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Willemsen, Steven; Kiss, Miklós

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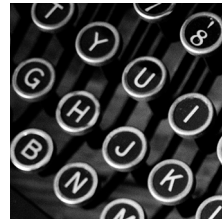
Keeping Track of Time

The Role of Spatial and Embodied Cognition in the Comprehension of Nonlinear Storyworlds

Steven Willemsen
MAX PLANCK INSTITUTE FOR EMPIRICAL
AESTHETICS

Miklós Kiss
UNIVERSITY OF GRONINGEN

ABSTRACT: What allows an audience to make sense of stories with complex nonlinear time structures that are radically different from everyday experience? To address this question, we distinguish between two types of narrative nonlinearity: *nonlinear storytelling* (a non-chronological presentation of events in the narration) and *nonlinear storyworlds* (nonlinearity as a feature of the narrated world, for instance by way of time-travel or temporal loops). With most scholarly attention focusing on the former, here we focus on the latter, as the question of what allows audiences to make sense of strange and impossible storyworld temporalities has remained somewhat overlooked. Drawing on the available research on text comprehension, we first discuss how both strategies of nonlinearity affect narrative comprehension differently. We then ask what cognitive abilities allow spectators to engage with nonlinear storyworlds. Drawing on insights from conceptual metaphor theory and mental timeline theory, we propose that the comprehension of nonlinear storyworlds is facilitated by the cognitive ability to mentally represent time in terms of space. By metaphorically blending spatial and embodied concepts into narrative timelines, strategies of spatial mental representation allow spectators to conceive and comprehend various forms of phenomenologically non-experienceable time structures—a hypothesis we seek to demonstrate through several cases of nonlinear storyworlds from contemporary complex cinema.
KEYWORDS: Narrative complexity, nonlinearity, puzzle films, conceptual metaphors, mental timeline

NARRATIVE COMPLEXITY AND NONLINEARITY

Fictional stories frequently feature complex temporal structures that are radically different from our everyday—more or less linear—conception of time. Narrative time can, among others, be fragmented, reversed, shuffled, multi-layered, looped, traveled by characters, or refracted to express subjective states. Nonlinear narrative strategies have featured in many traditions of complex storytelling across media—from modernist to postmodern literature and, today, in complex television series (Mittell) and puzzle films (Buckland). In popular fiction film, the striking rise of complex storytelling is, according to Alan Cameron, primarily a result of these films' "sense of time as divisible and subject to manipulation," making these movies, like the earlier modernist novels, first and foremost "tales about time" (2).

In previous work, we proposed that narrative complexity should not only be seen as an objective property of a story but primarily as a *cognitive effect* that narratives produce in their spectators (Kiss and Willemsen). In other words, narrative complexity is emergent from the dynamic between a story's structural and formal features and an (engaged) spectator's attempt to make sense of it. With this cognitive conceptualization in mind, nonlinearity, as one of the most striking and apparently effective complexifying techniques, raises a twofold question: first, what makes nonlinear narratives cognitively demanding—i.e., the *cognitive effect* question; and second, what real-world cognitive abilities allow spectators to engage with a story's challenging deviations from everyday temporality—which we will call the *ecological-cognitive* question.

While this article will be illustrated by examples from contemporary film, the theoretical work we build on is not restricted to audiovisual media per se, but targets more general underlying processes of narrative and textual comprehension. As these cognitive processes are usually regarded as functioning similarly across media, we assume that our findings can be extended to complex stories and storytelling in other narrative media (such as literature or serial television).

NONLINEAR STORYTELLING AND NONLINEAR STORYWORLDS

While nonlinearity is often referred to as a single category of narration, it is important to note that narratives can use a wide variety of techniques to create nonlinear temporal patterns and experiences. We find it useful to discern

two overarching categories among these: *nonlinear storytelling* and *nonlinear storyworlds*.

Nonlinear storytelling occurs when narration systematically presents events in an order that is different from their chronological occurrence. Such non-chronological storytelling can take many forms, from the seemingly unmotivated shuffling of events (e.g., *Pulp Fiction*) to systematic patterns like inverted orders (such as in *Memento*) that can be justified dramatically (for instance by a character's subjective state, such as Leonard's anterograde amnesia in *Memento*) or motivated emotionally (cf. the reversed theatrical and chronological versions of *Irréversible*). It must, of course, be noted that nonlinear narration need not always be experienced as "complex"; after all, non-chronological arrangements are a fairly common feature of many canonical stories, with devices like flashbacks and flashforwards often working to withhold or reveal information in such a way that it enhances key story effects, like curiosity, surprise, or suspense (Sternberg).

In *nonlinear storyworlds*, deviations from linearity are not the result of a non-chronological order of narration (though the two forms can occur in tandem), but they form a feature of the *diegetic fictional world* that is narrated. Nonlinear storyworlds frequently occur in genres like science-fiction or mystery-horror, when diegetic laws allow possibilities of time travel (as in *Primer*), mysterious temporal loops (*Triangle*), or multiple parallel and alternative universes (*Inception, Interstellar*, or *Donnie Darko*).

It may seem as if these two categories only form two different modes of "naturalizing" (Culler 152) nonlinear techniques—either as a result of the arrangement of information (or what narratologists refer to as the *plot*) or as an aspect of the told (or *story*). However, we propose to discern the two because they do not only represent two different *formal* categories of complexifying techniques but can also be associated with different *cognitive effects*, which are at the heart of the experience of narrative complexity that we focus on.

Effects on Narrative Comprehension

In what ways do these nonlinearities impact our cognitive engagement with stories? An assumption shared by many studies on text comprehension is that comprehending a narrative boils down to the reader's formation of a coherent *mental representation* of what is described in the story. Even when

making sense of a relatively simple and straightforward story, "readers construct representations of characters, events, states, goals, and actions that are described by the story. Readers create, as it were, a microworld of what is conveyed" (Zwaan et al., "The Construction of Situation Models" 292). This process is generally described as involving three aspects: the *source text* or discourse's *surface* structure (in a written text: textual signs and their organization into a whole), the network of *propositions* that the recipient can derive from this (i.e., the meaning or gist of the textual signs), and the resulting *mental representations* formed by the reader or spectator, varyingly described as *mental models* (Johnson-Laird), *situation models* (van Dijk and Kintsch), or *event models* (Zwaan, "Five Dimensions of Narrative Comprehension"). As Danielle McNamara and Joe Magliano summarize, these latter notions of active mental representation introduced "the critical notion that comprehension is more than deriving relationships between explicitly mentioned discourse constituents," emphasizing that "deep comprehension reflects an understanding of the referenced and implied situations, rather than merely representing explicit content" (307).

