22 How we conceptualise time: language, meaning and temporal cognition

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1 Introduction

This paper represents a linguistic investigation into the nature of time, and is based on proposals developed at greater length in Evans (2004). Given that linguistic organisation and structure reflects, at least partially, the nature and structure of thought, as it must if we are to be able to employ language in order to facilitate the expression of our thoughts, then language constitutes a key tool in investigating the nature of conceptual organisation. My focus here is on what language can reveal about CONCEPTUAL STRUCTURE – the nature and structure of thought. I will be focusing on TEMPORAL COGNITION– that aspect of conceptual structure which relates to our conceptualisation of time. The crux of my argument is that time, as realised at the conceptual level (and as revealed by linguistic organisation), is not a unitary phenomenon, but rather, constitutes a complex set of temporal concepts, which combine to form a number of distinct larger-scale cognitive representations for time.

While I will be focusing, in this paper, on the 'structure' of time at the conceptual level, that is, how we represent time as revealed by the way temporal concepts are encoded in language, this level of temporal representation derives from our experience of time. Accordingly, we must first, briefly, get a sense of what temporal experience is, as revealed by research in cognitive science. First, we turn to evidence from neuroscience, which points to the view that temporal experience is grounded in mechanisms necessary for regulating and facilitating perception.

Findings from neuroscience, the interdisciplinary study of the brain and nervous system, suggest that temporal experience is ultimately related to the perceptual mechanisms that process sensory experience (e.g., Turner & Pöppel 1983; Pöppel 1994; Michon 2004). That is, perceptual processing is underpinned by temporal intervals, termed PERCEPTUAL MOMENTS, which facilitate the integration of sensory experience into perceptual 'time-slots'. In other words, perception is a kind of 'windowing' operation, which presents and updates our representation of the external environment. The updating occurs by virtue of timing mechanisms: perceptual moments, which hold at all levels of neurological processing, and which range from thousandths of a second in duration to an outer limit of around three seconds. It is these timing mechanisms which form the basis of our experience of time.

Evidence for timing mechanisms comes from a number of sources, which are associated with a range of different brain structures including the cerebellum, and the cortex

(see Mauk & Buonomano, 2004, for an excellent review). One source of evidence comes from electrophysiological experiments. For instance, brain activity can be measured by techniques such as the electroencephalogram (EEG). The brain produces electrical signals, which are measured by attaching electrodes to the scalp. These read signals and send them to a galvanometer, an instrument which measures small electrical currents. An EEG allows researchers to observe changes in brain activity over split seconds of time. The brain rhythm revealed by an EEG is measured by the frequency of electrical pulses per second, and is produced on a galvanometer as a series of 'waves' with peaks and troughs (see Figure 1).

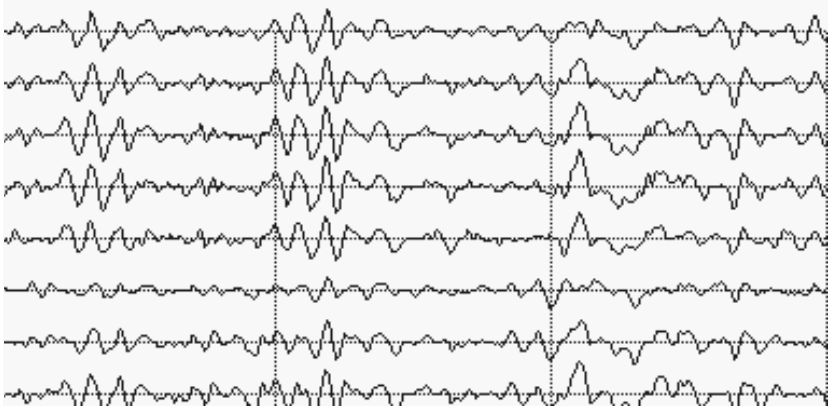

Figure 1: Approximately 3 seconds of data from 8 EEG electrodes

A second way of assessing timing mechanisms comes from exposing subjects to stimuli of certain kinds, at particular points of brain activity. A well-known experiment of this kind involves exposing subjects to two flashing lights, and relies on the phenomena known as APPARENT SIMULTANEITY and APPARENT MOTION. If the lights are set to flash with less than a period of between 0.1 and 0.2 seconds between their respective flashes, the lights will be perceived as flashing at the same time. This is the phenomenon of apparent simultaneity. If the interval between the two flashing lights is increased slightly, the flashing appears to be in rapid motion, the phenomenon of apparent motion. If the interval between flashes is increased again slightly, the flashing appears to be distinctly sequential. However, when lights are set to flash at an interval close to the transition between apparent simultaneity and apparent motion, experimenters have found that when the flashing is correlated with the brain's own activity, what is perceived depends on when in the subject's own brain rhythm the subject is exposed to the flashing lights.

In the visual cortex, the dominant rhythm, the alpha rhythm, has a frequency of around 10 pulses per second. If the lights are set flashing when the alpha rhythm is at a peak, then what the subject sees is apparent motion. If the flashing lights are started when the alpha rhythm is in a trough, it results in apparent simultaneity being perceived. Findings such as this provide compelling evidence that it is neurological activity in the

brain, innate 'timing mechanisms', which give rise to perceptual moments, and thus are in large part responsible for what we perceive.

A second source of evidence for perceptual moments comes from symbolic systems such as language. Language, like other human symbolic behaviours, notably music, appears to manifest rhythmic organisation. For instance, Turner and Pöppel (1983) have shown that the fundamental unit of metered poetry, what they term the LINE, can contain between four and twenty syllables, depending on the language. This is based on a wide survey of languages from a range of different language families and geographical areas, and even from different periods in history. Languages surveyed included Latin, Greek, English, Chinese, Japanese, French, German, Ndembu (Zambia), Eipo (New Guinea), Spanish, Italian, and Hungarian. Remarkably, however, despite the number of syllables involved, Turner and Pöppel found that the time taken for recitation of the Line among these languages typically ranges from between 2.5–3.5 seconds. The striking similarity in duration in units of metre across such a diverse set of languages is strongly suggestive that there is a common timing mechanism, or set of mechanisms, which is coordinating such rhythmic behaviour.

The upshot of all this is that, as Michon (2004) has strikingly put it, the basis of temporal experience is 'between the ears' rather than 'between the stars'; the provenance of time is internal rather than external. While time is not a physical thing, something that is objectively 'out there' which can be perceived in the same way that objects in space can be, it is nevertheless a real experience. Our awareness of time emerges from the process of perceiving, and from the properties of our perceptual apparatus. That is, it is a consequence, ultimately, of the various 'timing mechanisms' in the brain which give rise to a range of perceptual moments, or different intervals, which are necessary for and underpin perceptual processing. As such, time necessarily enters into our experience of everything as it is fundamental to the way in which perceptual processes operate.

Having considered some findings from neuroscience, we now briefly examine the results of research from psychology. Unlike space, time is not a concrete or physical sensory experience. Moreover, unlike the sensory-perceptual apparatus humans have that are specialised for assessing spatial experience (e.g., the visual system), we have no analogous apparatus specifically dedicated to the processing of temporal experience. Nevertheless, we are aware of the 'passing' of time. This awareness of time appears to be wholly introspective or subjective in nature, consonant with the findings from neuroscience. Research from psychology suggests that (i) temporal experience is both phenomenologically real, that is, we actually perceive temporal experience, albeit as an introspective experience; and (ii) our subjective experience of time is not a single unitary phenomenon. Rather, it is comprised of a number of distinct, although related, experiences such as our ability to assess duration, our ability to assess simultaneity, our ability to assess 'points' in time, our awareness that sometimes duration appears to proceed more 'slowly' or more 'quickly' than usual, our experience of 'now', and so on. For instance, one striking finding to emerge from both the pioneering work of cognitive psychologist Robert Ornstein (1997[1969]), and the more recent work of social psychologist Michael Flaherty (1999) is that there are different kinds of experiences of duration. Moreover,

and startlingly, rather than being dependent upon the nature of external events, our experience of duration depends on how we attend to the stimulus array associated with a particular event. That is, it is how we interact with and attend to a particular event, rather than any 'objective' temporal properties associated with such an event, which gives rise to our experience of duration. Flaherty (1999, p. 96) argues in detail that humans experience what he terms PROTRACTED DURATION. This constitutes the experience that temporality is proceeding more 'slowly' than usual. Flaherty suggests that

> protracted duration emerges within the context of so-called empty intervals (e.g., solitary confinement) as well as intervals which are full of significant events (e.g., interpersonal violence) […this is because these] intervals are in fact filled with cognitive and emotional responses to one's predicament. A sharp transition from normal interaction to 'empty' […or 'full'] time ignites a preoccupation with aspects of self and situation that would have been overlooked in ordinary encounters. In particular, we often find that the person becomes more caught up in the rhythms of his or her own physiological existence.

