

On Cognitive-Topological Construal Interpretation of Sensory Paths Fictive Motion

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Abstract:

Sensory paths represent one prevalent category of fictive motion grounded in human perceptual experience. Talmy categorizes linguistic representations of sensory paths into two distinct types: (1) the experiencing entity as the source and (2) the experienced entity as the originator. From the perspective of cognitive topology, spatial topology constitutes a fundamental cognitive capacity, with linguistic topology serving as its concrete manifestation. These two types of originator-based representations are essentially products of cognitive topology. Through the dimensions of topological equivalence and topological transformation, this study investigates the conceptual foundation and cognitive mechanisms underlying the sensory paths. The findings reveal that: (1) the topological invariance of sensory paths is manifested in both conceptual constructions and schemas; and (2) the cognitive interpretation of perspective shifting and figure-ground shifting constitutes a fundamental cognitive mechanism for the formation of sensory paths fictive motion.

Keywords:

Sensory Paths Fictive Motion, Cognitive Topology, Cognitive Construal

1. Introduction

Sensory Paths represent one prominent subtype within Fictive Motion Events, characterized by dynamic conceptualizations and descriptions of static scenes as nonveridical motions as they are expressed linguistically and perceived mentally. Sensory paths include conceptualization of two entities, the Experiencer and the Experienced, between which intangible lines are perceived to move along a unidirectional path and of something intangible moving in a straight path between the two entities in one direction or the other [1], as in example(1), or in the other direction, as in example (2) .

(1)The enemy can see us from where they're positioned.

(2)We can be seen by the enemy from where we're standing.

Example (1) observes the “Experiencer as Source” type configuration (abbreviated as the ERS type), the Experiencer, (the enemy) emits a conceptual “Probe (perceived as intangible lines)” that traverses from itself to the Experienced (we), thereby establishing detection upon contact. Conversely, Example (2) illustrates the “Experienced as Source” type paradigm (abbreviated as the EDS type), wherein involves the Experienced emits a “Stimulus” that travels from itself to the Experiencer (they), resulting in sensory stimulation upon encounter. Crucially, in both configurations, the actual Experiencer and Experienced maintain their static physical positions. There is a common folk belief that visual perception is the result of movement either from the eye to the perceived entity, or from the perceived entity to the eye [2,3]. While the aforementioned examples primarily illustrate visual sensory paths, it is important to note that this conceptual framework extends to other sensory modalities, including auditory and olfactory paths.

The theoretical foundation of this study is rooted in topology, a mathematical discipline concerned with the study of geometric properties and spatial relations that remain invariant under continuous transformations. These so-called “topological properties” refer to the invariance of certain characteristics amidst change [4]. The transition from static to dynamic conceptualization in sensory paths constitutes a topological transformation process, wherein static scenes maintain invariance in location and distance, while their mental dynamic processing implies changes in direction and distance—all of which are systematically encoded in linguistic expressions. This article aims to investigate the topological invariance inherent in sensory paths within fictive motion from the perspective of cognitive topology and construal. Through this investigation, this study seeks to analyze the underlying cognitive mechanisms that facilitate this conceptual transformation. The study intends to contribute to the cognitive study of fictive motion representation by offering a novel topological perspective and deriving theoretically significant insights into the nature of sensory path conceptualization.

2. Literature Review

2.1. *Sensory paths fictive motion*

The final chapter of the preceding discussion established that fictive motion is fundamentally characterized by three core components: dynamic mental processing, visual perception, and linguistic expression. These foundational elements have been extensively investigated across all types of fictive motion. Talmy [1] seminal classification system organizes fictive motion into six distinct categories, among which emanation paths constitute the most comprehensive classification, encompassing four subcategories including sensory paths. Within this framework, visual paths have emerged as a predominant type of sensory paths, receiving considerable scholarly attention due to their intrinsic connection with visual perception. Many accept the empirical research showing the fictive motion have its psychological reality through psychological experiments as well as eye movement experiments [5], and neurophysiological investigations utilizing Transcranial Magnetic Stimulation (TMS) have demonstrated that motion verbs in language significantly influence the excitability of both visual and motor systems, as evidenced by the recorded neural responses of nine experimental subjects [6]. From a linguistic perspective, notable differences have been identified between Satellite-framed languages (e.g., English and Russian) and Verb-framed languages (e.g., Spanish and

