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Understanding Timelines: Conceptual Metaphor and Conceptual Integration

One of the most broadly investigated topics in the conceptual metaphor literature is the importance of spatial construals for thinking and talking about time. We address the relationship between conceptual metaphor theory (CMT) and conceptual integration theory (CIT) by exploring how people understand timelines – both as graphical objects, in discourse about timelines taken from newspapers and the web, and in poetic examples. The inferential structure of the timeline is well captured by the conceptual metaphors TIME IS SPACE and EVENTS ARE OBJECTS. Instantiated graphically, the timeline serves as a material anchor for a conceptual integration network representing partial cognitive models of time, lines, objects, and a hybrid model known as a 'blend'. Understood in respect to this network, the analogue properties of the line give it novel computational properties facilitating inferences about the events that the timeline represents. The history of the modern timeline suggests that it reflects a distributed cognitive process, involving multiple individuals over a large span of time and illustrating the importance of cultural evolution in the development of conceptual integration networks. Analysis of both poetry and everyday discourse about timelines suggests that conventional mapping schemas are best viewed not as determining the interpretation of timelines but as providing soft constraints that help guide interpretation. Future metaphor research will best proceed via a merger of techniques from CMT and CIT, characterizing metaphor as involving complex networks of mappings that can be updated flexibly as a function of context and goals.

Keywords*: cognitive artifacts, cognitive semantics, conceptual blending, conceptual integration, material anchors, metaphor.*

1. INTRODUCTION

The publication of *Metaphors We Live By* marked a revolution in semantics and, more generally, in the understanding of the relationship between language and thought in cognitive science. In this classic work, Lakoff and Johnson (1980) urge readers to throw off the chains of formalism and rationalism and embrace a new, experientialist approach to meaning. According to conceptual metaphor theory (CMT), metaphorical language reflects metaphorical mappings, or correspondences, between conceptual domains (Lakoff & Johnson 1999). Metaphor is thus defined both as a linguistic phenomenon in which vocabulary is shared among domains and as a conceptual one in which different conceptual domains are linked by metaphorical mappings, based either on correspondences in people's experiences (Grady 1997) or

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analogical correspondences between domains (Lakoff 1993). Language is not an isolated symbolic system, independent of other cognitive processes. Rather, language is an overt manifestation of the human conceptual system, and metaphorical language, in particular, offers a window into the human mind (Lakoff & Johnson 1980).

Lakoff and Johnson's pioneering work marked the rise of cognitive semantics. Other researchers began to approach language as a cognitive phenomenon and meaning as involving the activation of concepts (see e.g. Talmy 2000). Fauconnier (1994) argues that language serves as a prompt for speakers to construct a mental representation of utterance meaning in mental spaces. On Fauconnier's model, a mental space contains a partial representation of the current scenario that includes one or more *elements* to represent discourse entities and *frames* to represent the relationships between them. Spaces partition the information evoked by a sentence into a series of simple cognitive models. Mappings between spaces capture the relationships between elements and their counterparts in other spaces. In this way, complex scenarios can be represented by positing a number of mental spaces and the connections between them.

Among other accomplishments, Fauconnier's (1994, 1997) model synthesized the insights underlying frame semantics (Fillmore 1982) and CMT, applying them to a broad range of topics including indirect reference and referential opacity. Referential phenomena accounted for by cross-domain mappings in CMT can be similarly accounted for by cross-space mappings in mental space theory: e.g., in CMT 'winning an argument' is understood via cross-domain mappings between argument and war; in mental space theory, 'winning an argument' prompts the listener to construct a mental space with a partial cognitive model of an argument and another with a partial cognitive model of war, and create cross-space mappings between them.

However, the notion of mapping is a more general notion in mental space theory than in CMT. Mappings in mental space theory can be motivated by many different factors, including analogy and identity through time – indeed, any understanding of a connection between two apparently different entities. For example, 'Iron Man wants to try directing' is understood as concerning the career goals of Robert Downey, Jr., by virtue of a mapping between one space with a cognitive model of actor Robert Downey, Jr., and another with a cognitive model of the movie *Iron Man*. Mental space theory suggests that the widespread, culturally and linguistically entrenched, cross-domain mappings described by Lakoff and his colleagues (e.g. Lakoff & Turner 1990) manifest a more general ability to establish mappings between structures in mental spaces.

Similarly, conceptual integration theory (CIT: Fauconnier 1997, Turner 1996, Fauconnier & Turner 2002) – the most recent version of mental space theory – takes Lakoff and Johnson's (1980) insight regarding the cognitive import of mappings and extends it to a vast array of cognitive phenomena. Conceptual integration is a basic, higher-order operation for combining information, said to be involved in metaphor and many other products of human cognition, such as metonymy, categorization, analogy, and

counterfactual reasoning. Fundamental aspects of CIT include (1) the idea that conceptualization involves networks of mental spaces with mappings between them (Fauconnier 1997), (2) an important role for simulation (Coulson 2001), (3) the construction of hybrid cognitive models via selective projection of structure from multiple input spaces (Fauconnier & Turner 1998), and (4) the generation of novel emergent structures (Turner 1996).

CIT is motivated in part by discoveries in cognitive science regarding the plasticity of conceptual structure. Whereas, in the 1980s, cognitive psychologists understood concepts as relatively static knowledge structures, the same researchers have come to view concepts as temporary structures in working memory (Barsalou 1993). Derived from more stable constructs in long-term memory, concepts – mental representations used in categorization and reasoning tasks – are not identical to the more stable long-term structures. CIT combines a view of concepts as inherently dynamic and situated in particular contexts with a key finding in mental space theory research regarding the ubiquity of mappings and people's ability to exploit contextually motivated mappings. In sum, CIT attempts to characterize regularities in the way concepts change in virtue of their combination with other, contextually relevant concepts (Fauconnier & Turner 2002).

In this paper, we address the relationship between CMT and CIT by exploring how people understand timelines. A cognitive artifact anchoring spatial metaphors for construing time, the timeline serves as an excellent vehicle for pointing out similarities and differences between CMT and CIT. With respect to differences, Section Two highlights CIT's emphasis on the importance of dynamic mappings and emergent structure. In Section Three, we analyze attested statements about timelines to underscore the flexible, context-sensitive way speakers recruit conceptual structure to serve their rhetorical goals. In Section Four, we turn to what many consider to be a particular forte of CIT: namely, its ability to account for novel metaphorical understandings. Analysis of a few lines of Paz's poem *Mas allá del amor* reveals a deeply creative construal of time with a non-trivial connection to the more pedestrian innovation of the timeline. Finally, in Section Five we discuss the relationship between CMT and CIT, revisiting Grady, Oakley, and Coulson's (1999) treatment of it.