In addition to protracted duration Flaherty discusses the experience of TEMPORAL COMPRESSION. As he puts it, while '[p]rotracted duration is experienced when the density of conscious information processing is high […] temporal compression is experienced when the density of conscious information processing is low' (1999, pp. 112–113). The density of conscious information can be said to be high when the subject is attending to more of the stimulus array. The density of conscious information can be said to be low when the subject is attending to less of the stimulus array. Flaherty provides a taxonomy of the various kinds of experiences which give rise to high and low densities of conscious information processing. For instance, experiences which give rise to a higher density of information processing and hence in which time appears to pass more slowly (protracted duration) include suffering and intense emotions, violence and danger, waiting and boredom, concentration and meditation, and shock and novelty. As the subject is consciously attending to the stimulus array, a greater density of information processing occurs. Given that our experience of duration appears to correlate with the amount of memory taken up (Ornstein 1997[1969]), then if more of the stimulus array is attended to, more memory is required to store and process what is being attended to, and consequently it is to be expected that we should actually experience the duration as being more protracted, which is what we find.[1]

Flaherty suggests that experiences which produce a lower density of information processing, and hence in which time appears to 'pass more quickly' (temporal compression) include those which involve ROUTINE COMPLEXITY. This relates to the idea that activities, which while potentially complex, through routine practice give rise to 'an abnormally low level of stimulus complexity brought on by the near absence of attention to self and situation' (1999, p. 108). Habitual conduct results in little of the stimulus array being attended to, resulting in low density of information processing. Accordingly, time seems to have passed 'quickly'.

In sum, the view that there are qualitatively distinct kinds of durational experiences which are associated with patterns of attending to particular stimulus arrays, and our level of familiarity with particular sorts of events, provides compelling evidence for the two claims which prefaced this discussion of Flaherty's work. First, temporal experience is phenomenologically real. We've all experienced events such as the first day drive to work which appears to take an extended period of time (protracted duration) as we carefully pay attention to the details of the route, etc. However, once mastered, after a few weeks or months, the same drive appears to go by 'in a flash' (temporal compression, due to the phenomenon of routine complexity). Second, temporal experience is not a unitary phenomenon. In just focusing on duration we have seen that there are two 'abnormal' kinds of durational experience, protracted duration and temporal compression.

Temporal experience, as it is represented at the conceptual level and encoded in language, which is the subject of the remainder of this paper, exhibits two levels of organisation. The first concerns LEXICAL CONCEPTS, which is to say, a concept which is conventionally represented by a single word, or by a fixed expression. Examples from English include the words *time*, *past*, *present*, *future*, etc. Lexical concepts of this kind can be structured in a range of ways at the conceptual level. For instance, the languages of the world appear to structure time in terms of motion, as we will see below. The second level of organisation concerns COGNITIVE MODELS for time. This is a level of organisation in which various lexical concepts are integrated together in order to provide complex, yet coherent, representations for time. It is this level of organisation that, for the most part, we employ in our everyday lives when we think and reason about time, and which we employ when we co-ordinate cultural and interpersonal activities such as scheduling meetings, moving meetings 'forwards' or 'backwards', when we prepare for 'approaching' events, and so forth. Thus, the main purpose of this paper is to provide an overview of the nature of our representation of these two levels of organisation which give rise to our conceptualisation of time, as evidenced by language.

2 Concepts for time

In order to provide an initial focus for the present investigation, I will examine the English lexical item *time*.[2] This presumably relates to our experience of time and so provides a good departure point. An important assumption that I am making is that lexical items constitute FORM-MEANING PAIRINGS. That is, the sound segments or PHONES which make up the lexical item *time*, consisting of a consonant, a diphthong and another consonant: [taɪm], are conventionally associated with a meaning element, i.e., a lexical concept. In this section I will show that *time* is conventionally paired with (at least) eight distinct, albeit related, lexical concepts.[3] The range of distinct temporal lexical concepts uncovered will begin to indicate both the complexity and the diversity of the way in which we conceptualise time.

2.1 Methodological issues

In order to be able to judge whether a particular linguistic usage of *time* relates to a distinct lexical concept or not, we require 'decision principles'. I propose three such principles or criteria. These relate to meaning, to concept elaboration and to grammar. In other words, when a particular usage of *time* is distinct in terms of meaning, or the way the concept is elaborated (which is to say structured), or if it exhibits a distinct grammatical pattern, then this is suggestive that we are dealing with a distinct lexical concept for *time*.

Let's consider each of the three criteria in turn. The first, the MEANING CRITERION, concerns whether a particular usage of *time*, in context, gives rise to a significant difference in meaning. To illustrate, consider the examples in (1) and (2):

(1) The relationship lasted some time

(2) The time for a decision is approaching

In the sentence in (1), *time* relates to the notion of duration, that is, an extended temporal elapse. This is in contrast with the sentence in (2) where *time* relates to a discrete temporal point or moment. Clearly, these two usages of time relate to significant differences in meaning.

The CONCEPT ELABORATION CRITERION relates to the way in which a particular lexical concept is structured at the conceptual level. This is reflected in the nature of the semantic content which collocates, i.e., co-occurs, with a particular meaning. One common way for the 'duration' meaning in (1) to be elaborated is in terms of length, as illustrated in (3):

(3) The relationship lasted a long/short time

As we saw in (2), the conventional way in which the 'moment' reading is elaborated is in terms of motion, as lexicalised by *is approaching*. A motion event of this kind is EGO CENTRED, as it relates to a contextually understood ego or 'perspective point' with respect to which the motion is directed. In other words, in (2) it is with respect to the speaker, or some other person, that the time for a decision 'is approaching'.

The final criterion, the GRAMMATICAL CRITERION, relates to the way the lexical form *time* is encoded. In grammatical terms the 'duration' reading associated with *time* is encoded as a mass noun, while the 'moment' reading is encoded as a count noun. The terms 'mass' and 'count' relate to a functional distinction in noun-types in which count nouns relate to entities conceptualised as being enumerable and thus can be counted, while mass nouns relate to entities which are not and thus cannot be counted. That is, while we can 'count' moments of time, as when we count seconds or minutes, precisely because entities of this kind constitute discrete moments, duration cannot be enumerated in this way, and constitutes an internally un-analysable mass. This distinction is reflected grammatically. Mass nouns can be encoded employing the quantifier *some*,

as in (1). *Some* serves the conceptual function of excerpting a portion of a mass entity thereby providing a discrete, and thus countable, unit (Talmy 2000). This quantifier cannot be applied to count nouns as these entities are already discrete, as illustrated by the ungrammaticality of the sentence in (4):

(4) *Some time for a decision is approaching

Following the convention in linguistics, the sentence in (4) is preceded by an asterisk indicating that when the 'moment' reading of *time* is encoded as a mass noun (i.e., employing *some*) the sentence is ungrammatical.

While we have just seen the 'moment' reading of time is not a mass noun, there is evidence that it is encoded as a count noun. This comes from the grammatically acceptable use of the indefinite article in conjunction with this reading, as in (5):

(5) A time for a decision will come one day

Only count nouns can appear with the indefinite article. This follows as the indefinite article indicates one instance of a particular entity, and thus an entity which can, in principle, be counted. As in the sentence in (1), the use of *time* in (5) relates to a temporal moment, and is elaborated in terms of ego-centred motion.

The three criteria discussed, with differential patterning in terms of meaning, conceptual elaboration and grammatical encoding suggest that the two distinct readings identified in the sentences in (1) and (2) constitute two distinct lexical concepts, despite both being encoded by the lexical form *time*. In the remainder of this section I will briefly examine the range of distinct lexical concepts or SENSES associated with the lexical form *time*.[4]

2.2 The duration sense

We met the Duration Sense in the previous section, an example of which was given in the example in (1). We observed that the meaning associated with this lexical concept related to the notion of duration, that it was elaborated in terms of length and was encoded grammatically as a mass noun.

Interestingly, the Duration Sense has two variants, the 'temporal compression' and 'protracted duration' variants illustrated in (6) and (7) respectively:

(6) Time flies when you're having fun ['temporal compression']

(7) Time drags when you're bored ['protracted duration']

These two variants relate to the phenomenologically real experiences in which time 'feels' as if it is 'passing' either abnormally 'quickly' or 'slowly', as discussed in Section 1.[5] What is common to the readings in (1), (3), (6) and (7) is that they all relate to the

experience of duration, albeit of slightly different kinds. However, while the Duration Sense can be elaborated in terms of length, as attested by the use of adjectives *long* or *short* as in (3), the two variants in sentences (6) and (7) are systematically elaborated in terms of distinct kinds of motion events. The 'temporal compression' variant is invariably elaborated in terms of motion events involving rapid motion, as in (8):

(8) Time whizzes/speeds/zooms/rushes (by) when you're having fun

or imperceptible motion as in (9):

(9) (a) The time has sneaked/tiptoed by/past
(b) Where has all the time gone?
(c) The time's vanished

This contrasts with the nature of motion events which elaborate the 'protracted duration' variant. These invariably relate to stationariness:

(10) Time seemed to stand still

or else extremely slow motion as we saw in (7).

Accordingly, what is common to the Duration Sense illustrated in (1) and (3) and the two variants illustrated in (6) and (7) respectively is that they are all related to the notion of 'duration', and hence all represent assessments of temporal magnitude. However, the two variants illustrated in (6) and (7) are distinct from the examples in (1) in that they are elaborated in terms of distinct kinds of motion events rather than in terms of length.

