

The Embodied Cognition Theory of Dreaming: A proposal for how dreams prepare individuals for waking life

Alwin E. Wagener

School of Psychology and Counseling, Fairleigh Dickinson University, New Jersey, USA

Summary. The Embodied Cognition Theory of Dreaming (ECTD) is a novel proposal describing the function of dreaming, which is to prepare individuals for waking life. ECTD builds on the theories of embodied cognition and embodied metaphor, applying them to the mental experience of dreaming. From that foundation, ECTD proposes three reasons for dreaming. The first is to organize schemas congruent with individuals' affective and sensorimotor understandings of self-in-context. The second is to prepare individuals to react to schemas, and the third is to prepare individuals to use sensorimotor processes likely to be needed in waking experience. ECTD posits that dreaming exists to prepare individuals to react to the types of experiences that were affectively significant in waking.

Keywords: Dreaming; embodied metaphor; embodied cognition; schema

1. Introduction

What is proposed in the Embodied Cognition Theory of Dreaming (ECTD) is that the primary reason for dreaming is to depict what is emotionally salient to the dreamer as a sensorimotor and affective experience with abstract concepts appearing in the dream as simulated embodied metaphors. The dream experience organizes what is affectively relevant to the dreamer in waking into schemas. Furthermore, by experiencing a sensorimotor and affective simulation while dreaming, through implicit learning, individual's sensorimotor processes are prepared to react to upcoming experiences like those that prompted the dream. In addition, through implicit learning, the individual is oriented to emotions related to stimuli that prompted the dream, thus preparing the dreamer to react to similar stimuli. In other words, dreams serve to transform recent emotionally significant waking experiences and cognitions into sensorimotor and affectively based schemas and prepare the dreamer to react to those schemas.

The elements of ECTD described above are supported in the following sections that address three core areas necessary to understand the theory. The sections begin with a description of the concept of embodied metaphors, their place within embodied cognition, and their link to ECTD. This section is important for addressing how dreams with content that appears unlinked to waking life can still directly relate to it. Next, the concept of schemas is explained and

connected to how and why waking experiences are organized into dream simulations. Finally, in support of dream experiences affecting waking life responses, implicit learning is elucidated in relation to dreaming and ECTD.

2. Basis for ECTD

2.1. Embodied Cognition and Embodied Metaphor

Embodied cognition has become a well-recognized and increasingly influential theory of cognition that describes cognitive processes as based in an organism's physical, sensorimotor experience of being in the world (Farina, 2021; Wilson, 2002). The sensorimotor experience of being in the world includes the sensory experiences of navigating within an environment and the motor experiences of existing, moving, and manipulating external objects within an environment. Embodied cognition postulates that abstract understandings of oneself, others, and the world (e.g., self-concept, interpersonal relationships) are built on those sensorimotor foundations through a metaphoric, cognitive process (Farina, 2021).

The understanding of metaphor as a cognitive process was first put forward by Lakoff and Johnson (1980) in the Conceptual Metaphor Theory (CMT). CMT posits that metaphoric relationships are a foundational part of the conceptual learning system, allowing individuals to generate new understandings based on prior knowledge. Based on CMT, concepts are understood through a metaphoric linking. In that linking, something known and understood (i.e., the source domain) is used to describe something else (i.e., the target domain). As an example, Lakoff (1993) described how the abstract concept of "love", the target domain, is understood through the known experience of a "journey", the source domain, in the metaphor "love is a journey". "Love is a journey" is a metaphor in the linguistic sense, but it also provides a way to cognitively understand characteristics of "love" through an individual's own experiences of journeys.

Embodied metaphors are the form of cognitive metaphors specific to embodied cognition and, consistent with CMT,

Corresponding address:

Alwin E. Wagener, School of Psychology and Counseling,
Fairleigh Dickinson University, 285 Madison Avenue, Madison,
NJ 07940, USA.

Email: awagener@fd.edu

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are seen as a foundational cognitive process for making sense of abstract information by connecting new concepts to previously understood relationships, namely sensorimotor experiences (Lakoff, 2014; Lakoff & Johnson, 1980). Unlike in CMT, embodied metaphors contain a bidirectional link between concrete sensorimotor experiences and abstract concepts (Lakoff, 2014; Slepian & Ambady, 2014). In ECTD, the bidirectionality is important for linking waking thoughts and experiences to dreams. The bidirectionality allows waking thoughts and experiences, which often contain abstract elements to manifest their sensorimotor foundations in dreams. In dreams, the embodied metaphor simulation rehearses the sensorimotor experiences that are the source domains. The rehearsal provides an implicit learning experience that enables individuals, upon awakening, to react more rapidly to stimuli with the same sensorimotor foundations.