2. TIMELINES

A timeline is an information visualization tool for communicating a sequence of related events. Verbal descriptions of events are arranged chronologically, displayed on a line oriented either horizontally or vertically. Timelines are frequently used by historians to depict important events in a given period and by biographers to denote important events in the life history of their subject. Figure One represents a typical timeline, both in form and content. It depicts the Eighteenth Century, the beginning of each decade serving as a temporal landmark. Important events in Benjamin Franklin's life are described in words and anchored to a locus on the timeline indicating the date at which they occurred.
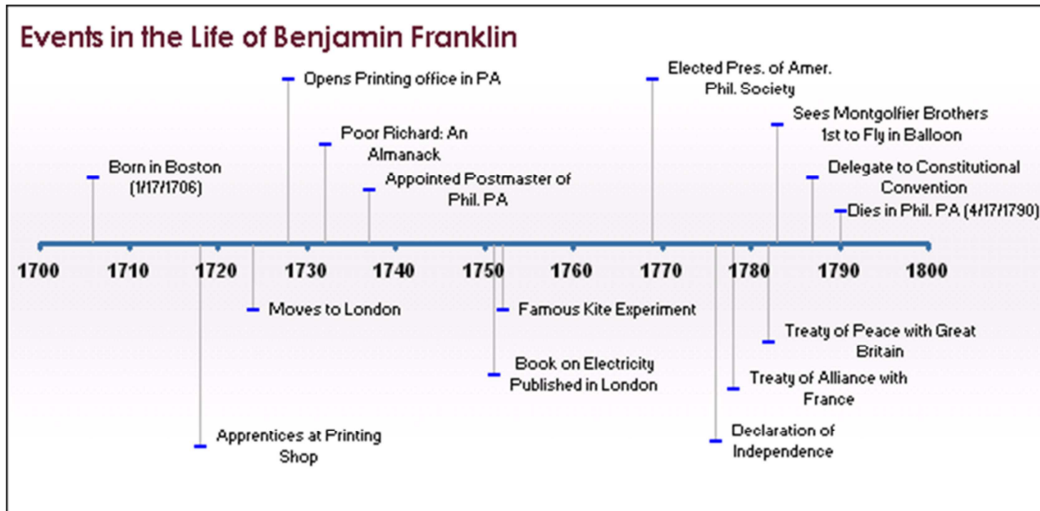
Figure 1: Timeline of Franklin's life, downloaded from www.vertex42.com/ExcelArticles/create-a-timeline.htm: an article by Jon Wittwer on how to use the software package Excel to create a timeline.

As a spatial depiction of time, the timeline conforms nicely to inferences predicted by CMT. It supports two key components of the TIME IS SPACE metaphor originally described in (Lakoff & Johnson 1980): the tenet that PROXIMITY IN TIME IS PROXIMITY IN SPACE supported by linguistic data such as (1), and the tenet that TEMPORAL DURATION IS SPATIAL EXTENT supported by examples such as (2) and (3). Moreover, the arrangement of events as objects along the timeline can be seen as an instantiation of the EVENTS ARE OBJECTS mapping of the event structure metaphor (Lakoff 1993).

(1)   Those two events happened very *close* together in time.

(2)   The war lasted a very *long* time.

(3)   The life of a butterfly is incredibly *short*.

CIT is required to explain the composition of TIME IS SPACE and EVENTS ARE OBJECTS (Lakoff & Johnson 1999) in one's understanding of timelines. Table One outlines the recruitment of conceptual structure from multiple domains; mappings are indicated by their occurrence on a common row in the table.

Time	Linear Extent	Objects	Ben Franklin's Life	Timeline Blend
Year	Line Segment			Year/Line Segments
Temporal Succession	Spatial Ordering			Left-to-Right Ordering
Date		Tick Mark	Salient Event	Tick Mark/Event

Table 1: Mappings in the 'timeline' blend. Each column represents a mental space. Entries in the table are either elements or relations. Entries that occur on the same row are mapped to one another.

The resultant blended object has an inferential structure well described by the above metaphors: temporal duration is expressed via spatial extent; temporal disparity of events is expressed via the spatial proximity of two tick marks on the line; temporal succession is conveyed via spatial ordering. That said, meanings of the timeline exist that cannot easily be explained by these binary mappings alone.

2.1 Emergent structure

One major difference between CMT and CIT is the way CIT highlights the emergent structure that arises in many metaphorical construals (Coulson 1996, 2001; Fauconnier & Turner 1994, 1998, 2002). In CMT, metaphor involves a set of correspondences between aspects of relevant source- and target-domain concepts; novel metaphorical construals of the target domain originate in the projection of inferences from the source domain (Lakoff 1993). In CIT, metaphor involves the integration of structure from multiple inputs, including extant construals of the target domain. The complexity of integration varies from the relatively straightforward case of *single scope* networks, which involve the projection of inferences from the source input as in CMT, to *double scope* networks, which involve the projection of inferences from the blended space (Fauconnier & Turner 2002). Because double-scope networks involve a blended space incorporating relational structure from at least two inputs, they afford construals that differ both from those available in the source domain and from extant construals of the target domain: that is, they represent emergent structure. Accordingly, the timeline has properties distinct from those of the cognitive models in each of its input spaces.

The timeline in Figure One derives some structure from the 'linear extent' input: the constituent line segments; and some from the Ben Franklin's Life input (the events referred to in the labels). It also has properties that derive from its communicative function, its use as a learning or organizational tool, and its elaboration via a set of criteria: i.e., the selection of the depicted events as the most relevant. Although it instantiates the mappings inherent in the TIME IS SPACE metaphor, the timeline is an integrated construct whose computational affordances differ from those available in the input domains. Studying the timeline in Figure One might enhance one's memory for the sequence of salient events in Franklin's life or allow one more easily to recognize Franklin's most productive periods, via the density of points. Researchers in the field of information visualization recommend using timelines, because their visual properties facilitate inferences about temporal events – such as temporal and causal contingency – that are either difficult or impossible to make using different representational formats (Phan *et al.* 2005).

CIT also provides a useful description of timelines as examples of *compressions*. Fauconnier and Turner (2000, 2002) define compressions as cases in which elements from different input spaces in an integration network are mapped to one or more elements in the blended space. Whereas the elements in the inputs relate via *inter-space* relations, those in the blended space relate via *intra-space* relations. In Figure One, each event on the timeline – being born, flying a kite in a thunderstorm, publishing *Poor*

Richard's Almanac – can be conceptualized in its own mental space. Compression affords the conceptualization of all these events within a single mental space as tick marks co-existing on the timeline. Whereas the input events relate to one another via the inter-space relation of temporal ordering, the tick marks relate via the intra-space relation of spatial succession.