Hence, while partially distinct, these variants do share certain similarities with the Duration Sense: notably, they relate to different aspects of the notion of duration. Put another way, they do not concern wholly distinct meanings, despite their differential patterns of concept elaboration. Accordingly, I classify the 'temporal compression' and 'protracted duration' variants as SUB-SENSES[6] of the Duration Sense rather than as distinct senses (Evans 2005).

2.3 The moment sense

The next lexical concept we turn to is the Moment Sense. As with the Duration Sense, we met this lexical concept above in the examples in sentences (2) and (5). The key characteristics of this lexical concept are that it encodes a discrete temporal 'point', is elaborated in terms of ego-centred motion events, as lexicalised by verbs such as *come*, *approach*, *arrive*, etc., and is encoded grammatically as a count noun.

2.4 The instance sense

The third lexical concept conventionally encoded by *time* is termed the Instance Sense. In this lexical concept *time* prompts for an instance of a particular event, activity, process or state, rather than an interval as in the Duration Sense, or a discrete temporal point as in the Moment Sense. Consider some examples of this lexical concept:

(11) (a) O'Neil improved for the fourth time this winter when he reached 64.40 metres at a meeting in Melbourne

(b) The horse managed to clear the jump 5 times in a row

In each of the sentences in (11), *time* references a particular instance (i.e., occurrence) of an event or activity, rather than an interval or a moment. For example, in (11a) if we attempt to construct a 'moment' reading for *time*, we find that *time* does not mean, for instance, that O'Neil improved for a fourth consecutive moment, or that he improved on the fourth moment of trying. In terms of a possible 'duration' reading, time does not mean that the improvement lasted for a period of four moments. Rather, it means that there were four distinct instances of improvement, each instance representing an improvement on a previous instance (of improvement). Clearly, this usage of *time* constitutes a new and distinct meaning, suggesting that we are in fact dealing with a distinct lexical concept.

In terms of concept elaboration, the semantics associated with this lexical concept, the Instance Sense – it relates to an entity which constitutes an instance of something else – has little in the way of distinctive content ascribed to it. Hence, there are no salient or striking patterns of concept elaboration specifically associated with this lexical concept. In fact, this is the only lexical concept conventionally associated with the English lexical item *time* which lacks a striking pattern of concept elaboration.

Finally, in terms of grammatical encoding, one of the notable features of the Instance Sense is that it can occur with both ordinal numbers (11a) and cardinal numbers (11b). This follows as the Instance Sense relates to distinct occurrences of the same or similar kind of event or activity, and hence can be iterated. This pattern of grammatical encoding appears to be unique to this temporal lexical concept.

2.5 The event sense

The Event Sense relates to a lexical concept in which *time* references specific BOUNDARY EVENTS. A boundary event constitutes a particular event which signals the beginning or ending of some more complex event sequence. To illustrate this, consider some examples:

(12) (a) The young woman's time [=labour] approached

(b) Arsenal saved face with a Thierry Henry leveller five minutes from time after having a jaded, end-of-season look

In (12a) *time* prompts for a particular boundary event, namely the beginning of childbirth. In (12b) *time* prompts for the end of a game of soccer in which the London team Arsenal equalised five minutes from the close of play. In other words, in these examples the lexical item *time* does not relate to a temporal interval, moment or instance, but rather to a specific boundary event, such as the beginning of childbirth, or the end of a football match.

In terms of concept elaboration, the Event Sense is similar to the Moment Sense, and is elaborated in terms of ego-centred motion events. The following examples are indicative:

(13) (a) His time [=death] has come/arrived

(b) Her time [=labour] is approaching/getting closer

In terms of grammatical encoding, the Event Sense, unlike the other lexical concepts so far considered, cannot co-occur with the definite or indefinite articles, 'the' or 'a'. This is evidenced in (12) in which no articles are present. In subject position, the Event Sense is unable to constitute a 'bare' noun, but is preceded by a possessive noun phrase, signalled by the apostrophe 's' ['s] marker, as in: *the young woman's* in (12a), or by a pronoun, such as *his* or *her*, as in (13). When not in subject position the Event Sense appears as a 'bare' noun, which is to say without a modifier, such as a preceding noun phrase as in (12b).

2.6 The matrix sense

In the Matrix Sense, *time* prompts for an entity which is unbounded, in the sense that it has an infinite elapse, and is conceptualised as subsuming all other events. It is for this reason that I employ the label 'matrix'. Accordingly, the Matrix Sense prompts for an entity, which, rather than being an attribute of other events and entities, is conceived as itself an independent entity, a reality apart from the events it subsumes. This lexical concept is evidenced in the following examples:

(14) (a) [T]ime, of itself, and from its own nature, flows equably without relation to anything external [Newton][7]

(b) Time flows/runs/goes on forever

In the examples in (14) *time* relates to a 'temporal matrix', which serves as the backdrop for the occurrence of other events. This is particularly clear with the example in (14a).

This example is drawn from Newton's *Principia Mathematica*[8] in which the notion of ABSOLUTE TIME was famously propounded. According to Newton, 'absolute time' constitutes an entity unrelated to external events, and against which the rate of change of events can be measured. Hence, on this view, *time* is a manifold which 'contains' events, and is independent of events. As this manifold is conceived as being in the world 'out there', the 'passage' of time represents an infinite entity which subsumes all other events.

One extremely common way for the Matrix Sense to be elaborated is in terms of motion.[9] In particular, the Matrix Sense is commonly elaborated in terms of the motion event described by the lexical item *flow*, as evidenced by the ubiquity with which it is likened to bodies of water such as streams or rivers which prototypically 'flow'. Consider the following examples, which evidence this elaboration, the sentence due to Marcus Aurelius, in (15c), revealing the antiquity of this imagery:

(15) (a) Time like an ever-rolling stream
Bears all its sons away [Isaac Watts][10]

(b) A wanderer is man from his birth,
He was born in a ship
On the breast of the river of Time [Matthew Arnold][11]

(c) Time is like a river made up of the events which happen [Marcus Aurelius][12]

(d) Time is but the stream I go fishing in [H.D. Thoreau][13]

While other temporal lexical concepts are elaborated in terms of motion events, it should by now be clear that a distinct pattern in terms of concept elaboration is emerging. The two sub-senses of the Duration Sense (the 'protracted duration' and 'temporal compression' variants) are elaborated in terms of motion which involve very slow or very fast motion respectively. The Moment and Event Senses are elaborated in terms of ego-directed motion, while the Matrix Sense is elaborated in terms of steady-state motion (unlike the Duration Sense) which is non-terminal (unlike the Moment and Event Senses). It is for this reason that the motion described by the verb *flow* is ideally suited to elaborating this particular lexical concept.

In terms of grammatical encoding, the Matrix Sense is a mass noun. The reason for thinking this is that it cannot be preceded by the indefinite article. In this it follows the Duration Sense. In addition, and unlike the Duration Sense, the Matrix Sense cannot be preceded by the definite article. This is likely to be because as one function of the definite article is to signal unique reference, and as the Matrix Sense already has unique reference (it refers to the single unbounded entity subsuming all other events), the use of the definite article becomes redundant. Thus, in addition to a distinct meaning, and a distinct pattern of concept elaboration, the Matrix Sense also has a distinct pattern of grammatical encoding.

2.7 The agentive sense

This lexical concept conventionally associated with *time* prompts for an entity which has the ability to affect us and our environment. For this reason it is termed the Agentive Sense. Consider some illustrative examples:

(16) (a) Time is the great physician [Benjamin Disraeli][14]
(b) Time is the greatest innovator [Francis Bacon][15]
(c) Time, the avenger! [Lord Byron][16]
(d) Time has aged me

In the sentences in (16), *time* relates to an entity which can variously heal, as in (16a), innovate (16b), steal our youth (16c), and age us (16d). In so far as this lexical concept relates to some change or effect that can be wrought, this lexical concept is clearly distinct, in terms of its meaning, from the other senses conventionally associated with time.

As is already clear, the Agentive Sense is elaborated in terms of acts or agents which bring about a change of state. To make this explicit, consider the following examples:

(17) (a) Time devours all
(b) Time reveals all
(c) Time heals all wounds
(d) Time had transformed him into an old man

The result of being devoured is that the entity being acted upon is no longer a discrete entity and hence no longer exists; the result of being revealed is to be exposed or rendered visible; being healed results in becoming better or well; and being transformed results in a markedly different form and state. Each of the examples above is unlikely to occur unless there is an agent who performs the devouring, revealing, healing and transforming. Thus, such acts correlate with agents. Moreover, these kinds of acts typically require agents with a particular skill or facility. That is, the acts are not accidental or random, but are contingent in some way. For instance, *devour* conjures up images of a ferocious beast, *reveal* and *transform* evoke the image of a magician or sorcerer, while *heal* connotes some kind of healer such as a medic. In short, each of the agents evoked by these terms possesses special features or abilities which enable them to bring about a relatively rapid and marked change in state. This is a pattern of concept elaboration which is not evident in the other senses associated with *time*.

