawking, 1988, Ch. 2).

However, the potential interchangeability of space with time in the semantic context of motion events is not universally manifested across all linguistic contexts. In everyday linguistic practice, our conceptualizations of spatial–temporal relations in motion events are restricted by *conceptual layering*. As discussed in Section 4.7, it makes us normally conceptualize motion as happening through space in time, rather than through time in space, despite the fact that from the outlook of modern physics there is no real difference between these two conceptions (Langacker, 2012). The research presented in this volume opens a question of *rigidity* of the conceptual layering. It demonstrates that as language users we are at certain liberty to choose either a spatial or temporal aspect for conceptualization of a motion event, according to what suits better our subjective *profiling* needs in a particular situation. For example, in urban environments, where our separation from remote locations depends on the traffic intensity, we naturally choose to express spatial distance as *travel time* (McEarchen, 1980; Wagner, 2006, p. 16). Moreover, whenever we wish to express our subjective stance to a distance in space, we can express spatial extension in temporal terms as particularly long, e.g. "It will take *ages* to reach London from this God forsaken place!" or short, e.g. "The road runs along the coast for only *two seconds*!"[109]

[109] This example is taken from Matlock's (2004a) study of conceptual motivation of fictive motion. Its full version: "The road runs through the city for over an hour, through the suburbs for 30 minutes, and then along the coast for only two seconds!" illustrates the speaker's intention to contrast a particularly short section of road along the coast with some other sections of the same road.

It appears that the rigidity of conceptual layering is established, as least for some part, by the patterns of commonly used phraseology, rather than by conceptual restrictions as such. This can be attributed to *sedimentation* of meaning understood as the linguistic consolidation of cognitive structures originally given in embodied sense-experience through certain persisting linguistic conceptualizations superimposed by language acquisition and socio-cultural transmission (Woelert, 2011).

A largely flexible nature of the conceptual layering can be observed in certain creative uses of space and time in descriptions of goings-on. Especially in literary texts, the lonely hero tends to *walk away into the sunset*, ghostly figures *melt away into the darkness*, and a devious villain can *emerge from the past*. In a similar fashion, even though it sounds startling at first, we accept that a course of action can proceed "from here to eternity",[110] and perhaps it would not be utterly senseless for something to vanish "from now to nowhere". Such elastic conceptualizations lie in the nature of human psyche, which effortlessly surpasses the confines of physical space and time. It can be observed in *constructing time after death* (Boyd & Zimbardo, 1997), and in *mental time traveling* (Suddendorf & Corballis, 2007). Both are absolutely common cognitive phenomena, traditionally associated with uniqueness of human beings (but see a recent discussion between Corballis (2013a) and Suddendorf (2013); Corballis (2013b) for a dissent, if the latter pertains to animals, as well).

For all that, the spatial–temporal entanglement is still "a rabbit hole phenomenon" (cf. Pinker, 2007, Ch. 2). From the perspective of studies presented in Chapters 7 and 8, it appears that a proper answer to the question of entanglement between space and time in cognition runs deeper than attributing their reciprocal relationship to the ties that bind space to time in motion, on the one hand, and the socio-cultural sedimentation of meaning through commonly used phraseology, on the other. This leads to another observation that can be drawn from this study, again bearing in mind the above-made reservation that the scope of this research is too restricted to draw some hard and fast conclusions. Namely, taken together the research discussed in Chapters 7 and 8 indicates that the entanglement of space and time in cognition relates to a higher-order distinction between conceptions of *objects* and *events* (Langacker, 1987b; 1991; 2008a; 2012; cf. Szwedek, 2011 for a distinction between the material world and the phenomenological world).

If we approach time and space in cognition as *relations*, following the Leibnizian model (H. Alexander, 1956) of space as a system of *spatial relations* between objects and time as a system of *temporal relations* between events (Huggett & Hoefer, 2009), it is plausible to presume that cognition of space and time is strongly tied to

[110] "From Here to Eternity" is the title of James Jones' novel published in 1951.

relations holding between objects and events, which act as the underlying conceptions for space and time at a higher ontological and epistemological level. It was already established by Piaget (1946/1969; Piaget & Inhelder, 1948/1956) that children first learn physical bodies and motions and only later, in relation to them, develop conceptions of space and time. In other words, the relationship between space and time may be viewed in a manner somewhat parallel to that of mathematical operations: they exist but do not mean much without entities to add, subtract, multiply, or divide, etc. For example, without entities that can be added and subtracted, there is not much to talk about the reciprocity between addition and subtraction, except for the fact that they are polar opposites. We need numbers to start discussing basic arithmetic (see Lakoff & Núñez, 2000). Similarly, there is not much to talk about the mutual relationship between space and time without entities, either. This is not to propose that *ception*[111] of space and time *per se* does not exist (cf. Gibson, 1975), but rather to assume that their mutual entanglement in cognition is closely tied to apprehension of specific relations holding between objects and events in the surrounding world, which essentially derives from perceptual-motor interactions (see Sheets-Johnstone, 2011).