An important underpinning to the idea of embodied metaphor and the bidirectional link between sensorimotor experience and abstract concepts is detailed by Lakoff (2014). Lakoff describes a foundational neural circuitry that links abstract thought with sensorimotor processes. This description is based on Feldman and Narayanan's (2004) development of the Neural Theory of Language, applying it not just to language but to cognition. The neural computation research from Feldman and Narayanan demonstrates how embodied metaphor may be neuronally based, using a widely distributed neuronal network linking core sensorimotor understandings to abstract concepts (for a description of this applied to embodied metaphor see Lakoff, 2014). Lakoff's neural account of embodied metaphor is consistent with a variety of studies showing bidirectional neural connections between metaphor and sensorimotor processes such as leaning being linked to desire (Harmon-Jones et al., 2011) and weight being linked to importance (Jostmann et al., 2008). The neuronal explanation of Feldman and Narayanan applied to embodied metaphors provides a basis for understanding how in ECTD, sensorimotor experiences are stimulated in dreams from waking thoughts and experiences along with a description of how the dream simulations strengthen the neural links between source and target domains in embodied metaphor, resulting in sensorimotor improvements in waking (Lakoff, 2012).

Applying embodied metaphors to dreams, ECTD posits that dreams depict both emotionally relevant sensorimotor experiences and sensorimotor source domains underlying emotionally salient abstract concepts (e.g., love, depression, power). The idea that dreams are metaphorical is not new. Dreams have been described as metaphorical in many locations, but the depiction of dreams as metaphor that best relates to ECTD came from Lakoff (1993). Lakoff directly related metaphors to dreams using CMT. He proposed that dreams are metaphors that take the waking concerns, drives, and emotions of the dreamer and link them to ideas and experiences that provide a foundational understanding for those waking concerns, drives, and emotions. The link between dreams and waking concerns, drives, and emotions of the dreamer are supported by numerous studies that demonstrate continuity of affect, actions, characters, relationships, and environments between waking and dreaming (Schredl et al., 2013; Van de Castle, 1995). ECTD builds from Lakoff's (1993) description of cognitive metaphors in dreams by proposing dreams exist to support the ongoing transformation of waking life experiences to appli-

able schemas, a process in which the schemas are enacted in the form of their source domains to assure individuals retain a consistent understanding of the world.

For instance, if a man in waking life experiences his boss verbally chastising him at work, he might dream of a large man physically attacking him. The dream links the power of the boss to the sensorimotor experience of someone larger being more powerful. The dream also links being criticized to the sensorimotor experience of a physical attack, with the danger of losing his job and the emotional experiences of fear and shame being metaphorically connected to physical harm. The metaphoric link between emotional pain and physical pain can be seen in the use of the word hurt to describe feelings, and the same connection can be seen in the use of phrases such as "hurt his career". In the dream, the sensorimotor details are the foundation used to understand the abstract concepts of power, criticism, emotional pain, and career danger. In the following section, the concept of schemas is defined, their relationship to ECTD is detailed, and the role of schemas in the example dream is explained.

2.2. Schema

A key concept in ECTD is schemas. In this manuscript, schemas are defined in alignment with the recent work of Durrant and Johnson (2021). Specifically, schemas are an associative mental structure learned through experience and contextually triggered but not specific to contextual details. Additionally, schemas create expectations and allow for rapid responses to the new experiences that contextually triggered the schema. Another way of thinking about schemas is that they organize previous experiences into simplified mental patterns. In the case of ECTD, those patterns are related to affective experiences paired with sensorimotor demands and portrayed through a sensorimotor simulation in which abstract concepts appear as embodied metaphors.

Image schema is a more specific term for schemas in embodied cognition (Johnson, 2017). Johnson (1987) and Lakoff (1987) developed the concept of image schemas and separately described them in publications in 1987. They explained image schemas as patterns of perceptions and sensorimotor experience that structure human understanding. Johnson (2017) further explained that image schemas, composed of affective and sensorimotor processes, structure abstract thought into recognizable patterns grounded in the affective and sensorimotor experience of being in the world. Image schema is the form of schema described throughout this manuscript but remains consistent with the definition from Durrant and Johnson's (2021), so the term schema in this manuscript should be read as synonymous with image schema.