Finally, the Agentive Sense is unique in that it appears to behave akin to a proper as opposed to a common noun (although see the discussion of the Measurement-system Sense below). That is, the Agentive Sense is encoded grammatically in similar fashion to names, which lack either a definite or indefinite article, as in (18), and cannot be preceded by quantifiers, as in (19):

(18) Time is a great healer

cf. Max is a great healer

(19) *Some time reveals all [Agentive Sense]

cf. Some time has passed/flowed (by) [Matrix Sense]

2.8 The measurement-system sense

In this sense, time prompts for a lexical concept which represents a measurement-system. Temporal measurement arises due to the correlation between periodic behaviour in the external world and our subjective experience of duration. As periodic behaviour correlates with internal temporal experience, it can be employed to represent temporality. Bergson (1999 [1922]:34) makes this point with the following example:

> If I draw my finger across a sheet of paper without looking at it, the motion I perform is, perceived from within, a continuity of consciousness… [which is to say]… duration. If I now open my eyes, I see that my finger is tracing on a sheet of paper a line that is preserved… Now, this line is divisible, measurable. In dividing and measuring it, I can then say, if is suits me, that I am dividing and measuring the duration of the motion that is tracing it out.

That is, physical (i.e., visual and aural) symbols can be employed to represent (i.e., measure) the duration with which they are correlated. An example of this is PERIODICITY. As some physical entities and events exhibit periodicity – a predictable cycle or rhythm of behaviour – such entities and events are highly useful for 'measuring' the duration with which they are correlated. It is this principle which underpins the concept of a clock, for instance. Clocks serve to divide the day into equal parts, originally into hours and later into minutes and seconds with the advent of accurate pendulum clocks from 1656, and accurate spring-powered clocks from 1700 onwards (Whitrow 1988; Barnett 1998).

In the Measurement-system Sense, *time* prompts for an entity which constitutes a system for measuring duration. A temporal measurement-system is defined primarily in terms of its rate of periodicity and for time-reckoning (as measured by clocks), by its place of occurrence. In what follows I will restrict my discussion to time-reckoning. For other examples of measurement-systems lexicalised by *time* see Evans (2004, chapter 13). To illustrate this lexical concept consider the following examples:

(20) (a) In the 1850s Railway Time was introduced as standard
(b) Don't forget to move the clocks forward with the start of Summer Time
(c) Eastern Standard Time is five hours behind Greenwich Mean Time

In each of the examples above, *time* prompts for a system of measurement which serves to regulate and co-ordinate.

A common way in which the Measurement-system Sense is elaborated is in terms of motion events of the kind illustrated in the following example:

(21) The time is approaching noon

There is a long tradition of time-reckoning in which clocks have manifested motion. One of the most salient forms of motion manifested is due to the motion of the clock 'hands' across a circular analogue clock or watch 'face'. As the literal motion of the hour hand towards the numeral 12, symbolising noon, correlates with the on-going function of the measurement process, this may have motivated the elaboration of the Measurement-system Sense in terms of motion. Accordingly, the Measurement-system Sense is typically elaborated in terms of motion events as exemplified by lexical items such as *approach*, *moving towards*, etc., and as implied by the prepositions which identify the location of clock hands against a conceptual frame of 'clockwise' (as opposed to 'anticlockwise') motion:

(22) The time is approaching 11pm

(23) (a) The time is (a) quarter to eight
(b) The time is (a) quarter past eight

Other kinds of motion concepts cannot productively be employed as they do not match-up with the behaviour associated with the motion of hands around a clock-face. Thus, the nature of the motion content which serves to elaborate the Measurement-system Sense, while oriented with respect to a reference point, is distinct from the motion which elaborates the Moment and Event Senses considered earlier. In those earlier lexical concepts, the motion which serves to elaborate is oriented, at least implicitly, with respect to an animate reference point or ego, e.g., *The time for a decision is moving closer (to us)*; *His time [=death] is approaching (him)*. In the Measurement-system Sense, the reference point with respect to which motion is oriented constitutes an inanimate landmark, typically a particular calibration on the clock 'face', as in (22), or a particular temporal moment which represents a particular calibration with which it correlates, as in the use of *noon* in (21) which stands for the numeral 12.

Finally, the Measurement-system Sense is distinct grammatically in that it can take the form of a mass noun or a proper noun. No other sense associated with *time* appears to have such flexibility. For instance, while the examples in (21) and (22) are mass nouns the examples in (20) are akin to proper nouns (i.e., names). In other words, time can refer either to a specific kind of measurement-system, e.g., *Eastern Standard Time* versus *Greenwich Mean Time*, or refer to a particular value within a measurement-system, e.g., *What time is it?* The former variant is encoded as a proper noun and the latter as a mass noun.

2.9 The commodity sense

We now turn to the final lexical concept to be considered. *Time*, in the Commodity Sense, refers to an entity which is valuable, and hence can be exchanged, traded, acquired, etc., as attested by the following examples:

(24) (a) Remember that time is money [Benjamin Franklin][17]
(b) Time has become a scarce commodity. Everyone wants more of it. [The Observer][18]
(c) Self-assessment tax and finding a stakeholder pension are both examples of the state taxing our time [The Observer][19]
(d) They sold/bought more advertising time

In the Commodity Sense, *time* prompts for an entity which is inherently valuable. As such, *time* constitutes a commodity which can be bought and sold. In this sense *time* prompts for a conceptualisation of an investment which yields returns, and which can be taxed. As the central characteristic of this lexical concept is of an entity which is valuable, content pertaining to entities conceived as valuable, such as commodities, can serve to elaborate the Commodity Sense. In this it is distinct from any other lexical concept lexicalised by time. A salient example of a valuable commodity is money, and just as we can *spend*, *invest*, *borrow*, and *budget* money, so too we can *spend*, *invest*, *borrow*, and *budget* time. Other entities which are valuable, including resources, can also serve to elaborate the Commodity Sense. For instance, content relating to valuable resources such as personnel, natural resources such as forests, water, minerals, etc., and manufactured products, can all serve to elaborate the Commodity Sense. For instance, we *manage* people, and other resources and commodities, and so too can *manage* time. Prospectors *find* oil, gold, silver, etc., and so too we can *find* the time to do something. Manufactured products are *made*, and so too we can *make* time for tasks, others and ourselves.

In terms of grammatical encoding, the Commodity Sense like the Matrix and Duration Senses is a mass noun. Evidence for this comes from the fact that the Commodity Sense undergoes the operation of portion-excerpting, in which a mass noun can be bounded using a quantifier such as *some*. For instance, in sentences such as: *Can you spare me some time?* the Commodity Sense is preceded by the quantifier *some*. It will be recalled from the discussion in Section 2.2 that this kind of quantification is one of the formal indices of a mass noun.

2.10 Summary

We have seen in this section of the paper that there are eight distinct lexical concepts conventionally associated with the lexical item *time*. The basis for claiming that these lexical concepts are indeed distinct mental representations derived from examining evidence relating to distinctiveness in terms of meaning, concept elaboration and grammatical encoding. For convenience, the major findings presented in this section are summarised in Table 1.

Table 1: Summary of lexical concepts for *time*

Name	Meaning	How elaborated	Grammatical encoding
Duration Sense Sub-sense 1: protracted duration Sub-sense 2: temporal compression	Assessment of magnitude of duration Duration 'slower' than usual Duration 'faster' than usual	Length, e.g., *a long time* Slow motion, e.g., *time drags* Fast motion, e.g., *time flies*	Mass noun; can appear with definite article and some quantifiers
Moment Sense	A discrete temporal 'point'	Ego-centred motion, e.g., *the time is approaching…*	Count noun; can appear with definite and indefinite articles
Instance Sense	An occurrence of some kind	N/A	Count noun; can appear with ordinal and cardinal numbers
Event Sense	A boundary-event of some kind	Ego-centred motion, e.g., *Her time is approaching…*	Count noun; cannot take articles, but can be preceded by pronouns and possessive noun phrases
Matrix Sense	An unbounded elapse conceived as the event subsuming all others	Non-terminal motion, e.g., *Time flows on forever*	Mass noun; cannot be preceded by definite or indefinite articles
Agentive Sense	A causal force responsible for change	Agent-centred action, e.g., *Time devours*	Proper noun; cannot be preceded by definite or indefinite articles
Measurement-system Sense	A means of measuring change and other behaviours, events, etc.	Motion events oriented with respect to an inanimate centre, e.g., *The time is moving towards 10*	Proper noun or mass noun
Commodity Sense	A resource	The manipulation of resources, e.g., *We're spending time together*	Mass noun