We can reasonably presume that conceptions of objects and events are located in the spatial-temporal framework, with space as the primary domain of instantiation for objects, and time as the primary domain of instantiation for events, respectively (Langacker, 1987b, 1991, 2008a, 2012; see also Radvansky & Zacks, 2011). The results of research discussed in Chapters 7 and 8 appear not only to confirm this presumption from the empirical linguistic perspective, but additionally make it plausible to assume, with due caution, that spatial and temporal conceptualizations of the surrounding reality descend from the ception of objects and events. Obviously, the scope of the research presented in this book is far too limited to indicate that the conceptualization of spatial–temporal relations is structured systematically with reference to the underlying conceptions of objects and events. However, the essential point this study is trying to make is that people do not map space and time onto each other in an exhaustive fashion, but rather construe linguistically both spatial and temporal representations in relation to the underlying structures of objects and events.

Taking such an outlook allows for reconciliation between two seemingly incompatible views on metaphorization of spatial–temporal relations, which were discussed in Section 2.5. From this perspective, it is as perfectly possible to accept *objectification of time* (Szwedek, 2009a) in static contexts, as it is to question *spatialization of time*, due to the *temporal transience*, in dynamic contexts (Galton,

[111] Borrowing from Talmy (1996), "ception" refers to both perception and conception.

2011). Moreover, it is as perfectly possible to question metaphorization of spatial and temporal relations (Szwedek, 2009a, 2009b; see also Jackendoff, 2002, pp. 356–360), when they are viewed as purely abstract in the Leibnizian sense, as it is to accept metaphorization of temporal relations in terms of space (Lakoff and Johnson, 1980, 1999), as well as metaphorization of spatial relations in terms of time (Engberg-Pedersen, 1999), when they are viewed as specific relationships holding between objects and events. From this outlook, conceptualizations of spatial–temporal relationships in certain contexts may be modulated not only by motion *per se*, but also by other kinds of *force-dynamic interactions* (see Langacker, 1991, Ch. 7; 2008a, Ch. 11; Talmy, 1988a; 2000a, Ch. 7; Kardela, 2007).

The complementarity of space and time in cognition has been additionally illustrated in this book with a study of the cognitive schema of temporal horizon presented in Chapter 9. It demonstrated an example of spatialization of time, which as pointed out by Bergson (1922/1999) enables us to transfer temporal thought into spatial codification in order to overcome the elusive, evanescent nature of time. Similar efforts directed at comprehending the nature of temporal cognition can be observed in studies examining the phenomenon of *mental time line* (see Bonato et al, 2012 for a review). We must, however, keep in mind that cognitive mechanisms of time perception and processing, despite tenacious efforts in psychology and neuroscience, have not been identified (Hancock & Block, 2012; Wittmann, 2013). So far, the cognitive complexity of temporal experience transcends the data obtained with any scientific instrument of time measurement.

The work started in this book is by no means finished. It barely touches upon selected aspects of spatial-temporal relations in language. As discussed throughout this volume, since the 1970s the investigation of spatial construals of time has been advancing in waves using diverse methodologies ranging from linguistic analyses and cross-cultural fieldwork, to psychological experimentation. Researchers across the disciplines of cognitive science still pursue this question on different levels with new methodologies, most recently neuroimaging (e.g. Dehaene & Brannon, 2011). The body of research collected so far includes a rich and multidisciplinary set of findings, but we still do not know exactly how spatial-temporal mapping arises, e.g. *evolutionarily*, *developmentally*, and by what mechanisms it is driven, e.g. *maturational*, *cultural* (Núñez & Cooperrider, 2013).

Spatial–temporal reasoning styles appear to depend on environmental factors, such as a particular geometry of the local terrain (e.g. Brown, 2012; Núñez, Cooperrider, Doan & Wassmann, 2012), cultural conceptions of the cosmic organization of reality (e.g. Boroditsky & Gaby, 2010; Núnez & Cornejo, 2012), or direction of writing (e.g. Miles et al., 2011; Bergen & Chan Lau, 2012). As summarized by Núñez and Cooperrider (2013, p. 225), "all of these factors may play a role in shaping spatial construals of time, but their relative weighting remains to be investigated". The research presented in this book suggests that a plausible point of departure for further studies on the entanglement of space and time in the human mind is to approach their mutual relations from the perspective of objects and events. From this foothold, we can systematically proceed deeper down the rabbit hole by analyzing the impact of internal structuring of objects and events on spatial and temporal conceptualizations. Although this book opens more paths for future research than provides definite answers about the present state of affairs, it is nevertheless hoped that it contributes a meaningful input, from the linguistic perspective, to efforts aimed at resolving the relationship between space and time in language and cognition.

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