Turkish) in their construction of visual path expressions, for example, there are some differences in the number and kind of different subjects used in English-Spanish coextensive path-type fictive motion expressions [7-8]. A corpus-based study demonstrated that Chinese exhibits characteristics of by a reciprocal construal type language, utilizing convergent verbs and adverbs to characterize visual paths, whereas English predominantly employs prepositions and adverbs [9]. Linguistic expressions of visual motion in ten languages are compared in a crosslinguistic experiment showing the diversity of different languages in encoding visual path information[10]. While the mental processing and linguistic lexicalization patterns of visual paths have been thoroughly investigated, it is noteworthy that research specifically focusing on sensory path categories remains relatively limited. This gap in the literature highlights the need for more specialized investigations into the broader category of sensory paths, beyond the well-studied domain of visual perception.

2.2. Topology and topological properties of linguistic representations

Topology, as previously introduced, constitutes a fundamental concept in geometry that examines the invariant properties of various “spaces” under continuous transformations. A classic illustration of this principle is the topological invariant known as “hole closure” in physical space, exemplified by the behavior of a rubber band, which is known as the “Topological Invariant” or “Topological Equivalence” [11], no matter whether it is stretched or twisted or reshaped into different geometric forms such as a rectangle, square, or triangle within its elastic range, it maintains its essential topological property of containing one hole. Such continuous deformations of a geometric figure or space, such as stretching, compression, bending, etc., are collectively called “Topological Transformation”. This phenomenon demonstrates that human cognition, constrained by its limited capacity, exhibits a propensity for extracting and utilizing core topological properties for identification and categorization, thereby underscoring topological invariance as a fundamental cognitive capability [12]. The processes of conceptualization, abstraction, and idealization are inherently topological in nature, involving the selective emphasis of certain aspects while disregarding others, thereby generating topological models of linguistic representation [13]. Language, as the external manifestation of cognition and mind, inherently embodies topological properties. The theoretical origins of linguistic topology can be traced back to Talmy’s work [1][14] on the topology of linguistic closed forms and Lakoff’s [15] “Invariance Hypothesis” of conceptual metaphors [16]. Talmy’s [1] research particularly emphasizes the topological invariance of linguistic closed forms, which encompass lexical categories (e.g., prepositions, conjunctions) or grammatical categories characterized by their closed nature. This principle is exemplified in examples (3) and (4), where the spatial preposition “across” consistently represents the same spatial and locational transformation despite variations in the geometric dimensions of the background, thereby reflecting the topological geometric properties of spatial prepositions. Another significant area within cognitive linguistics profoundly influenced by topology is conceptual metaphor [16]. The Invariance Hypothesis [15] posits that the mapping process from the source domain to the target domain involves the transfer of features that share topological homology properties, thereby maintaining structural consistency across domains.

(3)The ant crawled across my palm.

(4)That man walked across the field.

The integration of topological and linguistic research has introduced novel perspectives for the cognitive study of language. Numerous studies have unveiled the embedded topological structures within various linguistic representations, including euphemisms, word puzzles, and Chinese ortho-anti-syntactic structures [4][17-18]. Furthermore, several linguists have contributed to the synthesis, development, and refinement of topological theory in conjunction with linguistic theory, suggesting that cognitive topological linguistics is emerging as a significant trend within cognitive linguistics [12][19]. Many foundational theories in cognitive linguistics, such as prototype theory, conceptual metaphor and metonymy, and image schema theory, are underpinned by the principle of topological equivalence [15][20].

2.3. Research path

Previous studies have demonstrated that language possesses topological properties, or rather, language constitutes a topological system. This implies that language unfolds invariant features pertaining to conceptual meaning amidst constant changes in linguistic expressions. Conceptual meaning primarily refers to the schematic representations formed through human cognitive topological abilities, which extract invariant properties from entities and subsequently abstract them. Linguistic representations constitute a topological transformation process, mediated by the cognitive subject's construal based on the topological structure of the objective physical world [21]. This article posits that two types of sensory path patterns belong to the same conceptual topological space and represent specific linguistic representations formed through topological transformations with topological homogeneous properties. The cognitive topology and construal process can be schematized as shown in Figure 1.