The general finding to emerge from this is that how we conceptualise time is relatively complex. Moreover, the complexity we have uncovered so far relates only to a single lexical item, *time*, and to a single level of conceptual structure, namely the lexical concept. It ignores other lexical items which relate to temporality such as *present*, *past*, *future*, *era*, *epoch*, *yesterday*, *tomorrow*, and so on, and to more complex temporal structures such as large-scale cognitive models for time, to be explored later. Although I have reviewed eight distinct lexical concepts for time in the foregoing, these concepts can broadly be divided into two kinds, what I term PRIMARY LEXICAL CONCEPTS for time, and SECONDARY LEXICAL CONCEPTS. Primary lexical concepts are those that relate to common aspects of human cognitive processing. That is, they relate to experiences such as duration, simultaneity, assessment of a temporal 'point', the experience of now, etc. Experiences of this kind can be traced to underlying perceptual mechanisms and processes. Accordingly, concepts of this kind are likely to be more common in the languages of the world, and when they occur, to be more similar across languages. Primary lexical concepts include the Duration, Moment, Event and Instance Senses. That is, the ability to experience duration and a temporal moment, the ability to perceive and apprehend events, and the ability to categorise particular temporal moments and events as constituting instances of event-types, would seem to constitute basic cognitive abilities which enter into almost every aspect of perceptual processing and cognitive evaluation. In short, the processes and mechanisms that such lexical concepts relate to suggest themselves, with good reason, as being among the foundational mechanisms of our cognitive architecture. Primary lexical concepts can be contrasted with secondary lexical concepts, which, rather than relating to fundamental aspects of cognitive function, are cultural constructs, and thus may often be culture specific. A good example of this is the concept of time as a commodity, in which time is conceptualised as being a valuable resource which can be bought and sold, just like physical merchandise. This lexical concept while present in the languages of the industrialised world which pay for labour in terms of 'units' of time, is entirely absent in many non-industrialised cultures. Other secondary lexical concepts for time include the Matrix Sense, the Agentive Sense and the Measurement-system sense.

3 Cognitive models for time

We now turn to a consideration of more complex conceptualisations for time. I noted at the outset of this paper that there is linguistic evidence for (at least) two levels of conceptual structure for time. In Section 2 we considered the first level, that of lexical concepts. There is an additional and more complex level which is the subject of the present section. This relates to cognitive models for time.

Cognitive models are large-scale, relatively stable knowledge structures relating to our understanding of time. They consist of lexical concepts (both primary and secondary) and their patterns of concept elaboration, which are integrated in ways which are consistent and coherent. A crucial aspect of cognitive models for time is that they

serve to structure our conceptualisation of time in terms of space and motion through space. In this way they facilitate TEMPORAL REFERENCE, which is to say the 'location' in time of particular entities and events. An important function associated with cognitive models for time is to provide a REFERENCE FRAME for assessing temporal experience, and the occurrence of events. Temporal reference is achieved by virtue of establishing a temporal reference point which provides an 'anchor' with respect to which reference is established.

There are two main ways in which temporal reference is achieved. The first relates to EGO-BASED REFERENCE, giving rise to ego-based cognitive models for time. Cognitive models of this kind take as their reference point the experiencer, or ego. The ego correlates with the experience of 'now'. Hence, in models of this kind location of the ego metaphorically represents the experience of 'now'. In addition, the lexical concepts relating to the forms *present*, *future* and *past* are conventionally elaborated in terms of locational structure, such that the future is in front of the ego, the present is co-locational with the ego, and the past is located behind the ego.[20] That is, we normally think and talk about temporal concepts such as *present*, *future* and *past* in terms of physical locations relative to us.[21] This is illustrated below:

Present

(25) From our perspective **here** in the present, the Victoria era was a bleak **place**

Future

(26) She has a bright future **ahead** of her

Past

(27) His troubled past lies **behind** him

Accordingly, the lexical concepts associated with the forms *present*, *future* and *past* are integrated into ego-based cognitive models for time, providing a reference frame which serves to 'locate' the ego and events in time. There are two specific ego-based models in English. In the first, the MOVING TIME MODEL, the ego is stationary and time is conceptualised as undergoing motion. In the second, the MOVING EGO MODEL, time constitutes a stationary landscape across which the ego moves, as we will see below.

Now let's turn to the second way in which temporal reference is achieved. This relates to TIME-BASED REFERENCE, giving rise to time-based cognitive models for time. Cognitive models of this kind take as their reference point a particular temporal event which serves to 'anchor' the temporal reference frame. Rather than identifying 'location' in time, a time-based cognitive model serves to establish whether a particular temporal event is earlier or later, with respect to the anchoring temporal event. Hence, this kind of cognitive model is, in principle at least, independent of the egocentric experience of

'now', and the concepts of present, past and future (although see Evans 2004, chapter 18). There is just one kind of time-based cognitive model in English: the TEMPORAL-SEQUENCE MODEL, in which assessments as to whether a particular temporal event is earlier or later with respect to another temporal event is provided by virtue of this cognitive model being elaborated in terms of spatial content relating to the horizontal spatial axis.[22]

The three cognitive models discussed in this section are diagrammed in Figure 2.

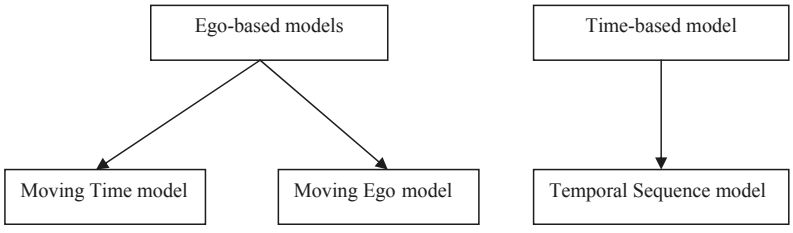

Figure 2: Taxonomy of cognitive models for time

3.1 The Moving Time model

The Moving Time model involves the integration of at least the following lexical concepts: Present, Future, Past, the Duration Sense (subsuming its two variants: 'temporal compression' and 'protracted duration'), the Matrix Sense, the Moment Sense, and the Event Sense. What is integrated constitutes the patterns of elaboration associated with these concepts in a way which is coherent and consistent with the other lexical concepts and their elaborations integrated in the model.

The model is diagrammed in Figure 3. As this model is ego-based, this means that the ego's location, which correlates with the experience of the 'present', serves as the reference point for establishing temporal 'location' of other temporal concepts. Moreover, as the patterns of elaboration concerning motion events associated with the Event, Moment and Matrix senses are integrated, it is this which gives rise to the notion of 'moving time'. As the future is 'located' in front of the ego, temporal motion is directed towards the ego, such that time moves towards the ego before passing behind.

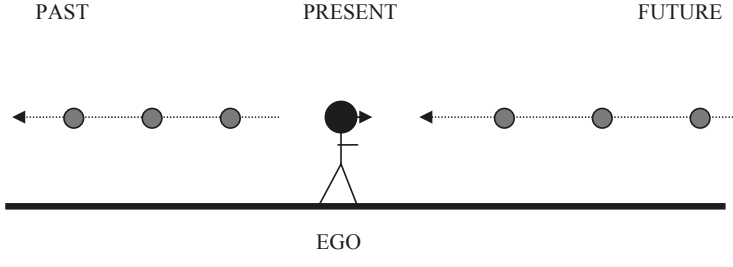

Figure 3: The Moving Time model for English

In Figure 3, the orientation of the ego, represented by the human figure, is indicated by the small arrow attached to the figure's head. The direction of temporal motion is indicated by the arrows associated with the dashed line. The dashed line indicates the motion associated with the temporal matrix. Temporal moments and events are indicated by small grey circles, 'embedded' in the temporal matrix. Hence, temporal moments and events ('times') are also in motion.

In addition, the 'temporal compression' and 'protracted duration' sub-senses are integrated into this model. Accordingly, rapid motion of the temporal matrix (or of temporal events or moments) past the ego results in the conceptualisation of 'temporal compression' – time passing abnormally quickly. Conversely, slow motion of the temporal matrix (or of temporal events or moments) past the ego results in time being conceived as passing abnormally slowly. This conception results in the inference that the normal state associated with the 'passage' of time is steady-state motion. In other words, this inference is not due to a particular lexical concept, but emerges as a consequence of the way the various lexical concepts and their patterns of elaboration are integrated into the Moving Time model.

Indeed, it is common to forget that this is in fact a way of conceptualising a fundamentally subjective experience. That is, whatever it is that time is and does, it presumably does not literally undergo locomotion. Yet, both philosophers and scientists appear to have often taken the cognitive models we employ to understand time, such as the Moving Time model, as physical fact. For instance, Newton took the inference regarding steady-state motion associated with Moving Time, what he termed 'absolute time', as a central axiom in his theory of mechanics (see Evans, 2004).

In sum, I present below in (28) the conventional patterns of inference that emerge from this model. For instance, motion of the temporal matrix past the ego 'gives rise to' an awareness of the 'passage' of time.