The compression in Figure One results in emergent structure that proves to be quite useful. In the separate spaces for each event in Franklin's life, events have different durations and can be considered separately: moving to London or serving an apprenticeship take longer than being born or dying even though, in the timeline construal, they do not: all salient events are identical objects represented with the same tick mark. So the numerous works, deliberations, meetings, etc., eventually culminating in the Declaration of Independence are compressed into one event-object on the timeline. Extended events such as the apprenticeship, shorter events such as the kite experiment, and instantaneous events such as Franklin's appointment as postmaster are all included as analogous elements belonging to a single category in which only saliency matters; differences in duration and complexity are left unrepresented.

Research in CIT has shown that compressions reduce conceptual complexity, facilitate inference, and afford novel affective reactions (Coulson & Pascual 2006). CIT goes on to describe regularities in patterns of compression, such as compression from disanalogy to change, from analogy to identity, and from identity to uniqueness (Fauconnier & Turner 2002). Indeed, much of the timeline's emergent structure, as well as its novel computational properties, results from the compression of temporal relationships to spatial ones, together with the congregation, in the blended space, of structures from multiple input spaces.

2.2 Timelines as material anchors and cultural artifacts

The timeline *qua* visual object is also an excellent example of a *material anchor*. Hutchins (2005) details the way many blends involve an input space constituted by a material object: often a cultural artifact; he refers to such input spaces as material anchors. So a queue of people waiting for theater tickets can be construed as a blend between two inputs: the physical configuration of people in the line – the material anchor – and a trajector moving through space in a particular direction. Integration of these in the blended space yields the emergent property of the queue as an ordered sequence of people moving in a particular direction: from the 'back' of the line to the 'front'. The perceptually salient material anchor provides stability to the blend and reduces individual cognitive load (Hutchins 2005).

The culturally sanctioned understanding of a queue as e.g. determining the order in which participants will be able to purchase theater tickets relies on this blend. The blend itself is possible because of the cultural practice of queuing; perhaps the main way the concept is learned is via participation in that practice. The importance of cultural factors such as material artefacts and cultural practices is a major theme in CIT; it helps explain how incredibly complex integration networks can be used by individual members of a culture despite their limited attentional and working-memory resources (Fauconnier &

Turner 2002). Indeed, metaphorical construals of time have been shown to involve a series of successive integrations, often involving the automating of once-creative blends (Fauconnier & Turner 2008).

Metaphorical language implying a linear conception of time is common to many times and cultures. Nevertheless, the timeline in its modern form seems to date from just a few centuries ago. Grafton and Rosenberg (2010) provide a thorough history of the timeline, with abundant illustrations of its instantiations as well as the numerous, less felicitous attempts that preceded it. They describe a long, arduous process by which historians repeatedly tried to create a way to represent temporal events visually. Intermediate steps in this process included chronological tables, human and animal bodies as representations of time periods (e.g., the Persian Empire could be the lung because, under Darius, Jews could 'breathe' freely), and geographical maps of time instead of space. Finally, in the second half of the Eighteenth Century, Joseph Priestly proposed the modern version of the timeline, integrating spatial and temporal relations. The timeline grew rapidly in popularity: its use was widespread within a few decades. People were surprised by its simplicity and wondered why it had not been thought of before.

Many cultural constructs like the timeline look obvious in retrospect, masking the way useful integrations often go unnoticed even by highly intelligent and innovative individuals. In discussing a closely related blend – the number line – Núñez (2009) notes that human beings had sophisticated knowledge of mathematics for thousands of years before inventing the number line in Seventeenth Century Europe. Archeological records suggest that the Babylonians had advanced knowledge of number bases, fractions.Moreover, Babylonian clay tablets contain diagrams used to help estimate square roots (Fowler & Robson 1998), suggesting that the Babylonians were aware of potential mappings between numbers and spatial forms, but no number line. Analogously, awareness of the potential mapping between spatial forms and time did not lead to the integrated concept of the timeline.

The emergence of useful cognitive artifacts such as the timeline is a gradual process involving multiple individuals and iterations (Hutchins 1995). The entrenchment of an innovative blend through cultural evolution has been described in detail for such cases as complex and imaginary numbers (Fauconnier & Turner 2002, Fauconnier 2005). Integration networks become widely shared in a culture because they can be used to construct relevant meanings at comparatively low cognitive cost. On most occasions, this success comes only after many failed or less felicitous integrations. Although the timeline appears to the modern observer as a 'natural', straightforward way of representing temporal continuity and relatedness, its invention is fairly recent and represents a remarkable conceptual achievement. As in the case of complex numbers, the timeline is an excellent example of the diachronic aspect of blending; it illustrates the extent to which conceptual integration is a distributed cognitive process involving multiple individuals over a large span of time.

2.3 Varieties and uses of timelines

The timeline, with its emergent properties, results from compressing spatial and temporal relations into one-dimensional space. The compression procedure can recruit any appropriate object to instantiate the linear schema. The object – with relevant length and irrelevant width – becomes a material anchor for the timeline blend whose affordances can be opportunistically exploited.

In a timeline outlining Lego's corporate history on its fiftieth anniversary, pictures of popular Lego toys were placed on the timeline at the date of their release. The significance of the pictures is readily understood via contextually motivated metonymic compression: the toy stands for its release and, hence, all its counterparts. A conventional TOKEN FOR TYPE mapping helps motivate the MANY-TO-ONE compression. At the same time, it is not at all conventional for a picture of a toy to represent the toy's release. That mapping is motivated by its relevance for the timeline.

Conventional mapping schemas are best viewed not as determining the interpretation of timelines but as providing constraints that guide interpretation. In the Lego example, the timeline was itself constructed from a series of Lego blocks laid end to end. In contrast to the picture of the original Lego blocks from 1958, the viewer understands that the linear arrangement of blocks does *not* correspond to the invention of those blocks but to time itself. This suggests that the TOKEN FOR TYPE mapping is not just applied reflexively; its use is influenced by aspects of the context, including the spatial configuration of pictures on the page. Spatiality – in other contexts a general factor in interpretation of metonymies – assumes special prominence in the context of timelines because of graphical conventions for their construction.

CIT provides a framework that readily accommodates contextual variability in instantiating different timelines. The same software used to create Figure One can be used to construct timelines for future events: another common use of timelines. For example, Lori Dector Wright posted a timeline of events for a wedding in a blog entry on http://loridector.com[1], intended to be included with wedding invitations. The timeline depicts important events, such as 'Guests arrive at Resort', 'Oceanfront Ceremony begins', 'Drinks & Pupus by the Pool', and 'Dinner Buffet'. Interestingly, all events are given the same amount of space on the timeline, even though they vary in duration from thirty minutes to five hours. In Figure One, space relates iconically to temporal duration with respect to both ordering and spatial extent. By contrast, the space-to-time mapping in the timeline of events at a wedding preserves the topological correspondence but not the metric: that is, left-to-right ordering of events maps faithfully onto the temporal ordering of wedding events; however, the mapping between spatial extent and temporal duration is absent: the same spacing separates each event. This is often the case in timelines for future events, where the sequence of events is often what matters.