As previously explained, metaphors are how schemas of abstract concepts are structured using sensorimotor and affective experiences. What ECTD does is attribute a role in the structuring of schemas to dreaming and state that dreams are a schema enactment, allowing the dreamer to experience the patterns of the schema and enabling the dreamer to better react to the schema when triggered by waking stimuli. For example, in the dream above about being criticized at work, the emotional experience of fear and shame identify the experience as significant to the dreamer. Then, in the dream, the core elements of the experience, which are having less power and feeling threatened, are or-

ganized into a sensorimotor based schema simulation of the waking experience in which being confronted by a greater power creates the potential to be harmed. The simulation strengthens the neural connections between the emotions and the core elements of less power and external threat. The experience of being under threat in the dream also stimulates the sensorimotor processes used when under threat, such as actively looking for escape and preparing the body to run. The stronger neural connections prepare the individual to implicitly recognize waking experiences linked to the schema and react by generating the sensorimotor activation experienced in the dream. In this case, the individual might recognize the danger posed by his boss slightly sooner and be slightly more reactive. The reaction would be linked to the dream experience of looking for an escape or running, which could, based on the bidirectional link in embodied metaphor, involve verbal deflection or backpedaling.

Consistent with the ECTD proposal, research indicates sleep is involved in the creation and recombination of schemas (Durrant & Johnson, 2021). Both non-rapid eye movement (NREM) and rapid eye movement (REM) sleep are linked to the creation and organization of schemas based on neuroscience and psychological research (Durrant & Johnson, 2021). Walker (2009) in a review of research on the relationship between sleep, emotion, and cognition identifies findings indicating NREM stage 3 sleep refines memories to select those that are affectively strong, which is what is required for schema development. Tononi and Cirelli (2006) and Ohki and Takei (2018) further developed the connection between NREM stage 3 sleep and schema creation by identifying neurological processes that may account for how affectively relevant memories are transformed into schemas during NREM stage 3. In coordination with the NREM extraction of emotionally salient schema memories, Walker (2009) describes findings indicating that in REM sleep those memories are organized and consolidated. Research findings showing the isolation of emotionally salient memories along with the organizing of those memories is consistent with what is proposed in ECTD.

ECTD builds on the research findings about schema development in sleep by proposing that dreams are a manifestation of the organization of schemas. In dreams, schemas are organized, modified, and reinforced through repetition in dreams, and the rehearsal of simulated sensorimotor processes within the dreams facilitates the waking use of the same sensorimotor processes. The support for this proposal is limited, but dreams being a simulation experienced as real by the dreamer (Domhoff, 2018), the improvements in tasks related to sleep and dreaming (Barrett, 2017; Benjamin et al., 2014; Wamsley et al., 2010), and the brain activity, particularly in the default mode network, memory networks, and limbic system are consistent with what would be expected for the process (Desseilles et al., 2011; Domhoff, 2018).

The understanding of schemas in ECTD addresses an important challenge that has prevented links between dream experiences and schemas from being established, namely the bizarreness of dreams that obscures obvious links between waking and dreams. This challenge is addressed through the concept of embodied metaphor. The simulation of schemas in dreaming is often metaphoric in nature because that allows schemas related to abstract concepts to be based in the core sensorimotor and affective experience of the world that is, according to the theory of embod-

ied cognition, the basis for human understanding (Farina, 2021). In other words, all cognitive understanding is built on the experience of being in a physical body and interacting with the external environment. In dreams, schemas are translated into sensorimotor and affective experiences to make applicable the relationships entailed within them. The patterns of relationships within the schema are made physically manifest in dreams, and those relationships are brought to awareness, such that though not necessarily remembered in waking, they are more readily recognized in waking life through the bodily experience of emotion and sensorimotor processes, which will be further explained in the implicit learning section below.

Additionally, the translation of schemas to experientially embodied metaphors ensures consistency between new schemas and previous understandings of the self and external world. For example, if an individual recently experienced the abrupt and unexpected end of a loving relationship, that person may dream of a plane crash or other unexpected disaster while traveling, whereas when the relationship felt safe and loving that same dreamer may have dreamt of traveling in comfort to an exciting destination. The changes in waking life affect the representation of the abstract concepts in dreaming and reflect a shifting of schemas from loving relationships being fun and exciting to dangerous and frightening. It is in this way that new experiences are linked with previous understandings and updated to reflect changes. The core metaphor (i.e., love is a journey) may remain the same but be transformed in a manner consistent with the new experience, which ensures a continuity with previous understandings of concepts.