Arriving at a full-fledged mental model of a narrative world involves large amounts of inferences from a recipient, who integrates information about agents, goals, actions, settings, and their causal, spatial, or temporal interrelations. Two kinds of information feed into this process: the cues provided by the *source text* (as disclosed in the reading-viewing process or, at a later stage, retrieved from memory) and the activation of the reader's or spectator's relevant *background knowledge* (such as real-world experiences, cultural stereotypes, and narrative conventions) stored in memory in clusters of related concepts, often described as frames (Minsky), schemas (Rumelhart), or scripts (Schank and Abelson). Recent work has emphasized how this activation of knowledge also involves *embodied* cognitive processes, with research indicating that both our "experiential backgrounds" (Caracciolo, *Experientiality*) and the mental models formed in comprehension include perceptual and motor contents (as opposed to mere abstract and propositional information), suggesting a role for active sensorimotor simulation (Zwaan, "The Immersed Experiencer"; Zacks and Magliano 448; Kuzmičová). Furthermore, models like Deictic Shift Theory suggest that narrative comprehension involves a *deictic shift* by which recipients transpose their everyday embodied sense of here-and-now (from which dimensions such as far-close, front-back, or left-right are mapped) to the fictional world,

projecting a virtual "embodied" reference point from which they grasp the spatio-temporal dimensions of the unfolding action.

Based on the above models of (textual) comprehension, we consider *nonlinear storytelling* and *nonlinear storyworlds* to produce dissimilar cognitive effects, as they affect different aspects of narrative comprehension. In the case of *nonlinear storytelling*, it is clear that nonlinearity occurs on the level of plot organization: narrative information is presented achronologically on the text's *surface* level, but recipients can derive from the textual cues a network of propositions and situations that contain *linear* relations, thus allowing the formation of a *mental model* that ultimately represents linear and chronological states of affairs comparable to real-world temporality. In *nonlinear storyworlds*, on the other hand, the arrangement of events on the text's *surface* level may, in fact, fully conform to their chronological order of occurrence, yet the text presents propositions and situations that are *non-linearly* related (e.g., characters travel back in time, events form a temporal loop, or alternative timelines exist in parallel), cueing the viewers to form a *mental model* that accommodates a world in which *nonlinear* time organization is somehow the natural state of affairs. As the *nonlinearity* of both forms affects different parts of the narrative comprehension process, they can be associated with different cognitive effects.

COGNITIVE EFFECTS OF NONLINEAR STORYTELLING

Concerning *nonlinear storytelling*, it is reasonable to assume that its potential to give rise to a complex experience follows primarily from the *heightened cognitive effort* demanded by *chronologically (re)ordering non-chronologically presented events*. Existing research on text comprehension suggests that nonlinear presentation tends to make information more difficult to grasp and memorize due to the effect of heightened cognitive load (e.g., Zumbach and Moraz). It appears that readers generally rely on an assumed connection between sequentiality and chronology, known in language comprehension research as the *iconicity assumption* (see Zwaan, "Processing Narrative Time Shifts"). This means that recipients' default assumption is that the order in which events are presented corresponds to the actual order of occurrence unless indicated otherwise. This processing bias can be plausibly seen as a result of real-world conditions (1209), given that everyday situations are perceived as occurring in continuous flow and

chronological order. The result, as Rolf Zwaan et al. suggest, is that "deviations from chronological order are relatively difficult—but not impossible—to process because a default assumption has to be overridden" ("Time in Narrative Comprehension" 79). When narrative events are presented in a deviant order, chronology must then be determined on an inferential basis, by way of causal relations, verb tense, or other temporal markers. Especially when the expected sequential order is disrupted, or when clear causal connections between events are lacking, this process demands more active processing effort and slows down comprehension (e.g., Mandler and Goodman; Mandler). Assuming the medium-neutrality of these aspects of narrative comprehension, systematically *nonlinear storytelling* in film too, such as in the aforementioned examples of *Pulp Fiction* and *Memento*, makes heightened demands on working memory, asking viewers to discern the connections between events and (re)arrange them into a coherent mental model, resulting in an experience that is likely to be felt as more cognitively complex.

COGNITIVE EFFECTS OF NONLINEAR STORYWORLDS

Compared to the research addressing *nonlinear storytelling* and textual order, *nonlinear storyworlds* have been relatively overlooked in the literature. Of course, *nonlinear storyworlds* too may require spectators to mentally (re)arrange events, as these frequently go hand in hand with *nonlinear storytelling* (here, one can think of films such as *Arrival* or *Primer*: the combination of both types of *nonlinearity* distinguishes these complex films from more viewer-friendly forms of time-travel or looping narratives, such as *Back to the Future* or *Groundhog Day*, which present *nonlinear storyworlds* through a single protagonists' linear-chronological experience). However, it seems reasonable to assume that *nonlinear storyworlds* could also produce distinct cognitive effects of their own. We hypothesize three such effects.

Disrupting Event-Indexing and Mental Model Formation

First of all, in some cases, *nonlinear storyworlds* can be expected to *undermine the habitual processes of mental model formation*, as they problematize the parameters by which the spatiotemporal connections between narrative events can be determined.

Available research indicates that *events* are the basic cognitive units of temporality and narrative comprehension. Event segmentation, as Jeffrey Zacks summarizes, "seems to be a central ongoing component of perception and comprehension," with research indicating that, across perception, attention, and memory, incoming information is continuously parsed and clustered into distinct "events." Events have been shown to be the building blocks of mental representations and higher-order neural processing in both visual and textual narrative comprehension (e.g., Loschky et al.; Baldassano et al.). As Zwaan et al. demonstrated, readers understand narratives by parsing incoming information into distinct events, and connect these by indexing their continuity and overlaps along five key dimensions: *time*, *space*, *entity*, *causality*, and *intentionality* ("The Construction of Situation Models"). In other words, discrete events are connected into a narrative situation model when they are perceived as occurring in the same *time frame*, in overlapping *spatial settings*, when involving the same *entities* (e.g., a protagonist) or when they are related by *causal* connections or an *intentional* structure (such as a protagonist's goals, plans, or motivations).