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[1] Note that, as of 9 October 2013, the website is offline.

Of course, CMT advocates will be quick to point out that mappings are highly selective and need not include all aspects of the source domain. That said, the appeal of CMT is its putative generality, and the way the same mappings – e.g., between lovers and travelers – underlie numerous expressions classed under a single metaphor: LOVE IS A JOURNEY. In the case of timelines, Figure One suggests an entrenched mapping between spatial extent and temporal duration, while the wedding timeline suggests that this mapping is not obligatory. As in the case of the conventional metonymy discussed above, the conceptual metaphor does not determine the timeline's interpretation but rather serves as a soft constraint, subject to the user's goals. With timelines, these goals usually privilege saliency and sequential order rather than duration. Whereas CMT suggests that metaphorical expressions and images, such as graphs, are interpreted via a static set of mappings, CIT says that their interpretation involves a more complex network of mappings that can be updated flexibly as a function of context and goals.

3. CUTTING, COMPRESSING, AND ACCELERATING TIMELINES

Emergent properties of the time-space blend affect not only the timeline as symbolic object, but also the way that spatial vocabulary is recruited to describe it. Below we discuss how attested statements about timelines incorporate mappings between spatial extent and time (Section 3.1) and between motion and time (Section 3.2).

3.1 Spatial extent

Consider Example (4), from a news story about the potential impact of software on drug design (*Drug Week* 2 April 2010, p. 3478: 'Apriso joins Dassault Systems Software partner community'; *emphasis added*) [http://www.apriso.com/company/news/press_releases/Mar_17_2010_Dassault_Systemes.php]:

(4)   This new combined solution addresses the challenge of sharing information between design and planning and production execution…. Design timelines can be *compressed*, products can be accelerated and overall quality can be elevated.

In many ways, (4) exemplifies the sort of linguistic data that motivates CMT. It involves a mapping from a concrete source to an abstract target: a verb describing physical transformation ('compression') has been applied to the abstract domain of scheduling. It can be seen as one instantiation of a more general pattern of mappings between spatial and temporal relationships. Inferences regarding physical compression find analogues in the temporal domain. The result of physical compression is a smaller object with greater density. Analogously, events on the new timeline occur in more rapid succession: their duration is reduced relative to the old timeline.

CIT suggests that this analogy is mediated by a blended model with links both to physical compression and the scheduled events. The timeline's spatiality affords its construal as something that *can* be physically transformed. Entrenched mapping schemas can then be used to interpret the implications of the timeline's physical transformations for the abstract domain of scheduling. Compression makes the timeline shorter, mapping onto the reduced duration of events. At the same time, compression results in a greater density of points on the timeline, mapping onto the more rapid succession of events. Notice, however, that the scheduled events in (4) are not construed via a general notion of compression but rather a specific sort of compression applied to timelines. This is why the compressed timeline is not bent but retains its original shape. The blending in (4) conforms to a regularity pointed out by Fauconnier and Turner (2002): the *disanalogy* between the length of the two timelines – before and after adoption of the software – maps onto change in the blended space in which one talks about compressed timelines.

Disanalogy likewise maps onto change when people talk about *cutting* timelines – as in (5), from an article about zoning-law changes for high-density housing projects such as large apartment buildings proposed for urban areas well supported by public transportation (*The Courier Mail*; Brisbane, Australia; Thursday, 18 March 2010 p. 10: 'Fast-track plan in "go zones"'; *emphasis added*).

(5)   AREAS close to public transport corridors will become 'go zones', effectively allowing state and local governments to fast-track approval of high-density developments…. The planning timeline would be *cut from years to months* in 'go zones'.

Consistent with the mapping between spatial extent and temporal duration identified by CMT researchers, the reduced length of the 'cut' timeline entails a corresponding reduction in the duration of the planning process discussed in (5). Interestingly, whereas cutting the latter half of a 60″ measuring tape leaves one with a scale of 0-30″, cutting the timeline need not imply omission of any events it depicts. Rather, cutting the timeline 'from years to months' implies revising the mapping between tick marks on the timeline and temporal units in the time space. In the blend, 'cutting' the years means transforming them into months, as manifest in the writer's use of the construction 'from… to' with the verb *to cut*. Event objects spaced years apart on the former timeline are now spaced months apart.

Similarly, (6) illustrates a change to a timeline that maps onto a reduced period for drug development process (*Drug Week* 2 April 2010, p. 3632: 'Global alliance for TB drug development: Global partners join forces to speed development of new TB drug combinations'; *emphasis added*) [http://www.highbeam.com/doc/1G1-222084889.html]:

(6)   'By working together, CPTR partners can *take years off* the drug development timeline for safer new TB drug regimens', said Dr. Raymond Woosley, President and CEO of the Critical Path Institute.

In (6) a temporal unit – years – occurs in the 'length' slot of a construction often used to describe removal from a container or surface: e.g., cutting hair, as in 'take a couple of inches off the back'. Here, as in (5), eliminating years from the timeline does not mean omitting any events planned for those years, but rather preserving their relative positions in a new, shorter timeline. As in both (4) and (5), the grammatically cued change construal ('take years off') maps onto a disanalogy between the duration, in the input spaces, of the original and new timelines.

In other cases, cutting a timeline *does* imply the omission of planned activities. Consider (7), from a news article about the UK's Royal Air Force (RAF) (*Aerospace Daily & Defense Report* Thursday, 1 April 2010 [**234** (1)], p. 3: Barrie, D., 'More RAF C-130Js unlikely despite A400M delay'; *emphasis added*).

(7)   The RAF already has been forced to reduce the anticipated service life of some of its C-130Js by three years as a result of greater than anticipated use. When first acquired, the aircraft were expected to remain in service until 2030. However, higher operational utilization in more demanding environments has *cut that timeline* to an estimated out-of-service date of 2027.

In both (5) and (7), the disanalogy between the original and the revised timeline is compressed – in the sense of (Fauconnier & Turner 2002) – to afford use of the change predicate 'cut'. Interpretation of (5), (6), and (7) depends on an entrenched mapping between spatial extent and temporal duration. However, in (7), changing the plane's out-of-service date implies the omission of three years' worth of planned flights; whereas (5) and (6) have no implication that cutting the timeline would result in omission of any planned activities. The precise implications of cutting a timeline thus seem to be a function of the discourse context – e.g., the rapid development of a drug or the early retirement of a fighter jet – and not of the concrete meaning of 'cut'. Focusing exclusively on the mappings between e.g. spatial extent and temporal duration common to all examples can lead one to ignore important differences that reveal a tremendous degree of sensitivity to content, context, and goals.