In considering dreams as schemas related to waking experiences, the nature of dream imagery must also be considered. Horton and Malinowski (2015) depict a process in which memory fragments that relate to current concerns but are not necessarily linked to one another are activated and bound together. This process decontextualizes memories and creates new dream experiences. In this account, the function of the process is to create new links between previous experiences allowing them to be accessed in relation to current concerns. By cross-linking autobiographical memories, it becomes easier to draw on past sensorimotor based experiences to react to current concerns. Piggybacking on this concept, in ECTD, the process of cross-linking autobiographical memory fragments is organized around the affective and sensorimotor foundation of recent, affectively relevant thoughts and experiences, creating embodied metaphors linked to memories along with any schemas to which those memories were previously linked. The organization of memory fragments linked to sensorimotor experience creates dream experiences that constantly revise and connect schemas.

In ECTD, the schema enactment of dreams may be prompted by waking experiences, thoughts, or memories that are affectively significant. This leads to several ways in which schemas may present in dreams. Emotionally salient waking thoughts anticipating future activities or revisiting memories of past experiences lead to dreams simulating preexisting schemas, while dreams prompted by new, affectively-relevant experiences or insights may require the development of new schemas or the modification of preexisting schemas. Regardless of whether the schema in dreams is unchanged, modified, or new, the affective and sensorimotor based simulation of the schema prepares the

individual for the types of experiences most recently affectively significant in waking. The next section will address how the dream simulations translate into waking preparation.

2.3. Implicit Learning

An important part of ECTD is the idea that sensorimotor experiences in dreaming can train individuals for waking responses despite those experiences not being consciously remembered, and there is a research foundation for this. Evidence indicates that most learning during dreaming is implicit not explicit (see the review by Ruch & Henke, 2020). This is consistent with a function of dreaming being to train the individual to recognize affective and sensorimotor patterns. The details of the dream are not important and unnecessary for waking, it is affective and sensorimotor experiences, both of which can exist as implicit, procedural memories, that is important for training the dreamer to react to schema patterns when awake. The idea of procedural learning in dreams is further indirectly supported by a variety of research studies showing amnesic patients capable of learning despite not being able to recall the learning experience (Glisky & Schacter, 1987; Meulemans & Linden, 2003; O’Kane et al., 2004).

One element of training in sleep that needs to be addressed is the requirement that the activity is an experiential rehearsal that uses the same processes as in waking, minus external physical movement. The evidence indicates that dreaming does meet the rehearsal requirement. In fact, studies show that in sleep there is the embodied simulation of affective and sensorimotor experiences (Domhoff, 2018). The embodied simulation replicates waking life in a manner that is experientially and neurologically nearly identical to waking. The challenge with this idea in the past has been based on the difficulty linking frequently odd dreaming experiences with waking experiences. The concept of embodied metaphor provides a bridge that can overcome the apparent differences between waking and dreaming experiences. If what needs to be the same for training to occur in dreaming is activation of the sensorimotor source domain of an experience, then embodied metaphors may provide the rehearsal needed for that training even if on the surface the dream activity appears unrelated to the waking activity.

The recognition of schema patterns, when the schemas are of abstract concepts for which the sensorimotor dream experience is a source domain, rely on a bidirectional neuronal link between source and target domains as described and reviewed by Lakoff (2014). This connection, which is not consciously recognized, allows for sensorimotor practice during dreaming along with schema mapping and rehearsal, and the procedural memories of those experiences allow them to influence waking recognition and responses without explicit memories or understanding.

That dream simulations could lead to improvements in sensorimotor tasks is supported by research showing that REM sleep (the sleep stage strongly and consistently linked with dreaming) along with NREM sleep (where dreaming occurs regularly, if not as frequently as in REM), are linked to improvements in sensorimotor performance and the consolidation of those procedural memories (Rienzo et al., 2016; Walker, 2009). Research findings also support improved pattern recognition after REM sleep, which is consistent with the ECTD proposal that dreaming improves schema recognition (Walker, 2009). Taken together, the findings are

supportive of the proposal in ECTD that the repetition of affective and sensorimotor patterns in dreams creates a learning experience consistent with that needed to improve sensorimotor responses and react to schema.

3. Conclusion

ECTD provides a proposal regarding the function of dreaming. It is a depiction of dreaming as a core process in schema creation, organization, and rehearsal along with preparing sensorimotor systems for actions likely to be required in waking. ECTD is grounded in embodied cognition, which has become an influential, research supported explanation of cognitive functioning, and ECTD extends embodied cognition to the internal cognitions known as dreams. ECTD provides a purpose for dreaming and answers the questions of why dreams are bizarre, experienced as real events, and difficult to remember.

Author’s note

Alwin E. Wagener ORCID ID: <https://orcid.org/0000-0002-9804-7274>

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