Although cinematic nonlinear storyworlds present readily "visible" and seemingly "natural" spaces, they can problematize these parameters by which spectators usually parse, connect, and integrate events into coherent mental models. Let us take *narrative timeloops* as an example. Films like *Los Cronocrímenes* (2007), *Triangle* (2009), and *Coherence* (2013) or the closing sequence of Stanley Kubrick's *2001: A Space Odyssey* (1968) all introduce strange temporal loops in their diegetic worlds: characters directly witness past or future events, are active at different points in time within the same spatial setting, and even directly encounter "earlier" or "later" incarnations of themselves. Such radical storyworld nonlinearity undermines the availability and applicability of the five "event-indexing" parameters by which spectators identify relations between different events. These timeloops may, for instance, disrupt the process of indexing *time* relations (since events can be seen as being simultaneously at different points in time, conflating past, present, and/or future) and *causal relations* (as events may appear as both their own cause and effect) and undermine the continuity of *entity* (since these characters directly encounter other versions of themselves, or appear in their own POV-shots).[1] In sum, by destabilizing the indices by which spectators normally parse events on the *local* level and connect them into a narrative mental

model on the *global* level, nonlinear worlds can be expected to render the formation of a coherent mental model more difficult.

Challenging the Reliance on Experiential Schemas

Highly nonlinear storyworlds can also be harder to grasp because they frequently entail *violations or deviations from spectators' (real world) schemas of knowledge.*

As mentioned, narrative comprehension relies on a matching process between the cues and information provided by the representing source or text and a spectator's pre-existing knowledge and experiences, stored in the form of frames, schemas, or scripts. As narrative theorists have noted, spectators initially form a mental model of a storyworld on the basis of the assumption that the fictional world will correspond more or less to the actual world known from everyday experiential reality. This assumption has been named the "principle of minimal departure" (Ryan, "Possible Worlds") or the "reality principle" (Walton). By their very nature, however, nonlinear storyworlds present fictional worlds that challenge real-world frames of knowledge. They present impossible worlds (Ryan, "Impossible Worlds") not by featuring *physical impossibilities* (e.g., talking animals or flying carpets) but foremost by including *logical impossibilities*, such as mutually exclusive versions of events, looping temporalities, or other paradoxes (Alber, "Impossible Storyworlds"). Such strong logical impossibilities appear more resistant to conventionalization than physical impossibilities, which constitute a common part of many frames and genres of fiction. One reason for this may be that while physical impossibilities can be made sense of by making specific modifications to a mental model (e.g., adapting the laws of a storyworld to account for the possibility of interstellar travel in science-fiction), strong logical impossibilities appear to undermine some of the fundamental principles of the mental model building itself (Kiss and Willemsen 80–94). After all, mental model building and event-indexing rely on parameters such as continuity of time and space, stable entities, and a logic of causality; such features are not just based on arbitrary conventions but are rooted in fundamental features of our everyday conscious experience and embodiment, which can be seen as formative to narrative (Fludernik 30).[2] To minds and bodies trained in (and tailored to) an environment characterized by unidirectional time, causal relations, and a generally stable continuity and unicity of entities,

narrative worlds that feature timeloops, causal paradoxes, and duplicating characters are likely to prove more challenging simply because we hold no concrete phenomenological experience or real-world schema to readily grasp such a state of affairs (unless the deviation is itself already highly conventionalized—see Ros and Kiss 80–83). After all, as Torben Grodal has argued,

The more concrete the phenomena we deal with—the more easily they can be comprehended through schemas derived from our basic interaction with external reality—the easier the thought processes involved, because they are both conceptually and emotionally backed up by our basic embodiedness. (210)

In this sense, (logically impossible) nonlinear storyworlds are likely to be experienced as more complex because they demand the mental representation of situations that do not resonate with spectators' existing schemas of real-world knowledge, and are not backed by concrete embodied experience. Appropriate mental models to accommodate these worlds therefore often have to be constructed from the bottom-up.

Problematizing Deictic Orientation

Narrative nonlinearity may also *render it difficult for spectators to establish a clear (deictic) center of narrative orientation.*

As introduced, Deictic Shift Theory proposes that, in narrative understanding, readers or spectators establish a kind of virtual *deictic center*—a reference point that allows the determination of "where we are" in the story. As William F. Hanks summarizes, the deictic field "is the indexical ground or origo relative to which relations of proximity, temporality, perceptual access, givenness in discourse, and prospection and retrospection are arrayed" (99). Comparably to our embodied sense of "here and now" in the real world, virtual deixis affords navigation by mapping dimensions like "close-far," "front-back," and "up-down," allowing one to understand the position and actions of characters in relation to the spatio-temporal progression of the narrative world (determining, for instance, what should be seen as flashback or flashforward).

Nonlinearity can problematize this process in two ways. First, some forms of *nonlinear storytelling* may hinder viewers' orientation by denying

a clear *deictic center* from which the order and relations among unfolding events could be mapped (one may think here, for example, of David Lynch's 2001 *Mulholland Drive*, a film which leaves unclear how events are related to each other: are they past or present, reality or hallucinations?). Second, the parallel or single but looping timelines of *nonlinear storyworlds* can trouble viewers' orientation in the narrative by offering *multiple*, often conflicting, deictic reference points simultaneously. Loop narrative films like *Triangle* or *Primer*, for instance, present at least four duplicate versions of their protagonist active in a time loop occurring in one spatial setting. Operating within a single diegetic world, all versions of these protagonists influence the course of events through their own actions and motivations. In such cases, keeping track of narrative events and their causal interrelations, therefore, requires viewers to hold in mind and connect multiple experiential paths of multiple versions of the protagonists, asking them to map the plot from multiple deictic centers in order to comprehend the full narrative development.

COMPREHENDING NONLINEAR STORYWORLDS: A ROLE FOR SPATIALITY

In sum, while *nonlinear storytelling* makes cognitive demands on viewers to (re-)arrange non-chronologically presented events, *nonlinear storyworlds* ask spectators to mentally construct a world that behaves nonlinearly. The next question this raises is what we call a *cognitive-ecological* question[3]: if everyday reality does not confront us with nonlinear temporal experiences, what cognitive capacities then afford our ability to make sense of such scenarios in fiction?