(28)	a.	motion of the temporal matrix (and hence embedded times and events) past the ego	→	awareness of 'passage' of time
	b.	rapid motion of events past the ego	→	temporal compression
	c.	slow motion of events past the ego	→	protracted duration
	d.	steady-state motion of events past the ego	→	experience of normal duration
	e.	events in front of the ego	→	future
	f.	events co-located with the ego	→	present
	g.	events behind the ego	→	past
	h.	an event approaching the ego	→	imminent occurrence of the event
	i.	arrival of an event at the ego	→	occurrence of the event

Further, the Moving Time model also accounts for a range of other secondary temporal concepts, as lexicalised by *Christmas*, *graduation*, *the deadline*, etc., which can all be integrated with this model. Lexical items and expressions of this kind relate to secondary lexical concepts as they concern culturally-relative notions, rather than directly

relating to more cognitively basic temporal experiences. Hence, these expressions can be conceptualised in terms of the Moving Time model, as evidenced by the following examples:

(29) (a) Christmas is getting closer (to us)
(b) Graduation is coming up
(c) The deadline has passed

For instance, the example in (29a) can be accounted for based on (28h). By virtue of 'getting closer', the occurrence of Christmas is imminent. After all, being an abstract temporal concept *Christmas* cannot literally get closer. Yet, by virtue of understanding Christmas in terms of this model, we understand its motion in terms of imminence. That is, all secondary temporal lexical concepts can be integrated into the model such that the inferences deriving from the Moving Time model can be applied to them.

3.2 The Moving Ego model

The Moving Ego model is presented in Figure 4. In Figure 4 the location of the ego at any particular time constitutes the present. The past is located behind the ego and the future in front. This model is distinct from the Moving Time model in that here it is the ego, rather than time, which moves. The ego moves over or across the temporal 'landscape'. The motion of the ego is signalled by the arrows in Figure 4, while the temporal landscape is captured by the bold line upon which the ego is standing. Temporal events (the grey circles) are located on the temporal landscape and constitute 'locations'. The ego moves towards and then past these temporal events.

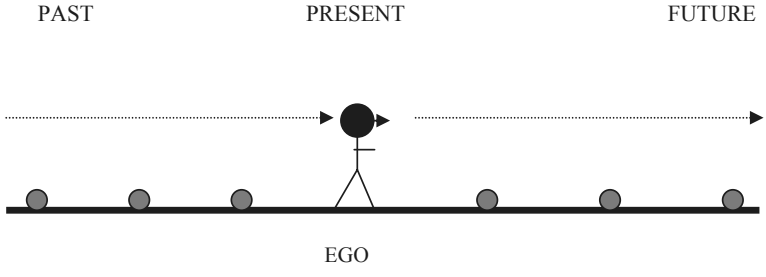

Figure 4: The Moving Ego model

The lexical concepts which are integrated into this model are similar to those integrated in the Moving Time model. The fundamental difference is that whereas in the Moving Time model the elaborations relating to the motion of temporal concepts were integrated, it is rather patterns of elaboration relating to non-motion content (i.e., spatial relations) which are integrated in the Moving Ego model.

One conventional means of elaborating the Matrix Sense is in terms of a straight linear path 'across' which events pass. This elaboration provides the temporal 'landscape' elaboration, which is integrated into this model. A consequence of integrating the Event and Moment Senses with the temporal landscape conception is that these senses, both of which are discrete with respect to the on-going temporal Matrix, are conceptualised as discrete locations embedded within the temporal 'landscape'. Integration of the Duration Sense, in which duration can be elaborated in terms of length (as discussed earlier), results in the distance between events being conceptualised as 'lengths' of duration. Hence, an important consequence of this model is that the temporal landscape can be quantified, and that this quantification results from temporal events being embedded as 'locations' within a temporal Matrix conceptualised as 'landscape'. This is illustrated in the following example:

(30) Manchester United FC is approaching three matches in the space of 5 days.

In (30), soccer matches are conceptualised as locations contained 'in' a physical container of 5 days which the English team, Manchester United, approach.

Accordingly, the nature of the elaborations integrated, and the way in which they are integrated provides a number of inferences deriving directly from the Moving Ego model itself. These are detailed in (31):

(31)	(a)	motion of the ego across the temporal landscape	→	awareness of the 'passage' of time
	(b)	locations	→	events (and moments of time which correlate with events)
	(c)	distance between events	→	magnitude of duration
	(d)	the landscape in front of the ego	→	future
	(e)	the landscape behind the ego	→	past
	(f)	the landscape in the proximal	→	present vicinity of the ego
	(g)	ego approaching a location	→	imminent occurrence of an event
	(h)	arrival of ego at location	→	occurrence of an event
	(i)	motion of ego past a location	→	an event's occurrence being past

As with the Moving Time model there are a large number of secondary temporal concepts which can be conceptualised in terms of the Moving Ego model, as we began to see with the example in (30). For instance, our ability to conceptualise our own motion with respect to abstract concepts such as Christmas, etc., serves as a means of 'locating' the occurrence of Christmas relative to our experience of now. This accordingly serves to provide temporal reference. Some everyday examples which are motivated by the Moving Ego model are given below:

(32) (a) We're moving up on Christmas
(b) We're approaching my favourite part of the piece
(c) She's passed the deadline
(d) We'll have an answer within two weeks
(e) The meetings were spread out over a month

3.3 The temporal sequence model

This model integrates those temporal lexical concepts which can be conceptualised as being discrete. That is, this model relates to specific temporal events, moments etc. and does not involve integration of the Matrix Sense. Moreover, as this model does not involve the integration of the concepts Present, Past and Future, the reference frame which organises this model as a whole is not anchored with respect to an ego, but rather another temporal event in a sequence of temporal events.

The distinguishing feature of this model is that the various temporal events which are integrated into this model, and which are conceptualised as undergoing motion, form a sequence, hence the term Temporal Sequence. The motion sequence involving the temporal events and moments is unidirectional, exhibiting what I will refer to as IN TANDEM ALIGNMENT (Evans 2004; see also Tyler and Evans 2003). A motion event of this kind is one in which the entities involved in the motion event are travelling in the same direction such that they are sequenced with respect to one another. This is diagrammed in Figure 5.

Figure 5: In tandem alignment

Thus, in this model, as there is no ego, the important configuration is not a spatial one involving the location of the ego relative to time. Rather, the key aspect of the model is the relative position of a particular temporal moment or event with respect to another temporal moment or event. Moreover, in the Temporal Sequence model, the in-tandem alignment is a consequence of the model itself, rather than being associated with any of the individual lexical concepts which give rise to the model. The Temporal Sequence model is illustrated in Figure 6.

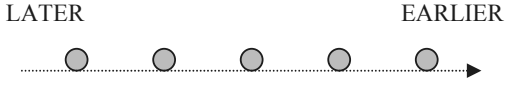

Figure 6: The temporal sequence model

In Figure 6 the shaded circles represent temporal events of various kinds. These include, but are not limited to, the Event Sense, the Moment Sense, and temporally framed events such as days of the week, months of the year, seasonal holidays such as Christmas, sub-events of particular events, e.g., half-time and full-time in a soccer match, etc. While each of these events can be elaborated in terms of ego-centred motion events, a consequence of their integration in the Temporal Sequence model is that an in-tandem alignment is imposed on the various temporal events, as signified by the arrow which designates orientation. Accordingly, these events are conceptualised in terms of their sequence with respect to each other, resulting in an assessment of an earlier/later relationship.

That is, an assessment of an earlier/later relationship is a consequence of this complex cognitive model.

Evidence for this comes from the fact that the verbs *follow* and *precede* and the prepositions *before* and *after* are compatible with this model, while these lexical items are not otherwise employed with the individual lexical concepts which are integrated in this model. For instance, while verbs of motion such as *come*, *draw near*, *arrive*, *approach*, etc., are conventional ways of elaborating, for instance, the Event Sense, as in the following:

(33) (a) The young woman's time [=labour] is approaching/coming/drawing near
(b) The young woman's time has arrived

However, the lexical items *precede*/*follow* or *before*/*after* are not conventional ways of elaborating this lexical concept, as evidenced in (34), where a question mark preceding a sentence indicates its semantic oddness:

(34) (a) ?The young woman's time is following
(b) ?The young woman's time is preceding
(c) ?The young woman's time is/comes before/after

In none of the sentences in (34) do we derive a reading in which it is understood that childbirth is imminent. This follows as the verbs *precede*/*follow* and the prepositions *before*/*after* are only compatible with the Event Sense when it is integrated in the Temporal Sequence model. This model serves to relate one event to another by virtue of imposing an in-tandem schema which relates all the events integrated in the model.

Interestingly, other prepositions which are related to *before* and *after*, namely *in front of* and *behind* (and *in back of* in American English) are not compatible with the Temporal Sequence model[23]:

(35) (a) ?February is behind January (cf. February is after January)
(b) ?January is in front of February (cf. January is before February)

This follows as prepositions such as *in front of* and *behind* relate elements in static spatial scenes. Hence, they are incompatible with spatial configurations which also involve motion. As the temporal lexical concepts which are integrated in the Temporal Sequence Model are already elaborated in terms of motion, then we would expect that prepositions of this kind would be incompatible with this model, which is what we find. By way of summary, the inferences resulting from integration of temporal lexical concepts in the Temporal Sequence model are as follows:

(36) (a) sequence of temporal events → chronology of events
(b) temporal events located before → earlier events or preceding other events
(c) temporal events located after → later events or following other events
(d) motion of temporal events with respect to other temporal events → awareness of the 'passage' of time

3.4 Evidence for cognitive models of time

There are potentially a large number of lines of evidence in support of positing a level of conceptual organisation at the level of cognitive model, in addition to the 'simpler' level of lexical concept. These relate to (i) unpredictable inferences associated with individual lexical concepts, (ii) entailments, and (iii) distinct patterns of temporal reference. I briefly describe each of these below.