3.2 Accelerating timelines

Besides using the mapping between spatial extent and temporal duration, speakers frequently use motion verbs to discuss timelines. Presumably, this reflects the importance of the 'time' input to the timeline blend, and that blend's connection to entrenched construals of time involving motion. Consider (8), taken from a newspaper article about the lobbying activities of Los Angeles mayor Antonio Villaraigosa (The *Christian Science Monitor* 11 March 2010: Wood, D.B.: 'Will Washington fund a Los Angeles subway expansion?'; *emphasis added*) [http://www.csmonitor.com/USA/2010/0311/Will-Washington-fund-a-Los-Angeles-subway-expansion]. The article describes a 2010 trip Villaraigosa took to Washington, DC, to

lobby the federal government for a change in the funding schedule for a planned Los Angeles subway expansion known as 'Subway to the Sea'. The original plan projected construction to last thirty years; Villaraigosa was arguing for a loan to support an alternative, ten-year plan.

(8) Mayor Villaraigosa is now trying to *accelerate the timeline* for such projects from 30 years to 10 by asking the federal government for a bridge loan to get started. He's set to speak before a Senate Environment and Public Works Committee hearing on Thursday. Besides accelerating the start and finish dates of several projects, the loan would save millions and create between 150,000 to 200,000 jobs.

The example is understood so seamlessly, one almost does not notice the difference between the timeline's construal in (8) and that of the examples discussed in Section 3.1. First and foremost, the timeline in (8) is not a static object by which spatial extent has implications for temporal duration. The article describes a proposed change in the duration of the project from thirty years to ten: 'Mayor Villaraigosa is now trying to accelerate the timeline for such projects from 30 years to 10...'. The change in duration is not described in terms of the timeline's spatial extent; it is described as acceleration: i.e., as change in the timeline's 'rate'.

The use of motion language here can be understood as instantiating the conventional metaphor TIME IS A MOVING OBJECT, by which temporal events are construed as objects moving relative to an egocentric reference point (Boroditsky 2000, Moore 2006, Núñez & Sweetser 2004). Future events are construed as being in front of the reference point, past events as behind. The metaphor explains why statements about temporal events routinely involve use of motion verbs ('Dad's birthday is coming'), 'rate' adverbs ('the deadline is rapidly approaching'), and spatial deictics ('May Day is almost here'). Table Two shows some of the important mappings in this metaphor.

Time	Space/Motion
Events	Objects
Now	Ego
Future	Observer-relative Front
Future Events	Objects Moving towards Observer
Immediacy	Spatial Proximity

Table 2: Important mappings in the TIME IS MOTION metaphor.

Using the framework of CIT, Fauconnier and Turner (2008) account for similar linguistic data, along with statements about the subjective experience of time: e.g., 'when you're young, the days fly by, but the years drag on forever; when you're old, the days drag, but the years fly by'. They suggest that a full account of the metaphor TIME IS SPACE requires successive integrations of at least the following inputs: (1) events; (2) objective and subjective experience of motion through space; (3) a blend of the two, with all possible displacements compressed into the case of traversing a path; (4) the blended cyclic day, compressing multiple days into a repeating day, and (5) a natural or technological mechanism that blends with the cyclic day. The last provides yet another input: the socially constructed notion of time, with emergent universal events like seconds, minutes, hours, etc. The result is a dual network dependent on viewpoint: the experiencer can move through time or *vice versa*; it is also possible to view time motion as a detached observer. If the topology of the constructed 'time' notion is privileged, one has 'objective' time experience running at normal speed: e.g., 'an hour must pass before we may leave'. If the experience of events provides the framing, one has 'subjective' time experience running at variable speed: e.g., 'this hour is passing very slowly'.

Such an elaborate system of integration networks accounts for numerous emergent meanings that cannot be explained as the result of direct projections from space to time: e.g., time units have the properties of space measures but are also moving objects ('hours go by'). In the time-space blend, all observers are in the same location; they look in the same direction and see the same objects: namely, time units. Far from encompassing the whole domain of space, this looks like a very particular spatial experience designed to match temporal relations. Although all objects move along the same path, observers can perceive different speeds – e.g., 'the class went by fast for me and slowly for her' – depending on their attitudes. Distant objects can be perceived as close at hand or even more distant: e.g., 'yes, you are only fifty but retirement is just around the corner', 'tomorrow seems light years away'.

The meaning of (8) follows neither from the standard mappings in CMT (see e.g. Lakoff 1993), nor from the account outlined in (Fauconnier & Turner 2008). Accelerating the timeline does not imply that the passage of time changes in any way – either objectively or subjectively. Even in subjective-time expressions in which time is experienced as accelerated so that thirty years can go by in an instant, still, thirty years cannot become ten. The discrepancy involves the mapping between rate in the space/motion domain and its counterpart in the time domain. Although object motion in (8) does indeed map onto passage of time, the rate of object motion maps neither onto objective rate of time, as implied by (Lakoff & Johnson 1980); nor onto perceived rate of time, as in many of the examples in (Fauconnier & Turner 2008). Rather, *acceleration* implies that the project's duration will change. This inference differs substantively from the inferences available in the source input of motion through space. Whereas people talk of a car accelerating from zero to sixty miles per hour, (8) describes a different sort of acceleration: the acceleration of the timeline from thirty years to ten. The use of *accelerate* here involves an entrenched

conventional metaphor in a way that omits the standard mapping between rate of motion and rate of time. Instead, it employs a mapping between the rate of object motion and the project's duration. Moreover, the mapping in (8) is contrary to the conventional mapping between spatial extent and temporal duration so important to the interpretation of (4)-(7), in which a longer distance corresponds to a greater amount of time. In (8), *increasing* the rate of travel implies *decreasing* the project's duration. In the source domain of motion through space, increasing the rate of travel should either increase the distance covered – corresponding to a longer line, implying increased duration – or have no impact. Thus, one sees that the inferences evoked in (8) by the concept of acceleration cannot be generated using a straightforward correspondence between spatial extent, object movement, and temporal duration.

Of course, the invited inference in (8) is that acceleration will increase the rate at which future events travel, allowing them to arrive sooner than they would otherwise. Though slightly different from the mappings outlined in (Fauconnier & Turner 2008), the construal in (8) is better captured by the flexible integration processes of CIT than by the CMT account involving retrieval of fixed mappings. This is because aspects of the TIME IS A MOVING OBJECT construal are relevant for some metaphorical expressions about time, but not for the invited inference in (8). In (8), the critical mappings are not from the space/motion to the temporal domain, but rather from time in one imaginary hybrid space/motion construct – a blend in which dates serve as landmarks on a timeline moving towards the observer – to time in another: a cognitive model of future events in Los Angeles.