As noted, most of the available studies have focused on narrative texts that present information out of chronological order. While *nonlinear storytelling* may not be a "natural" ecological occurrence, its cognitive demands (of mentally rearranging and connecting events) are based on inferential logic and event-indexing operations that arguably do pertain to very everyday cognitive abilities. This, however, seems somewhat different for *nonlinear storyworlds*, which derive part of their cognitive effects, challenges, and perhaps their appeal, from their "impossible" nature. The question what allows us to comprehend nonlinear worlds will be our focus for the remainder of

this paper, as it appears to have been largely overlooked in the literature. We hypothesize that spectators often make sense of strange and impossible forms of *time* by having recourse to more familiar and concrete concepts of *space*. This, we argue, is based on the activation of two general cognitive principles, also observable in everyday mental representations of time: *conceptual metaphor theory* and the formation of *mental timelines*.

Conceptual Metaphors

Conceptual metaphor theory (CMT) posits the influential notion that metaphors are instrumental to human cognition. It proposes that metaphorical reasoning allows us to understand conceptual domains that are novel, abstract, or inconcrete by reference to domains that are familiar, concrete, and readily comprehensible. As George Lakoff and Mark Johnson influentially argued in their work on metaphors, abstract *conceptual meaning* is often metaphorically rooted in concrete meaning derived from *embodied experience*. Central to this are so-called *image schemas*: "structures for organizing our experience and comprehension" that arise from repeated everyday embodied experiences and ecologically situated action patterns (Johnson 29). Examples of such schemas are the SOURCE-PATH-GOAL schema (derived from the experience of a goal-oriented movement from A to B, following a specific trajectory), the CONTAINER schema (stemming from the material and spatial constraints of things and our bodies having an inside and an outside, separated by a boundary), and other elementary bodily governed orientational schemas, such as UP-DOWN, FRONT-BACK, PART-WHOLE, and CENTER-PERIPHERY.

These elementary schematic patterns of space and movement can, in Mark Johnson's words, "be transformed, extended, and elaborated into domains of meaning that are not strictly tied to the body" (45). As such, embodied image schemas provide a resource to metaphorically express and conceptually grasp more abstract conceptual domains through, for instance, *orientational metaphors* (Lakoff and Johnson 14) that organize entire systems of concepts (e.g., "happy is up, sad is down") or *ontological metaphors* (25) that enable reasoning about abstract concepts by expressing them in more tangible form (e.g., "life is a journey"). As Lakoff and Johnson put it, "[u]nderstanding our experiences in terms of objects and substances allows us to pick out parts of our experience and treat them as discrete entities or

substances of a uniform kind," thus making it possible to "refer to them, categorize them, group them, and quantify them—and, by this means, reason about them" (25).

As a highly pervasive yet somewhat imperceptible or intangible aspect of experience, understanding *time* is often dependent on such metaphorical modes of comprehension. After all, in the words of developmental psychologist and cognitive scientists Katharine Tillman et al.,

the perception of time is both ephemeral and subjective. Consequently, precise coordination of activities across large groups of people requires a means of timekeeping that is available to all. To deal with this problem, many cultures have devised external symbolic systems to describe and measure the passage of time [. . .]. These include a variety of spatial tools, such as clocks and calendars, and graphical representations of time such as charts and timelines. Space and time are also linked via linguistic descriptions ("a long time") and practices such as reading and writing, which associate the unfolding of narrative with the eye's progress along a spatial pathway. (1)

Cognitive linguists have observed such metaphorical conceptualizations of time in terms of embodiment and spatiality across languages and cultures, with expressions of time often being metaphorically placed along a spatial axis (e.g., as sequentially moving from left to right) or conceptualized deictically (e.g., in relation to an ego-reference point, for instance, as having the future in front of us). In English, these forms are evident in such common expressions as "let's move the meeting *forward*," "December is still *far away*," or "the deadline is *approaching*."

Additionally, cognitive literary and film theorists have, in recent years, suggested that image schemas are constitutional to the comprehension of narrative structures as well (e.g., Turner; Dannenberg 65–70; Kimmel; Caracciolo, "Tell-Tale Rhythms"; Kiss, "Film Narrative and Embodied Cognition"). As Michael Kimmel notes, "Image schemas are a major avenue towards explaining how readers go about the necessary task of conceptualizing time-flow and breakpoints" (172), manifesting in, for example, the reliance on the FORCE, LINK, and SOURCE-PATH-GOAL schemas to apprehend stories as causal trajectories (of characters striving toward particular goals for instance) or the PART-WHOLE schema to grasp how a story is comprised

of various parts (e.g., scenes) that together form a whole. Moreover, the whole notion of a story being "linear" or "non-linear" is itself indicative of a tendency to conceptualize narrative temporal progression in spatial and embodied terms (Caracciolo, "Tell-Tale Rhythms" 54–55).

Mental Timelining

A number of studies have also emphasized that spatial conceptualizations of time are not a purely linguistic or higher-order conceptual phenomenon but extend into mental representation as well. Daniel Casasanto and Lera Boroditsky, for instance, detected clear overlaps in people's mental representations of time (or duration) and space (or distance) in a series of psychophysical experiments. Their findings suggest that "the asymmetric relationship between space and time found in linguistic metaphors is also found in more basic nonlinguistic representations of distance and duration" (589), with reasoning about time appearing dependent on spatial thinking, but not vice versa (or at least not to the same degree).

The relation between mental representations of time and spatial thinking has been further investigated under the header of *mental timeline* theory (MTL). Reviewing work on the subject, Mario Bonato et al. concluded that studies point to a universal tendency to mentally represent time along a mental timeline. This mental timeline works by (i) representing time on a *spatial continuum*, often as flowing from one end to another, (ii) the orientation of which is both *embodied* and *culturally mediated*, (iii) providing an understanding of time as a *relative* spatial position on the continuum, and (iv) involving several forms of *spatial attention* (2258). While the reliance on mental timelines to mentally represent temporal flow appears universal, specific qualities like orientation (e.g., left-right as past-future or future-past) have been shown to be subject to cultural factors, such as writing direction, conventionalization, and habitualization (e.g., Anelli et al.; Tillman et al.).