3.4.1 Unpredictable inferences

The first line of evidence relates to linguistic examples such as the following:

(37) Time flows by

I argued earlier that linguistic examples involving the ascription of motion which is continuous and ongoing as lexicalised by the verb *flow* relate to the Matrix Sense. Moreover, this lexical concept is not normally elaborated in terms of ego-centred motion as the Matrix Sense is conceptualised in terms of an unbounded and eternal elapse. However, in (37) the use of the spatial particle *by* presupposes an ego-like reference point. That is, time 'flows **by**' something or someone. An informal survey suggests that for native speakers of English, in a sentence such as this, the reference point is assumed to be facing the moving temporal matrix, such that as a portion of the temporal matrix 'passes', it comes to be 'located behind' the ego. That is, the ego and time are aligned in something akin to a 'face-to-face' configuration. Yet, there is nothing in the sentence which might provide such a reading, as the landmark past which the 'flow' of time proceeds is not encoded linguistically, and as such its orientation with respect to the temporal matrix cannot be established based on linguistic evidence. The fact that native speakers of English appear to consistently derive a reading in which the ego is facing the approaching temporal matrix in examples such as this is highly suggestive that they are applying a conventional schema or cognitive model in order to interpret this sentence. In other words, there is a cognitive model beyond the Matrix Sense – the Matrix Sense encodes nothing regarding reference points or ego, with respect to which temporal motion is experienced, or past which time moves – that facilitates our understanding of examples such as (37). In the case of this example, the cognitive model in question is that of Moving Time, which integrates an ego corresponding to the experience of 'now' with that of the Matrix Sense.

3.4.2 Entailments

The second line of evidence relates to the notion of entailments. I define an entailment as an obligatory inference. Crucially, certain entailments cannot be traced to individual lexical concepts. For instance, steady-state motion is associated with the normal experience of duration. Yet, all things being equal, the Duration Sense is not conventionally elaborated in terms of steady-state motion. The Duration Sense is normally elaborated in terms of length, e.g., *a long time*, and its two sub-senses in terms

of slow or rapid motion. However, due to integration of these sub-senses in the Moving Time model, there is an entailment that our 'normal' experience of duration can be elaborated in terms of steady-state, or 'equable' motion. Indeed, it is this entailment, which emerges from the Moving Time model which Newton ascribes to his notion of 'absolute time'. Entailments of this kind provide evidence that there is a distinct level of mental representation above the level of lexical concepts. In other words, entailments emerge from the integration of lexical concepts which make up the model. However, a particular cognitive model may include inferences which involve more than the 'sum of the parts' which make up the model. In the case of the inference relating to equable motion, as we've seen this is not a pattern of conceptual elaboration associated with any of the lexical concepts which make up the model. Rather it is EMERGENT, arising from the cognitive model itself.

3.4.3 Distinct patterns of temporal reference

The third line of evidence relates to the temporal reference frames imposed by the three cognitive models we have examined in this section. That is, the cognitive models provide a frame of temporal reference which is distinct, and emerges from integration of a number of distinct temporal lexical concepts rather than the individual lexical concepts themselves. Moreover, there are three kinds of reference frame in English and many languages, suggesting there are (at least) three kinds of cognitive model. As the Moving Time and Moving Ego models are ego-based, they serve to locate a particular temporal experience or event with respect to the ego's experience of now. Yet they do this in different ways. In Moving Time, temporal experience is in motion and constitutes the FIGURE understood with respect to a stationary ego which serves as the GROUND, in order to identify the 'location' of a particular temporal event. In the Moving Ego model it is temporal experience which is the ground, serving to 'locate' the ego, the figure which moves 'in' and 'across' time.

The Temporal Sequence model is not concerned with 'locating' temporal events or moments with respect to an ego. Rather, this model serves to provide assessments of earlier or later relationships, by relating events to each other. It does this by imposing an in-tandem sequence of temporal motion. These three distinct patterns of temporal reference suggest that there are three distinct types of cognitive model at work.

4 The spatial basis of concepts for time

It has frequently been observed that time at the conceptual level is structured in terms of spatial experience such as motion through space (e.g., Smart 1949; Clark 1973; Lakoff and Johnson 1980, 1999; Evans 2004). Indeed, the research presented here supports this view. In particular, I have shown that at all levels of conceptual organisation (i.e., lexical concepts and cognitive models), time is conceptualised in terms of spatial relations and motion through space. In this section I briefly consider why.

Some scholars have suggested that we structure time in terms of motion though space because time is a mental achievement, grounded in more directly perceivable and more concrete experiences such as that of space, and motion events. In other words, we cannot actually experience time itself, if time is even a thing unto itself, but always do so by constructing it from more basic experiences. This is the view advocated by scholars as diverse as the ecological psychologist James Gibson (e.g., 1975) and cognitive linguists George Lakoff and Mark Johnson (e.g., 1999: Chapter 10), and constitutes a view which can be traced back to the philosophy of Leibniz (1646–1716), who argues that time is an ideal, rather than a real experience (Turetzky 1998). One reason for this view is that unlike our experience of space, time is not a concrete sensory experience. Moreover, unlike our perceptual apparatus specialised for assessing spatial experience (e.g., the vestibular, haptic and visual systems, which contribute to the detection of motion in space), there is no analogous sensory apparatus specifically dedicated to the processing of temporal experience.

However, this view assumes that 1) time cannot be related to cognitive mechanisms or processes and 2) is not directly perceived. As we saw at the outset of this paper, evidence from neuroscience and from psychology offers compelling evidence both that temporal experience can be traced to neurological mechanisms, such as the notion of the perceptual moment, and that time is a phenomenologically real, albeit complex set of related experiences. These two lines of evidence undermine the claim that time, at base, is merely a construct of the intellect.

Yet, if time is a real and directly perceived experience, why at the conceptual level is it systematically elaborated in terms of patterns of imagery which relate to space and motion through space? Grady (1997) argues that the reason that temporal concepts are structured in terms of spatial elaboration is due to a distinction between what he terms RESPONSE CONCEPTS versus IMAGE CONCEPTS. Response concepts arise from evaluations and assessments, i.e., responses to sensory experience, which enter into the sensory experiences they are responses to. Image concepts derive from sensory experiences which they are 'redescriptions' of. Hence, subjective responses receive a lower level of attention in conscious experience than sensory experience. For instance, when judging the similarity of two dogs, it is the dogs in question that constitute the focus of our experience. The experience of similarity relates to a subjective response deriving from comparing the two dogs. Hence, it is the dogs themselves rather than the experience of similarity which is foregrounded. Analogously, evaluations of temporal magnitude, i.e., assessments of duration, constitute responses to events and/or states of particular kinds. Thus, the evaluation of duration enters into the event or state being perceived, rather than being focused on in its own right. Put another way, duration is a response to something rather than an experience which emerges in its own right. On this account, the reason response concepts such as the primary lexical concepts for time are elaborated in terms of structure relating to space and motion through space, is that they are structured in terms of the kinds of image concepts they are responses to, and thus correlate with. This serves to facilitate the foregrounding of otherwise backgrounded subjective experiences.

However, this account does not directly address temporal lexical concepts which I termed secondary lexical concepts. The reason for this is that such concepts, which include the Matrix Sense, the Agentive Sense, the Measurement-system Sense and the Commodity Sense are cultural constructs which do not so directly relate to phenomenologically basic and real evaluations and responses. Rather, such lexical concepts relate to and are grounded in more complex culturally-situated relationships and connections. The patterns of elaboration which serve to structure temporal concepts of this kind appear to be motivated by the need to provide more abstract concepts, in the sense of concepts which are not directly grounded in subjective experience, and thus really are cultural and mental constructs, with concrete models which serve to add (relational) structure to the concepts in question. Accordingly, the Matrix Sense is elaborated in terms of entities such as rivers, which provide a concrete analogue of the matrix conception of time; the Agentive Sense is elaborated in terms of entities which are agents of change, such as physicians; the Measurement-system Sense is elaborated in terms of the motion associated with canonical time-reckoning artefacts, such as the motion of hands on a clock-face; and the Commodity Sense is elaborated in terms of other kinds of commodities, particularly money, which is the example of a valuable commodity *par excellence*.