The example in (8) can be described in CIT as involving two blended input spaces, each connected to other spaces in the timeline network. In the ***present timeline input***, events – i.e., start and finish date – move towards the observer at a fixed pace conveyed by the line. In the ***desired timeline input***, event objects – start and finish date again – move towards the observer at a faster pace than at present. Events, related by analogy in the inputs, map onto a single event object in the blend via analogy-identity compression. The disanalogy between rate of motion in each input space is compressed to rate change in the blend, affording the construal of the timeline as *accelerating*. The metaphorical use of acceleration is motivated not by straightforward analogy with the domain of motion but by the way it highlights differences between the present and desired timelines. More generally, (8) demonstrates how cognitive models of hypothetical possibilities figure prominently in the semantics of utterances about timelines and how CIT may be used for describing the way these interact with metaphorical construals of the target.

4. POETIC USES OF THE TIMELINE BLEND

Fauconnier and Turner (2008) show how novel metaphors preserve the complex space-time network by examining a literary example (McDonald 1991: 82-83):

(9)   Perhaps time is flowing faster up there in the attic. Perhaps the accumulated mass of the past gathered there is pulling time out of the future faster, like a weight on a line. Or perhaps, more mundanely, it is only that I am getting older every year and that it is the accumulated weight of time behind me that is unreeling the years with ever-increasing speed. What a horrible thing it must be to grow older and find that ever-decreasing number of years hurrying you faster, faster toward your grave, as if time were impatient to be rid of you.

Here one finds a derivative of the standard time-space network: 'time has a variable speed and now a new blend is constructed according to which that motion is induced by standard physics. Weight is pulling the timeline along' (Fauconnier & Turner 2008). Following our analysis, one could say that this is another case of an accelerated timeline. However, there are fundamental differences. In (9), subjective time is accelerated: the number of years (to live) remains the same, but they pass faster. In (8) – as we noted – time is not accelerated in any way, but the duration of the LA subway project is shortened. In (9), one does not have the additional inputs of a present and a desired timeline but instead, as Fauconnier and Turner describe, a subjective time-space blend that happens to recruit the image-schematic structure of a line – and that is how 'standard physics' opportunistically intrudes. This is exploited to serve the narrator's communicative goals, aimed at constructing affective meaning related to aging and the sentimental connotations of attics – which, in the blend, become the weight that unreels the timeline faster and faster.

However, we wish to stress that the appearance of the linear schema in examples like this one is far from either trivial or fanciful: representations of objective or subjective time do not need to include a line. The line is an added input to the network: one that happens to be an especially useful structure for compression, at the same time matching beautifully the type of motion in the blend and the regular continuity of time. The recruitment of the linear schema confirms the existence of a widely shared *generic integration network* – as defined by Pagán Cánovas (2011) – for the compression of time relations into one-dimensional space, of which Priestley's timeline is only one possible instantiation. In (9), the unreeling of a pulley-like device provides quite a different context-driven anchor, under pressure to depict speed and intentionality of time as a personified abstract cause. These last aspects are normally absent from chronological timelines; but nothing in the concept of time prevents the pulley from being used as a timeline in e.g. a history museum as an interactive exhibit.

One does not always need to interact physically with the material anchors of blends. If the material structure is widely shared and simple to operate – as many such structures are – they can be virtually manipulated by imagining them, representing them, remembering them, talking about them (Vygotsky 1978). One does not need to be shown a clock to be told the time – or even to make one understand complex metaphorical examples such as (10) (Asch 1952: xiv-xv; quoted in Rozin 2001):

(10) In their anxiety to be scientific, students of psychology have often imitated the latest forms of sciences with a long history, while ignoring the steps these sciences took when they were young. They have, for example, striven to emulate the quantitative exactness of natural sciences without asking whether their own subject matter is always ripe for such treatment, failing to realize that one does not advance time by moving the hands of the clock.

Representing a – sometimes peculiar – material anchor for the timeline blend is common to many metaphorical expressions. Instantiations of the timeline can look quite strange indeed in poetic texts, as poets introduce structures that nevertheless connect with relevant knowledge and become effective prompts for affective meaning. The first lines of a poem by the Mexican Noble Prize winner Octavio Paz provide a spectacular example:

(11) **_Más allá del amor_**, by Octavio Paz

Todo nos amenaza:
el tiempo, que en vivientes fragmentos divide
al que fui
del que seré,
como el machete a la culebra;

Everything threatens us:
time, which into living fragments divides
the one I was
from the one I will be,
like the machete the snake;

Time here is not a line but a personified agent (Line 2) that separates one's past from one's future self. *Time the Divider* – already a blend – maps onto a mental space in which the agent severs a living being 'into living fragments'. However, none of the integrations we have just sketched justifies the choice of the snake. One can cut many plants and animals 'into living fragments' with a machete. Why a snake? What makes the snake so effective a choice?

Several cultural reasons may make the snake appropriate. It has symbolic value for Paz and for Mexico, although perhaps that value is not easy to apply here. As the poem unfolds, one sees that Paz is opposing an animalistic, sensual, 'full' life to consciousness: time experience, self awareness, language, etc. As a wild animal, the snake can be linked to that primordial life represented, farther along in the poem, by the jungle and the ocean's foam. The snake may also prompt for activation of a widely shared cultural frame: Adam and Eve's story in Genesis. These and other associations can be both relevant and productive; but they are not enough to justify the choice of the snake among all the other possibilities.

When one finishes reading the fifth line, how does one see the snake? Is it rolled? Is it 'snaking'? How many times does the machete cut it, and into how many pieces? The text specifies no answer to these questions. However, most people will probably have envisioned the snake as a more-or-less straight line

cut in two. One is prompted to see two pieces by the 'living fragments' into which the self is divided in the preceding lines: past and future. Why a straight line? Live snakes are almost never found in such a position. We suggest that the structure has been imported from another input: the timeline.

Mapping back to a timeline is an especially useful property for this snake, driven by the context – *Time the Divider* severing the past from future self – and the poet's rhetorical goal of suggesting that one's time awareness makes one suffer and die, that it prevents one from enjoying life fully. In the resulting blend, the snake's elongated shape is used opportunistically to activate the line in a context of reflection on time: the snake becomes an imagined anchor instantiating the timeline. The snake-as-timeline maps onto the divided self, which was not necessarily linear in the first part of the simile but becomes so in the final blend. This is crucial for supporting the construction of affective meanings that one would ordinarily not encounter in other timeline examples. Some of the most significant mappings and emergent structures include:

(a) In contrast to one's conventional understanding of temporal continuity, Paz' timeline, instantiated as a snake, can be broken into pieces that cannot be put together again, leaving a gap between them.

(b) *'The one I was'* and *'the one I will be'* have no spatial definition beyond being living fragments of a previous whole. In Line 5, they map onto the two (linear) sections of the snake's body into which the machete has cut the snake. Most readers will probably see the part of the snake containing the head as analogous to the future self, the part containing the 'tail' as analogous to the past.