Like CMT, MTL theory thus suggests that mental representations of time often recruit the more concrete domain of space. This involves reasoning about time derived from everyday embodied image schemas (e.g., mapping time by deictic reference, such as approaching or traversing it) and spatial schemas (e.g., mentally representing events as arranged along a spatial axis). Whether mental timelines should be seen as themselves metaphorical in nature, however, remains subject to debate, as some researchers have

suggested that MTL theory rather reflects a deeper "evolutionary recycling" of spatial representations (Srinivasan and Carey).

MAPPING PLOTS: CMT AND MTL IN ACTION

How do these theories of everyday reasoning about time relate to the comprehension of nonlinear cinematic storyworlds? Let us look at a concrete example.

One of the most well-known cases of a highly nonlinear storyworld in contemporary mainstream cinema has been Christopher Nolan's 2010 *Inception*. The film tells the story of professional thief Dom Cobb (Leonardo DiCaprio), who specializes in the infiltration of people's dreams—an ability he exploits for the criminal practice of stealing ideas from or planting concepts in his victims' subconscious. This synopsis entails a multilayered storyworld that allows characters to enter each other's dreams, and, within that, travel into ever-deeper layers of dreams-within-dreams.[4] As an added complication, on each deeper dream-level, time moves slower relative to the level above (e.g., time in the first dream-level moves twenty times slower than time on the reality-level, meaning one hour in dream-time on the first level only spans about three minutes in reality). The result is an intricate plot structure that, in order to follow the story, requires viewers to map the characters' simultaneous actions on multiple embedded (but parallel) dream-levels, with events on each level influencing the other levels, yet at different rates of temporal progression. Despite the narrative's relative complexity, *Inception* attracted a large and wide audience, becoming one of the year's most successful blockbuster films.[5]

Figure 1 shows an overview of the film's narrative structure drawn by director Nolan, who reportedly used this map for reference during production (Rich). Beyond the hermeneutic and meta-fictional pleasures of seeing an author mapping out his own story, the drawing is interesting for a number of reasons. First of all, it is a clear graphical manifestation of a particular instance of mental timelining, warranted by a nonlinear storyworld. The drawing organizes the narrative events and their temporal relations as linear trajectories, from left to right, with the different horizontal lines representing the different levels from reality to dreams on which events unfold. The vertical lines and arrows between them represent the characters' distinct timelines as they travel across the five levels of reality and dreams.

More importantly, this map reveals how the conceptualization and temporal logic of *Inception*'s nonlinear storyworld are crucially dependent on two central *spatial metaphors* that are, in turn, derived from two elementary embodied image schemas: CONTAINMENT and VERTICALITY (Figure 2).
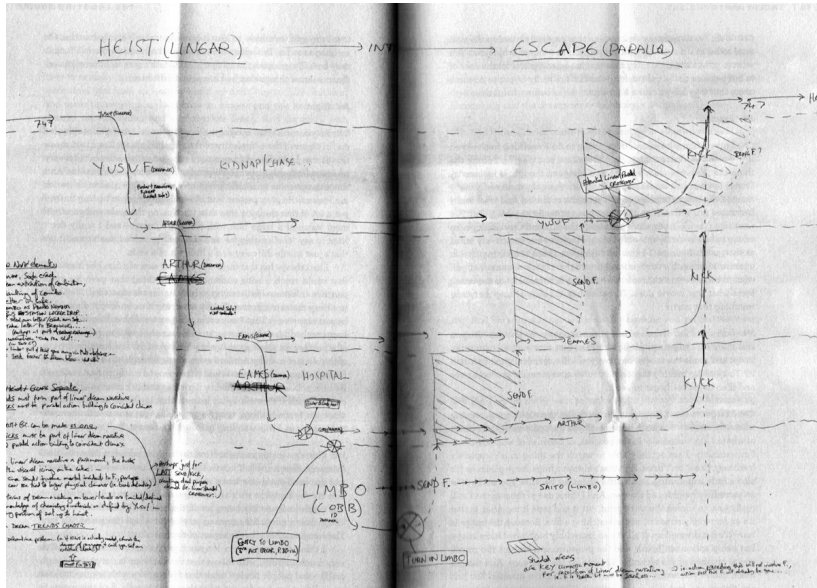

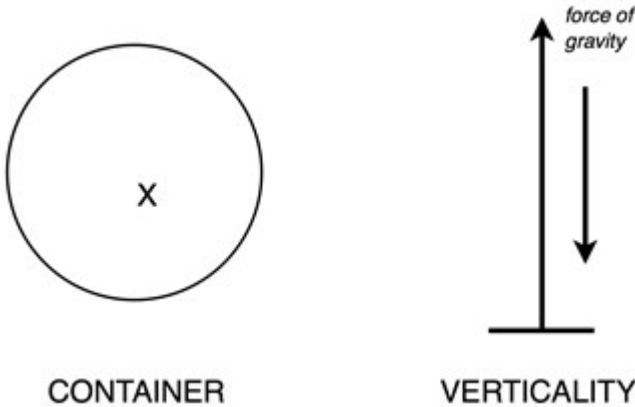Figure 1 · Director Christopher Nolan's hand-drawn plot map for *Inception*.

Figure 2 · The embodied image schemas of CONTAINMENT and VERTICALITY.

Following the principles of CMT and MTL, these spatial schemas provide the metaphoric basis for conceiving the storyworld's temporal organization in two ways:

1. The CONTAINER schema, as noted, is derived from the common spatial logic that objects and spaces can have an inside and an outside, separated by a boundary. In *Inception*, this elementary logic facilitates the idea that the different storylines of the various dream-levels exist "inside" one another. Hence, it provides the logic that, unlike in our everyday experience, here, entire worlds can be understood as embedded *within* other worlds, with characters having the possibility to travel *inside* or *outside* of one world in relation to the others.

2. The ordering of these embedded worlds relies on a logic of VERTICALITY— the schema derived from our everyday embodied-orientation of things being "up or down" in relation to our current position. In *Inception*, the schema of VERTICALITY affords the logic of the embedded worlds forming different "levels" that exist in a hierarchical relation, with the film's reality forming the top level and each additional dream-level below that providing an understanding of these timelines as "deeper" layers into which the characters "descend" (as protagonist Cobb remarks, "Downwards is the only way forwards").

Although it would be a stretch to claim that viewers need pen and paper to understand *Inception*, we do argue that grasping the storyworld involves activation of these spatial concepts. Understanding the narrative and the interrelation of the various non-sequentially organized storyworld-components necessitates a rough overview of the story's global structure. As the conceptual logic of this story structure is based on image-schematic *spatial* metaphors, it asks us to hold in mind at least an approximate mental representation comparable to Figure 1.