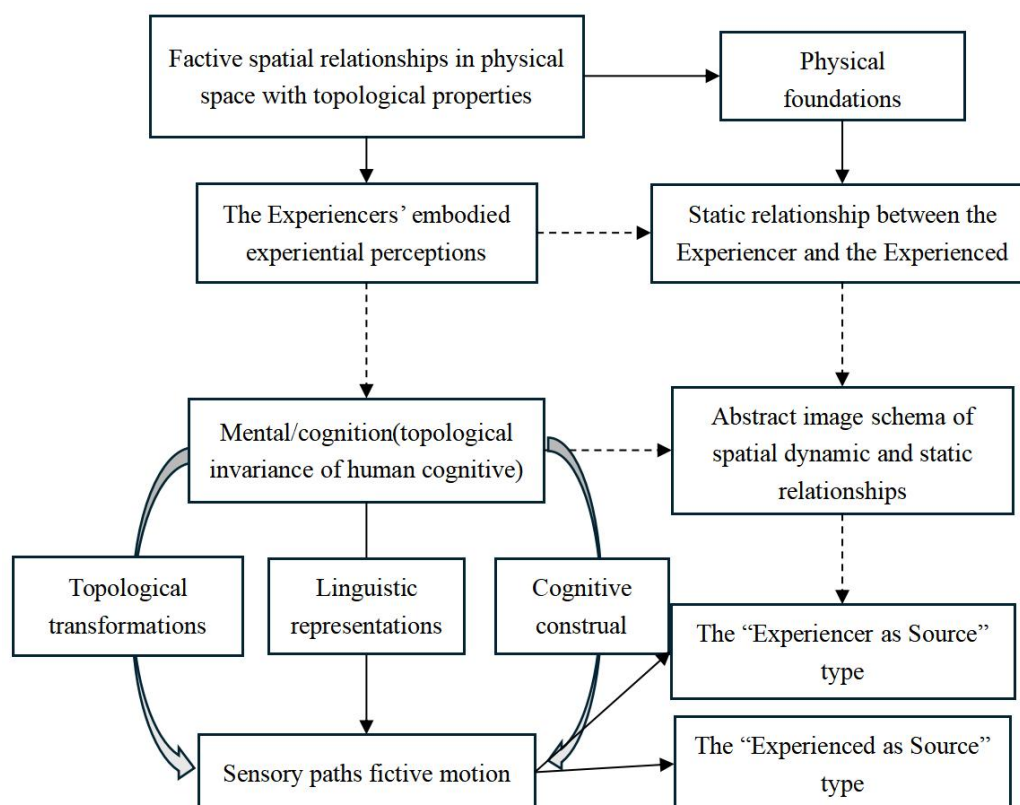


Figure 1. Cognitive topology and construal mechanism for sensory paths.

Figure 1 illustrates the cognitive topology and construal mechanism for sensory paths. In this figure, solid lines represent objectively observable processes in the real world, such as motion events or linguistic symbols, while dashed lines symbolize unobservable mental processes. Motion events occurring in the objective world, which possess spatial topology, provide an indispensable physical basis for the cognitive construction of sensory paths. Human form image schemas, which can generally be defined as dynamic analog representations of spatial relations and movements in space [22], in their brains based on their experiential perception of the objective world. Influenced by cognitive topological abilities, image schemas also exhibit topological features at the mental level, reflecting not only the essential characteristics of movement events but also human creative processing of reality. Image schemas, as abstract concept, are represented through language. In sensory paths, the factual spatial relations between the Experiencer and the Experienced are transformed into an abstract system of kinetic relation image schemas through perceptual experience and mental processing by the observer (see Section 3.2 for details). Linguistic representations are also characterized by a variable factor-cognitive operations of the mind-specifically cognitive construal [21]. Within sensory paths, two different types emerge due to perspective transformation and Figure-Ground reversal. In summary, cognitive topology represents a realization process from objective reality to concepts to language [17]. The conceptual basis for sensory paths lies in the topologically equivalent spatial-motor-stationary relational image schema, and the specific mechanism of their formation is attributed to the cognitive construal operations of the human mind.