(c) The present self maps onto the bleeding wound, which corresponds to the gap in the timeline. This differs from standard construals of time, in which the present is not a missing part but a moving point in the timeline.

(d) The mappings between *divided self, severed snake,* and *'broken' timeline* bring into question basic aspects of the standard notion of time.[2] Here, the present does not link the past and future: it separates them. One's two selves can no longer meet: the wound is incurable.

(e) One's 'living fragments' cannot last long: life is short and cruel.

(f) All this is extremely painful to the reader. She is a victim, just like her analogue, the snake. This challenges practically all the archetypical views of snakes as dangerous, powerful, repulsive, etc. In this context, these archetypical features remain latent: if one could only liberate oneself from time awareness, one would become that kind of creature.

(g) One's consciousness of time creates the linear self and causes time to divide that self into irretrievably separated selves. One's awareness puts one in the position of the snake falling under

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[2] For poetic metaphors and questioning, see (Lakoff & Turner 1989: 67-72).

> the machete. It is one's consciousness that causes one's misery and, ultimately, destroys one's true identity and the life one could live.

There is nothing the reader can do. Like the snake, she is helpless as she receives the blow – from an object (note that time is the machete, not the wielder of the machete) to which one cannot successfully respond: time and consciousness are unavoidable and merciless. Trying to appease *Time the Divider* would be like the snake negotiating with the machete.

5. LOOKING FORWARD: THE IMAGE-SCHEMATIC BASIS OF TIMELINE BLENDS, AND CONSIDERATIONS FOR FUTURE RESEARCH

The selection of a linear structure to anchor time-space mappings is neither trivial nor whimsical, as shown by both conventional and novel examples. In the input of motion through space, an object can take any trajectory. Faster objects surpass slower ones, and several objects can reach a destination simultaneously. In the time-space blend, by contrast, time units share the same (linear) trajectory, come from the same direction, cannot overtake one another, and cannot arrive at the same time. If one's goal is to present Franklin's life as a series of salient events in sequence, then these events cannot be allowed to co-occur, and the length-duration relationship must be the only one that holds. The properties of a straight line comply with these constraints and provide an adequate topology for the blend, though they clash with many other aspects of one's experience of traversing paths.

As for integrating one-dimensional line with two-dimensional path, spatial cognition often makes the image-schematic structure of the line a tool for construing narrow shapes as one-dimensional objects, discarding those properties that are irrelevant for present *ad hoc* purposes. Indeed, people often integrate paths, ropes, blades, and snakes with linear schemas, allowing them to build cognitive models with a combination of properties from one- and two-dimensional objects: e.g., a path that allows only one object to move along it at a time. These are not characteristics of lines that are transferred onto time, but needs of time conceptualization that make lines especially appropriate for the mapping. Recruitment of the line as input to the timeline integration network requires extant knowledge of time along with certain representational goals. It is not that one understands time in terms of space. Rather, it would seem that the relevant spatial structure has been adjusted to fit one's knowledge of sequences: that is, the spatial topology has been modified to fit the temporal structure. The most creative and complex examples one can find confirm this fine tuning of spatial to suit temporal structure. In Paz's poem (11), one sees that the machete-snake input has been adjusted to match its time-self counterpart: out of the infinite possibilities available to instantiate the scene that the poet describes, one imagines a straight snake cut into two pieces.

Grady, Oakley, and Coulson (1999) argue that CMT and CIT are complementary: the former well suited to identifying general cross-domain mappings, the latter to analyzing specific examples. The

implication is that metaphor research should proceed in parallel tracks, with metaphor theorists focusing on conventional language and blending theorists on creative examples. The intervening years have seen increasing convergence of the two approaches, as metaphor research in CIT draws increasingly on the methods and findings of CMT (e.g., Oakley & Coulson 2008) and cognitive linguistics in the CMT tradition increasingly advocates the need for additional analytic tools. Lakoff and Johnson (1999) allow that analysis of metaphor in everyday language frequently requires the mechanisms of CIT for composing two or more conceptual metaphors. Moore (2006) suggests that the definition of conceptual metaphors as cross-domain mappings is overly general, recommending instead their characterization as mappings between elements in simple frames, akin to those that structure mental spaces.

CIT research increasingly involves the identification of generalizations (Fauconnier 2009, Pagán Cánovas 2011, Pagán Cánovas *in press*). The examples discussed in Section Three collectively suggest that blending disanalogous timelines into a single timeline, with emergent properties related to change, is to construct a generic integration network. Fauconnier (2009) defines a *generalized integration network* as an abstract blending pattern underlying multiple examples that can be applied to novel domains: e.g., the 'Zoloft network' is a blended space incorporating incompatible information from the actual circumstances in a situation (in which a teenager has murdered his grandparents) with structure from a salient counterfactual space, so as to emphasize one aspect of that situation. Fauconnier suggests that the same pattern applies to the following excerpt from the San Francisco Chronicle 'Bar patrons fume over smoking law: Drinks left inside as they puff away', by Michael Taylor, *San Francisco Chronicle* [01/02/98: http://no-smoking.org/dec97/01-02-98-1.html]:

> (12) 'No Smoking' signs were tacked up in bars all over California yesterday, and hard-core smokers nursing a scotch or a beer were so angry that if they had been allowed to light up, the smoke would have been coming out of their ears.

In (12), the relevant structure from the actual circumstances is that the smoking ban made smokers angry; the salient counterfactual involves a cognitive model incompatible with the structure in that space: the smokers are allowed to smoke. In the blend, the smokers use their temporary release from the smoking ban to express their anger over it by emitting smoke from their ears.

The Zoloft network gets its name from a court case in which a teenager, who had recently begun taking the medication Zoloft, murdered his grandparents. One of the arguments for the defense was that, were his grandparents alive, they would support a lenient sentence for their grandson. The actual circumstances of their murder are blended with the salient counterfactual in which they are still alive to underscore the accused person's lack of culpability. Such cases suggest that intricate generic integration networks can become conceptual templates, easily recruited and modified to suit *ad hoc* purposes. Just because the blending account is more detailed does not imply it has less generalizing power than CMT's

binary mappings. Through automatization, even highly complex conceptual recipes can become entrenched – systematically rendering emergent structures useful in different communicative contexts.

We believe that timelines are paradigmatic of metaphorical understanding. As graphical objects, timelines demonstrate the way that metaphor – indeed, conceptual structure in general – is not a 'mere' product of language but plays an important role in structuring cognitive activity. Furthermore, timelines demonstrate the import of material anchors: input spaces constituted by material structure, tools designed specifically to reduce individual cognitive load and promote efficient, error-free computations. Timelines employ compressions, in which elements from multiple input spaces map onto closely related elements in the blended space, giving it novel computational properties. The utility of the timeline is not simply that it involves a metaphorical mapping from a concrete domain to an abstract one; the linear schema has been selected, via a process of cultural evolution, to best meet the needs of time conceptualization.