What the case of *Inception* shows, then, is how metaphorical thinking about time in terms of space (as afforded by reliance on CMT and MTL) is at the heart of what makes nonlinear storyworlds *conceivable* and *comprehensible*.

First, regarding the notion that mental timelines make nonlinear story-worlds *conceivable*, Casasanto and Boroditsky have noted that

Thinking about time metaphorically in terms of space may allow us to go beyond [. . .] basic temporal representations. Mentally representing time as a linear path may enable us to conceptualize more abstract temporal events that we cannot experience directly through the senses (e.g., moving a meeting forward or pushing a deadline back), as well as temporal events we can never experience at all (e.g., the remote past or the distant future). Metaphorical mappings from spatial paths, which can be traveled both forward and backward, may give rise to temporal constructs such as time-travel that only exist in our imagination. (591)

Indeed, the spatial representation of time as space allows for our notion of temporality to be blended with other spatial schemas, providing a basis for the conception of abstract temporal structures that deviate from the everyday linear conception of time. These can comprise a variety of nonlinear forms, such as characters traveling back and forth to different points on a timeline (a repurposed SOURCE-PATH-GOAL schema—Figure 3), time paths alternating across multiple interrelated lines (Figure 4), timeloops based on the spatial figure of a circle (Figure 5), or nested storyworlds embedding multiple layers through the CONTAINER and VERTICALITY schemas (as shown in Figure 1). In other words, the nonlinearity of such worlds is derived from spatial conceptualization, as they would be impossible to conceive in purely temporal terms.

It should be noted that, while these deviating time patterns are derived from an elementary spatial logic, their conception may also (indirectly) have roots in everyday "micro-phenomenological" experiences of nonlinearity. One can think here of phenomena such as the co-occurrence of the memorized past and the present in lived experience, protention and retention in time consciousness, and optional thinking (Ben Shaul), or déja vu, which may also be inspirations for such forms of mental play.[6]

Second, as for aiding narrative *comprehension*, relying on spatialized mental timelines may help viewers to counter some of the earlier identified cognitive challenges of nonlinear storyworlds. Mental timelining may not only render abstract nonlinear worlds graspable by providing a cognitive instrument to make them mentally representable but, additionally, also provides
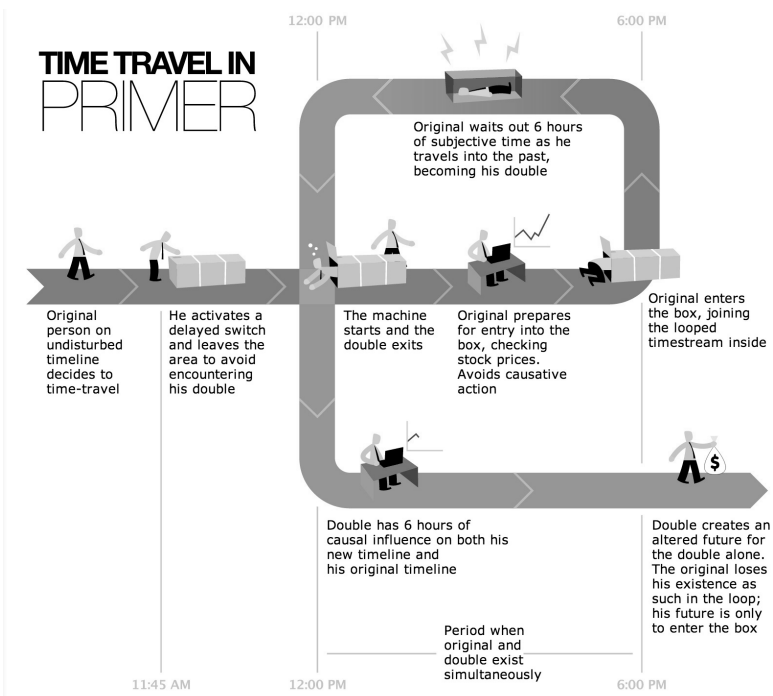
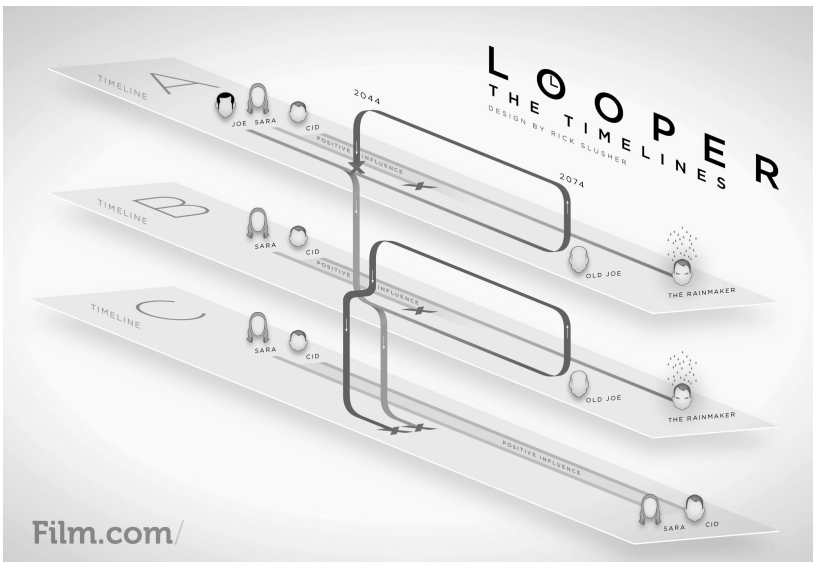Figure 3 · Plot map for Shane Carruth's 2004 *Primer* by Tom–B.

Figure 4 · Plot map for Rian Johnson's 2012 *Looper* by Rick Slusher.