3. Topological Equivalence in Sensory Paths Events

In the case of natural languages, topological equivalence is manifested both at the level of semantic content and at the level of syntactic structure [13]. Topological equivalence of sensory paths in semantic level pertains to the invariant conceptual structure and image schema.

3.1. Topological equivalence of conceptual construction

Sensory paths, as a subcategory of emanation paths within fictive motion, can be conceptualized as motion events that involve the treatment of a situation containing motion or the continuation of a stationary location. A basic motion event conceptually consists of one object (the Figure) moving or located relative to another object (the reference object or Ground). It is analyzed as having four components: besides Figure and Ground, there are Path and Motion. The Path (with a capital P) is the path followed or site occupied by the Figure object with respect to the Ground object. The component of Motion (with a capital M) refers to the presence per se of motion or locatedness in the event [14]. Talmy represents motion by form MOVE and static location by BEloc, a mnemonic for “be located”. In addition to these primary components, Co-events often bear the relation of Manner or Cause to the motion event. The topological nature of geometric space is reflected in the linguistic representation of motion events, where “linguistic expressions can undergo substitutions that incorporate immutable aspects of linguistic change” [13]. Specifically, in sensory paths, the same spatial motion event can be represented in two ways: the ERS type and the EDS type.

English expressions of the “Experiencer as the source” type sensory path

Agentive

(5)Even a casual passerby[F] can see[BE_{loc}] the old wallpaper[G] through the paint[-PATH].=[a causal passerby SEE_{loc} the old wallpaper] WITH-THE-FICTIVE-PATH[through the paint]

(6)I[F] can hear[BE_{loc}] him[G] all the way from where I'm standing[-PATH].=[I can HEAR_{loc} him] WITH-THE-FITIVE-PATH[from where I'm standing]

(7)I[F] can smell[BE_{loc}] him[G] all the way from where I'm standing[-PATH].=[I can SMELL_{loc} him] WITH-THE-FITIVE-PATH[from where I'm standing]

In these examples, the animate human as the Experiencer (a casual passerby or “I”) actively emits an intangible line from their sensory organs (e.g., eyes, ears, nose) that fictively moves toward the Experienced (the old wallpaper or “him”). It is crucial to note that both the Experiencer and the Experienced remain static, with no actual movement or displacement occurring in physical space. Talmy[1] has proposed active-determinative principle, a cognitive principle that determines the source of emanation, which believed that the object in a motion event perceived as more active or determinative is conceptualized as the source of emanation. Thus, the agentive Experiencer is more active, decisive, and prominent than the Experienced entity, which is either inanimate (e.g. “old wallpaper” in example 5) or less significant (e.g. “him” in examples 6 and 7) because of the active agency. The figure has been confirmed having perceptual prominence, and psychological research has shown that it is more likely to be perceived more prominent than ground [23]. In the “ERS” type, the Experiencer possesses conceptual agency and saliency, making it the Figure, while the less salient object aligns with the Ground. In examples (5)-(7), no actual movement occurs; instead, they depict a relative stationarity relationship between the Experiencer (Figure: a casual passerby or “I”) and the Experienced (Ground: the old wallpaper or “him”). The static sensory verbs, which mean there is no movement, in these examples (see, hear, smell) are represented by the abbreviated form BE_{loc}. Sensory paths are characterized by the use of static sensory verbs, with the source and path of the Experiencer indicated through satellite constructions involving prepositions like through and from, which are fictive (denoted by “-”). Based on the analysis above, the conceptual construction of the ERS sensory path can be formalized as: [F][BE_{loc}][G][-PATH]. This topological construction generalizes the conceptual semantic elements of the ERS type, representing an invisible ray emanating from the Experiencer, which actively explores the Experienced object.

English expressions of the “Experienced as the source” type sensory path

Nonagentive

(8)The breathtaking view of the Grand Canyon[F] came[MOVE] into[+PATH] my view[G] as I stood at the edge, feeling overwhelmed by its majesty[Co-EVENT].=[The view MOVE INTO my view] WITH-THE-CONCOMITANCE-OF [as I stood at the edge.....]