5 Conceptual metaphor theory and time

I conclude this paper with a discussion of CONCEPTUAL METAPHOR THEORY (CMT), and implications of the present analysis for this theory and its approach to time. CMT, advanced, in particular, in the work of Lakoff and Johnson (e.g., 1980, 1999; Lakoff 1993), represents a relatively well developed theory within cognitive linguistics, and constitutes an approach to conceptual organisation and structure which has been influential in cognitive science more generally. The central idea associated with CMT is that the kinds of patterns I have been referring to as concept elaboration are motivated by CONCEPTUAL METAPHORS. A conceptual metaphor consists of a mapping or a set of mappings holding between concepts in two distinct conceptual domains, e.g., the domains of time and space, for instance. The idea is that these sets of mappings, which constitute relatively stable knowledge structures, serve to conventionally structure one kind of more abstract domain, such as time, in terms of a more concrete kind of domain such as space. This relationship can be expressed by the mnemonic TIME IS SPACE, with two distinct variants TIME IS THE MOTION OF OBJECTS, and TIME IS (MOTION ALONG) A PATH. In other words, these two variants of time constitute conventional knowledge structures which license many of the patterns of elaboration of temporal concepts in terms of motion outlined in this paper.

Accordingly, it might appear, on first blush, that the main (or only) distinction between the CMT account of time and the lexical concepts and cognitive models (LCCM) approach presented here is one of detail. While CMT views things from the

perspective of relatively schematic mappings, the present approach is more concerned with the detailed patterning in terms of distinct kinds of lexical concepts, and the differential patterns of concept elaboration associated with each distinct lexical concept for time. However, the present account, I argue, actually gives rise to a much more fundamental critique of CMT, which calls into question the way it models the phenomenon of CONCEPTUAL PROJECTION – the projection of imagery in order to provide conceptual representations with additional structure. The critique that the present approach gives rise to be can be subsumed under two headings, the problem of abstractness, and the problem of psychological plausibility. I address each of these below.

5.1 The problem of abstractness

In recent years CMT has increasingly moved towards much more abstract representations for metaphoric patterns. The current position advanced in Lakoff and Johnson (1999) and based on work by Grady (1997) is that there is a distinction to be made between what are known as PRIMARY METAPHORS and COMPOUND METAPHORS. Primary metaphors relate to mappings holding between concepts which derive from basic and directly perceived aspects of subjective and sensory experience. Moreover, metaphors of this kind are foundational. Compound metaphors, on the other hand, result from integration of the more foundational primary metaphors. On this view, primary metaphors constitute conceptual primitives, from which more complex kinds of conceptual representations can be constructed. However, primary metaphors are stated at a very high level of abstraction. For instance, TIME IS THE MOTION OF OBJECTS, and TIME IS (MOTION ALONG) A PATH have been proposed as possible primary metaphors for time (Grady 1997).

The difficulty here, as we have seen, is that there are a range of temporal lexical concepts that have distinct patterning in terms of motion events. For instance, the two primary metaphors TIME IS THE MOTION OF OBJECTS and TIME IS (MOTION ALONG) A PATH would account for the range of motion events which serve to structure both the variants of the Duration Sense, as well as the Moment Sense, the Event Sense, the Matrix Sense and the Measurement-system Sense. However, they do this by being stated at a very high level of abstractness. In other words, the conceptual metaphor account has no way of predicting (or accounting for) the differential patterning in terms of the nature and range of motion events which can (and cannot) structure the individual lexical concepts uncovered in this paper. This suggests that the foundational conceptual metaphors, primary metaphors, may be stated at too high a level of abstraction, and in fact, conceptual representations, based on the linguistic evidence, are more correctly captured at a more specific and detailed level, the level of the lexical concept, as defined in this paper. Indeed, primary metaphors such as TIME IS THE MOTION OF OBJECTS and TIME IS (MOTION ALONG) A PATH might better be thought of as relating to the level of the cognitive model (Evans 2004).

5.2 The problem of psychological reality

The second major problem that the present study poses for CMT is that the psychological reality of conceptual metaphors, particularly primary metaphors, as the foundational level of conceptual structure, is called into question. This follows for the following reason. A primary metaphor constitutes a conventional association holding between response and image concepts in distinct conceptual domains. Yet the response and image concepts associated in a primary metaphor are supposed to relate to phenomenologically 'simple' and unitary kinds of experiences. Moreover, the association between the response and image concepts is meant to be psychologically real. Yet, the kind of linguistic evidence that metaphor scholars employ relate to very different aspects of temporal experience and motion events. In other words, neither the kind of temporal experience nor the motion events invoked relates to a single kind of 'simple' temporal experience or motion experience.

For instance, consider just two of the examples Lakoff and Johnson (1999) present to support what they term the 'Moving Time' Metaphor (=TIME IS THE MOTION OF OBJECTS):

(38) (a) The time for action has arrived
(b) The summer just zoomed by

While in the first example the temporal experience being described relates to the occurrence of a particular temporal moment or point (what I have identified as the Moment Sense for time), the second relates to the experience of temporal compression, i.e., the summer 'feels' as if it's gone by abnormally quickly. Moreover, in terms of the kinds of motion event involved, the first sentence employs terminal ego-centred motion, while the second employs a motion event which is extremely rapid. Put another way, neither of these examples relate to time in general or motion in general, but rather, to specific and distinct kinds of temporal and motion experiences in service of particular and distinct kinds of conceptualisation. In particular, it makes little sense to claim that there can be a unified concept of time, which relates to a correspondingly 'simple' phenomenological experience of time, precisely because the linguistic evidence suggests that there is no such unified concept of time – the English word *time* relates to a set of distinct, albeit related, lexical concepts. Moreover, research from neuroscience and psychology, reviewed briefly at the outset of this paper, supports this conclusion. Thus, as primary metaphors represent levels of abstraction not supported either by the linguistic data employed to make the case for the conceptual metaphors posited, nor are such abstract representations supported by evidence from neurological or phenomenological levels of function and experience, we must conclude that in terms of psychological plausibility, primary conceptual metaphors are on shaky ground (Evans 2004).

However, in making this claim, I want to re-iterate that what is at stake is not the principle of conceptual projection implicit in the conceptual metaphor framework. I am not suggesting that conceptual projection itself is psychologically implausible. Indeed, in my discussion of concept elaboration I have argued for just that, which is to say, for

conventional patterns of imagery being associated with distinct lexical concepts for time. Rather, my claim is that the primary metaphors for time considered don't constitute a psychologically plausible foundational level of conceptual representation. Based on the evidence presented here, this level is better modelled in terms of lexical concepts. If (primary) metaphors are psychologically real, then they are better thought of in terms of cognitive models, of the kind discussed in this paper.

Notes

1 Pöppel (1994, p. 194) has suggested that as perceptual processing appears to only be able to unify experiences within a temporal window with an outer limit of between 2–3 seconds, temporal compression may be the result of 'temporal leakage', in which 'successive information disintegrates into parts, if longer lasting stimulus sequences have to be processed.'

2 I will use the term 'lexical item' in a technical way to refer to discrete units of language such as words.

3 This phenomenon, in which a single form has a range of distinct but related meanings associated with it is termed POLYSEMY, and is an extremely common and widespread phenomenon in English and indeed, in other languages (see Tyler & Evans, 2001, 2003; Evans & Tyler, 2004; Evans, 2004, 2005; Evans & Green, 2006). Polysemy represents an innovative solution to the problem of conventionally encoding a relatively large set of concepts in language with a smaller set of lexical forms, thereby reducing mental storage pressures.

4 I will use the term 'sense' inter-changeably with the term 'lexical concept'.

5 For discussion of these phenomena see Evans (2004) and Flaherty (1999).

6 The term 'sub-sense' is borrowed from the work of Cruse (e.g., 2000; Croft & Cruse, 2004).

7 Newton's view of 'absolute time', cited in Turetzky (1998, p. 73). See also Griffiths and Sinha (2004).

8 Newton (1642–1727) enshrined his view of mechanics in his great work *Principia Mathematica*. Classical mechanics stood firm until the advent of Einstein's work on special and general relativity at the beginning of the twentieth century.

9 For a discussion of other ways in which this sense is elaborated see Evans (2004).

10 Psalms xc.

11 The Future.

12 Meditations, IV. 43. Marcus Aurelius was Roman Emperor from 161–180 AD, and was also an influential Stoic philosopher.

13 Walden, 'Where I lived and what I lived for'.

14 Endymion, book. I, chapter 81.

15 Essays: 24, Of Innovations.

16 Childe Harold IV, cxxx.

17 Advice to Young Tradesmen.

18 The Observer on-line: 'The Mad Rush to Save Time' 3rd October 1999 [www.newsun-limited.co.uk/observer/ focus/story/].

19 The Observer on-line: 'The Mad Rush to Save Time' 3rd October 1999.

20 While English and many languages elaborate lexical concepts associated with the forms *past* and *future* in terms of locations which are behind and in front of the ego respectively, this is not the way all languages elaborate these concepts. For instance, there is now evidence that the South American language Aymara elaborates future-based concepts in terms of locations behind the ego and past-based concepts in terms of locations in front of the ego. See Núñez and Sweetser (in press).

21 Indeed, in general it is extremely difficult to think and talk about our temporal experience without making using of the spatial reference frames to be discussed below.

22 There is good evidence that some languages, such as Mandarin, additionally make use of the vertical spatial axis in order to elaborate the time-based cognitive model for time. See Evans (2004) for a review.

23 See Tyler and Evans (2003, chapter six) for a discussion of the complexity, and distinct semantic character associated with prepositions of this kind.

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