Triangle (2009) by Christopher Smith

Timeloops & levels of reality

Erik Buikema
s1547712

Reset (3)

Jess#3 leaving home

Jess#1 throws
Jess#3 overboard

Jess#1 takes knowlegde
position of Jess#3

Jess#3 Boards
the Ship
Reset (4)

Reset (2)

Jess#1 Boards the ship

Jess#3 takes knowledge
position of Jess#1

Jess#3 throws
Jess#1 overboard

Reset (1)

Jess#1 leaving home

Reset (1) marks the beginning of the movie
which then follows Jess#1
For further information see additional notes

Purple = Jess#1
Green = Jess#3
Red = Mad Jess
Orange = Jess#Dress/ Jess#New

Note:
Jess#1 = Jess#3
Jess#Dress/ Jess#New = Mad Jess
Blue = what is not directly revealed
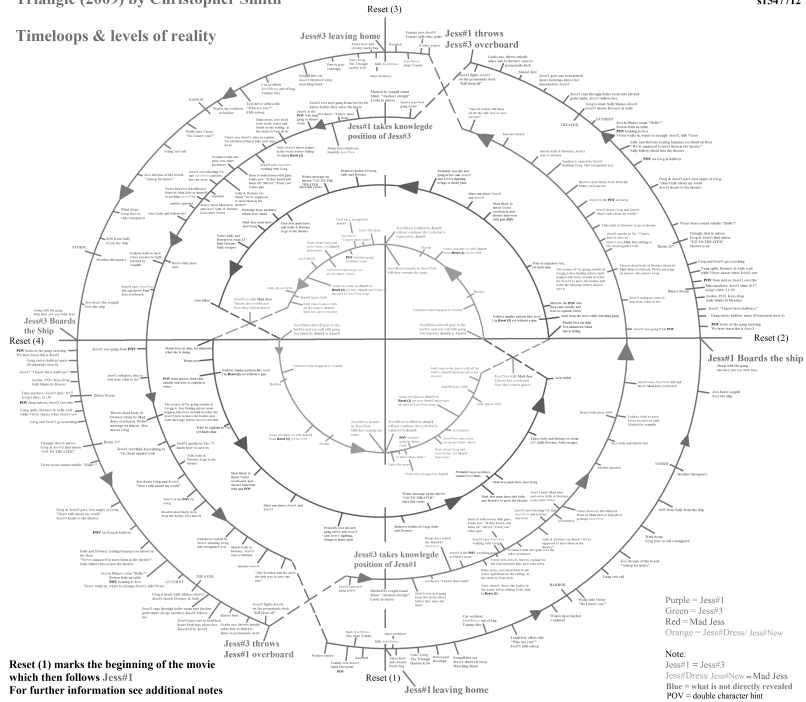POV = double character hint

Figure 5 · Plot map for Christopher Smith's 2009 *Triangle* by Erik Buikema.

a backbone for the "mapping" of new, incoming information in the process of mental model building. As McNamara and Magliano summarize, in text comprehension research, "mapping" is used as

a general term to refer to processes to establish how the current linguistic input is related to the prior context. Mapping is influenced by referential and situational cohesion. It is likely an unconscious activity, but the product can be consciously available to the reader. A sense of continuity emerges from the mapping process. When mapping fails, the reader may be induced to generate inferences. (304)

Holding in mind spatial mental representation of the narrative timeline provides a top-down template to represent the story's global structure and its interrelated components, onto which, in turn, new and incoming information can be mapped. In *Inception*, for instance, the mental plot map

(or a concrete graphical one) allows one to assign incoming events and information to their respective "levels" of dream and reality and to draw inferences on how events causally affect each other across these.[7] Moreover, mental or even graphical plot maps may, in some cases, even function as a kind of "extended cognitive prostheses" to working memory. Graphical maps, especially, can be effective in unburdening limited cognitive resources, alleviating working memory by offloading information onto paper, and potentially helping to reveal new semantic fields or overlooked patterns and relations.[8] While the processes of mental timelining and metaphorical mapping will, in most cases, remain largely preconscious, we can reasonably assume that the more challenging the temporal dimensions of a storyworld, the greater the likelihood that these mental mapping operations become consciously reflected or graphically elaborated upon.

In this light, it is worth observing that some viewers too have produced and shared their own plot maps for *Inception* (Figures 6 and 7), reflecting the same underlying image schematic logic as found in Nolan's map. Though the motivations behind creating and sharing these maps may be aesthetic, creative, and social as much as driven by the need for narrative comprehension, they do reveal how these films cue us to conceive of their nonlinear storyworlds in spatial metaphorical terms (see, for instance, how Figure 7 refers to the plot's architecture).
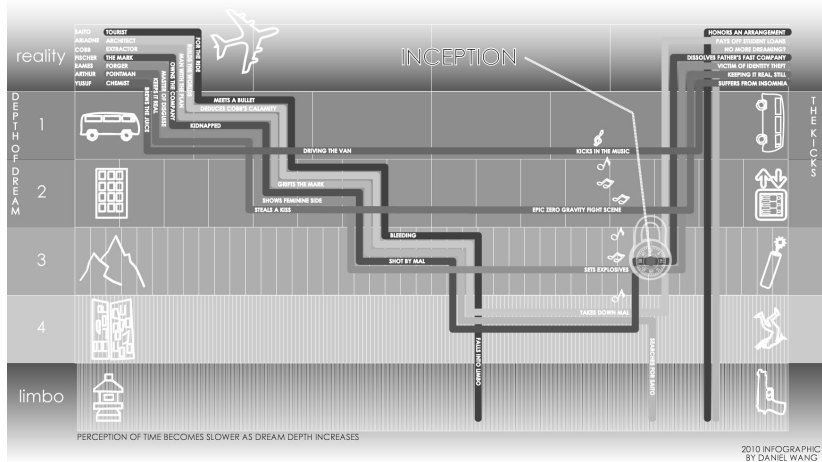

Figure 6 · Plot map of Christopher Nolan's 2010 *Inception* by Daniel Wang.
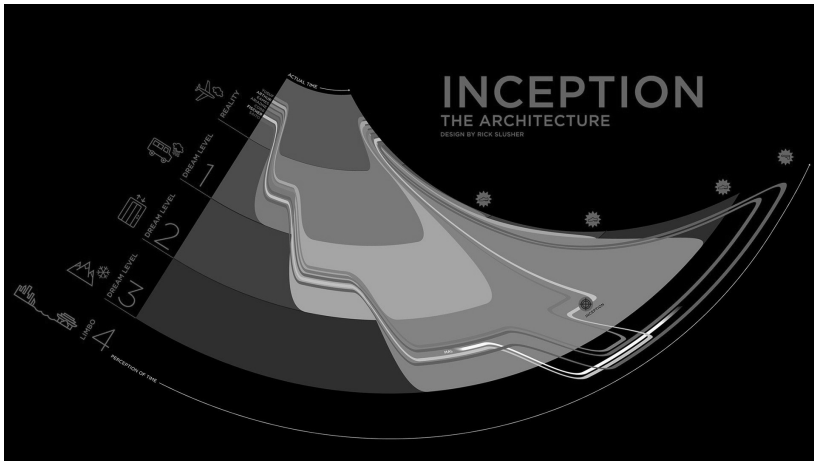
Figure 7 · Plot map of Christopher Nolan's 2010 *Inception* by Rick Slusher.