Finally, we have stressed the extent to which particular timeline instantiations have different underlying mappings as a function of their differential content and contexts. Examination of attested examples reveals a great degree of variation in the mappings and inferences promoted. As Fauconnier and Turner (2008) show, classical conceptual metaphors like TIME IS SPACE are only the tip of the iceberg. Our analysis suggests that even the dual system of integration networks – connecting events, objectively and subjectively experienced motion along a path, and the socially constructed notion of time (Fauconnier & Turner 2008) – is not enough to provide a full account of timeline blends. Representational goals often lead speakers to combine two or more conceptual metaphors via metaphorical and metonymic mappings, and to embed their metaphors in hypothetical – or even explicitly counterfactual – contexts.

In conclusion, metaphor use is often strategic: language users seek cognitive models to promote their desired construals of the topic at hand, much as poets do. Such discourse does not occur in a vacuum; speakers and listeners together navigate a rich cultural landscape of extant construals with varying degrees of entrenchment. These construals include the binary mappings of CMT but also detailed blending patterns described via generic integration networks. Sharing these detailed procedures for building complex structure makes the meaning construction process more fluid and adaptable to speakers' communicative needs. Better understanding metaphor – like better understanding timelines – requires the development and refinement of more detailed generalizations of the type proposed by CIT.

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REFERENCES

Asch, S. (1952). *Social Psychology*. Englewood Cliffs, NJ: Prentice-Hall.

Barsalou, L.W. (1993). Flexibility, structure, and linguistic vagary in concepts: Manifestations of a compositional system of perceptual symbols. In Collins, A.C., Gathercole, S.E. & Conway, M.A. (eds.), *Theories of Memory* (29-101). London: Lawrence Erlbaum Associates.

Boroditsky, L. (2000). Metaphoric structuring: Understanding time through spatial metaphors. *Cognition, 75*: 1–28.

Coulson, S. (2001). *Semantic Leaps: Frame-shifting and Conceptual Blending in Meaning Construction*. Cambridge, UK: Cambridge University Press.

Coulson, S. & Pascual, E. (2006). For the sake of argument: Mourning the unborn and reviving the dead through conceptual blending. *Annual Review of Cognitive Linguistics, 4*: 153-181.

Fauconnier, G. (1994). *Mental Spaces: Aspects of Meaning Construction in Natural Language*. Cambridge, UK: Cambridge University Press.

Fauconnier, G. (1997). *Mappings in Thought and Language*. New York: Cambridge University Press.

Fauconnier, G. (2009). Generalized integration networks. In Evans, V. & Pourcel, S. (eds.), *New Directions in Cognitive Linguistics* (147-160). Amsterdam: John Benjamins.

Fauconnier, G. & Turner, M. (1998). Conceptual integration networks. *Cognitive Science, 22*(2): 133-187.

Fauconnier, G. & Turner, M. (2000). Compression and global insight. *Cognitive Linguistics, 11*(3-4): 283-304.

Fauconnier, G. & Turner, M . (2002). *The Way We Think: Conceptual Blending and the Mind's Hidden Complexities*. New York: Basic Books.

Fauconnier, G. & Turner, M. (2008). Rethinking metaphor. In Gibbs, Jr., R.W. (ed.), *Cambridge Handbook of Metaphor and Thought*. New York: Cambridge University Press.

Fillmore, C. (1982). Frame semantics. In The Linguistic Society of Korea (ed.), *Linguistics in the Morning Calm* (111-137). Seoul: Hanshin.

Fowler, D.H. & Robson, E.R. (1998). Square root approximations in Old Babylonian mathematics: YBC 7289 in context. *Historia Mathematica, 25*: 366–378.

Grady, J. (1997). Foundations of meaning: Primary metaphors and primary scenes. Doctoral thesis, Linguistics Department, University of California, Berkeley.

Grady, J., Oakley, T. & Coulson, S. (1999). Blending and metaphor. In Gibbs, Jr., R.W. & Steen, G. (eds.), *Metaphor in Cognitive Linguistics* (101–124). Amsterdam: John Benjamins.

Grafton, A. & Rosenberg, D. (2010). *Cartographies of Time: A History of the Timeline*. New York: Princeton Architectural Press.

Hutchins, E. (1995). *Cognition in the Wild*. Cambridge, MA, USA: MIT Press.

Hutchins, E. (2005). Material anchors for conceptual blends. *Journal of Pragmatics,* **37**: 1555–1577.

Lakoff, G. (1993). The contemporary theory of metaphor. In Ortony, A. (ed.), *Metaphor and Thought: Second edition* (201–251). New York: Cambridge University Press.

Lakoff, G. & Johnson, M. (1999). *Philosophy in the Flesh*. New York: Basic Books.

Lakoff, G. & Turner, M. (1989). *More Than Cool Reason: A Field Guide to Poetic Metaphor*. Chicago: The University of Chicago Press.

Lakoff, G. & Johnson, M. (1980). *Metaphors We Live By*. Chicago: University of Chicago Press.

McDonald, I. (1991). *King of Morning, Queen of Day*. Bantam Spectra.

Moore, K.E. (2006). Space-to-time mappings and temporal concepts. *Cognitive Linguistics,* **17**: 199–244.

Núñez, R. (2009). Numbers and arithmetic: Neither hardwired nor out there. *Biological Theory,* **4**(1): 68–83.

Núñez R. & Sweetser, E. (2006). With the future behind them: Convergent evidence from Aymara language and gesture in the cross-linguistic comparison of spatial construals of time. *Cognitive Science,* **30**: 401–450.

Oakley, T. & Coulson, S. (2008). Connecting the dots: Mental spaces and metaphoric language in discourse. In Oakley, T. & Hougaard, A. (eds.), *Mental Spaces in Discourse and Interaction* (27-50). Amsterdam: John Benjamins.

Pagán Cánovas, C. (2011). Erotic emissions in Greek poetry: A generic integration network. *Cognitive Semiotics,* **6**: 7-32.

Pagán Cánovas, C. (2011). The genesis of the arrows of love: Diachronic conceptual integration in Greek mythology. *American Journal of Philology,* **132**(4): 553-579.

Phan, D., Gerth, J., Lee, M., Paepcke, A. & Winograd, T. (2008). Visual analysis of network flow data with timelines and event plots. VizSEC 2007 (85-99), Berlin: Springer.Rozin, P. (2001). Social psychology and science: Some lessons from Solomon Asch. *Personality and Social Psychology Review*, **5**(1), 2-14.

Talmy, L. (2000). *Toward a Cognitive Semantics Vol. I: Concept Structuring Systems*. Cambridge, MA, USA: MIT Press.

Turner, M. (1996). *The Literary Mind*. Oxford: Oxford University Press.