IN CONCLUSION: THE "NATURALNESS" IN "UNNATURAL" NARRATIVE TIME

Finally, it is worth noting that if spatial metaphorical reasoning underlies nonlinear narrative comprehension, *disruption* of this underlying logic should then also be a potential source of narrative complexification. After all, we argued that narrative complexity usually occurs when stories strategically obstruct the processes of narrative comprehension. Indeed, there seem to be complex narrative structures that work by challenging underlying image-schematic logics. One set of examples is provided by so-called "ontological metalepses" (Ryan, *Avatars of Story* 247). These appear in storyworlds that feature multiple embedded narrative levels (e.g., stories within a story or dreams within the diegetic reality) with playful transgressions between their boundaries (e.g., characters from the story-within-the-story appear in the framing story, or the dream seeps into reality). By presenting transgressions between these supposedly isolated levels, ontological metalepses problematize viewers' reliance on the CONTAINER schema that underlies the conceptualization of the narrative levels as embedded "inside" one another: events can no longer be determined to be contained "inside" or "outside" of their respective narrative levels, undermining the logic underpinning their supposed ontological order. Some films have used disruptions of this logic to create strikingly "impossible" scenarios—such as Quentin Dupieux's *Réalité*, which repeatedly upsets the boundaries between

embedded dreams, fiction, and diegetic reality (to the caricaturesque point of making it impossible to determine their interrelation; see also Willemsen and Kiss) and Spike Jonze's *Adaptation*, which employs a character named Charlie Kaufman (like the film's actual screenwriter) who is both the writer and the protagonist of the film's story, which, in turn, is the story seen by viewers. By exploring the (anti-)logic of a screenwriter/character being the protagonist of the story that he is struggling to write (but that viewers actually watch), *Adaptation* breaks down the boundaries between extradiegetic, diegetic, and hypodiegetic narrative layers, conflating narrative frames of fiction and reality to create a paradoxical metafictional scenario.

In sum, nonlinear structures can make the notion of a "disorienting" story more than just a metaphor. While we often tend to think of the engagement with complex storyworlds as a predominantly mental and cerebral affair (as labels like "puzzle" or "'mindgame" films also appear to imply), we hope to have shown that nonlinear storyworlds also involve one's sense of one's body, movements, and space. And although the appeal of such "unnatural" fictional worlds may indeed primarily lie in exploring—in Jan Alber's words—"the question of 'what it is like' (Herman 14) to experience the transcending of physical laws, logical principles, or standard human limitations" (Alber, *Unnatural Narrative* 7), making sense of their otherworldly temporal structures at the same time appeals to our cognitive abilities used to grasp real-world time and space and to come to terms with the ontology of everyday temporality.

STEVEN WILLEMSEN is a Senior Research Fellow at the Max Planck Institute for Empirical Aesthetics in Frankfurt am Main. His research interests lie in narrative studies, (embodied-)cognitive film theory, and empirical aesthetics. He has previously been a Lecturer in Film and Media Studies at the University of Groningen, and a Visiting Research Scholar at the University of California, Santa Barbara's Research Centre for Literature and the Mind. He is author of *Impossible Puzzle Films: A Cognitive Approach to Contemporary Complex Films* (Edinburgh UP, 2017, with Miklós Kiss). (s.p.m.willemsen@gmail.com)

MIKLÓS KISS is Associate Professor in Audiovisual Arts and Cognition at the Department of Arts, Culture, and Media of the University of Groningen, The Netherlands. His research focuses on contemporary audiovisual media, intersecting the fields of narrative and cognitive film studies. He is coauthor of the books *Film Studies in Motion: from Audiovisual Essay to Academic*

Research Video (with Thomas van den Berg, Scalar, 2016) and *Impossible Puzzle Films: A Cognitive Approach to Contemporary Complex Cinema* (with Steven Willemsen, Edinburgh UP, 2017). (m.kiss@rug.nl)

NOTES

1. For an exploration of such "impossible" POV-shots, see Coëgnarts et al.

2. In Monika Fludernik's words: "Embodiedness evokes all the parameters of a real-life schema of existence which always has to be situated in a specific time and space frame, and the motivational and experiential aspects of human actionality likewise relate to the knowledge about one's physical presence in the world. Embodiment and existence in human terms are indeed the same thing" (30).

3. We follow Joseph D. Anderson, for whom a "cognitive-ecological" approach to cinema "attempts to place film production and spectatorship in a natural context. That is, the perception and comprehension of motion pictures is regarded as a subset of perception and comprehension in general, and the workings of the perceptual systems and the mind of the spectator are viewed in the context of their evolutionary development" (10).

4. The film's logic of transgressing dream-layers can also be seen as a diegetization of the narrative theoretical concept of "metalepsis" – the transgression of embedded story-layers (see Kiss, "Narrative Metalepsis as Diegetic Concept").

5. As an indication of its popularity: the film grossed 828.3 million dollars at the box office (boxofficemojo.com) and obtained eight Academy Award nominations, out of which it won four.

6. This notion was helpfully pointed out by an anonymous reviewer and invites a potentially rich avenue of research targeting the interrelations between nonlinear narrative forms and the phenomenology of everyday time experience.

7. This process is further aided by *Inception*'s narration, which provides ample explication about the nature of its structure, high amounts of redundancies and overlaps between narrative information, and clear spatio-temporal markers for the different levels (such as clearly differing spatial settings for each dream-world). This ensures that the film remains cognitively manageable for a large audience, making it a good example of contemporary "mainstream complexity" (Kiss, "Narrative Metalepsis as Diegetic Concept").

8. Interestingly, scholars too have been exploring the visualization of nonlinear narratives as an analytic tool, such as through the *Storycurves* software (Kim et al.), developed as a narratological means to map nonlinear stories and detect patterns in their structures.

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