(9)The faint sound of music[F] drifted[MOVE] from[+PATH] the open window of the nearby house[G], blending with the night air[Co-EVENT].=[The sound MOVE FROM the open window of the nearby house] WITH-THE-CONCOMITANCE-OF [blending with the night air.....]

(10)The smell of Gingerbread[F] is coming up[MOVE]through the stairs [+PATH][G] and the Trail Center is all decked out for Christmas, as you can see from

the pictures[Co-EVENT]. = [The smell MOVE THROUGH the stairs] WITH-THE-CONCOMITANCE-OF [the Trail Center is all decked out for Christmas.....]

Examples (8) – (10) illustrate the EDS type sensory path, where the Experienced objects (the breathtaking view of the Grand Canyon, the faint sound of music, or the smell of Gingerbread) are conceptualized as the more active or determinative sources of emanation. These objects send a stimulus traveling from the Experienced to the Experiencer who may be omitted in language representations. These examples feature dynamic motion verbs (*come, drift, come up*) and prepositions (*into, from, through*) that indicate the path of motion, emphasizing the onset, mediation, or endpoint of the path. Additionally, these examples encode Co-events related to the motion events, indicating sequential, causal, or modal relationships, though these aspects will not be explored in detail here. The conceptual construction of the EDS type sensory path can be formalized as: [F][MOVE][+PATH][G][Co-EVENT].

3.2. Topological equivalence of image schema

The conceptual basis for understanding sensory paths fictive motion is the abstract image schema, which can be defined as a recurring dynamic pattern of our perceptual interactions and motor programs that gives coherence and structure to our experience [24]. For instance, the image schema of the preposition “across” exhibits spatial relations and is inherently topologically invariant, with the topological nature of “crossing” remaining constant. Through repeated interactions with the objective world, humans gradually form image schemas, which are topological in nature and play a crucial role in reasoning, understanding, and organizing abstract activities, experiences, and concepts. In other words, “recurring experiential patterns tend to be abstracted topologically into image schema, which have topological constancy and are the conceptual basis for human understanding of objective world” [13]. Below, the topological schemas of the three main types of sensory paths are analyzed.

Visual Paths

(11) From here, you[F] can see[BE_{loc}] across the Lerma Valley of northern Argentina[G][+PATH].

(12) The sight of the old, abandoned house[F] on the corner of the street entered[MOVE] my field of vision[+PATH][G], evoking a sense of nostalgia[Co-EVENT].

Examples (11) and (12) illustrate visual paths, involving a visual perceiver (“you” or “I”) and a seen entity (“the Lerma Valley” or “the old, abandoned house”). Example (11) represents an agentive sensory path, where the Experiencer actively controls a line of vision, enabling it to retract, remain stationary, or shift focus. This dynamic perception is conceptualized by the preposition “across”. A line of vision emerges from the eyes of a visual perceiver and moves to a seen entity and then its head may further move away from it toward another entity [25]. In contrast, Example (12) exemplifies a nonagentive visual path, where the seen entity is encoded as the more active object, emitting intangible lines that moves from the Experiencer to the Experienced. The dynamic perception here is conveyed by the verb “enter”. Based on this analysis, the moving process of the visual path can be diagrammed as follows:

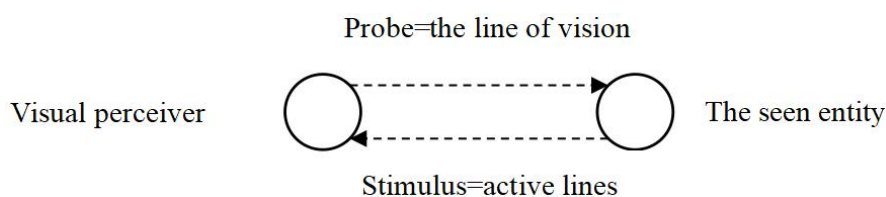


Figure 2. The topological image schema of visual paths.

Auditory Paths

(13) We[F] heard[BE_{loc}] the distant thunder[G] rumbling in the northwest[-PATH], signaling the approach of a storm[Co-EVENT].

(14) The distant sound of thunder[F] rolled[MOVE] across the sky[+PATH], signaling the approach of a storm[Co-EVENT].

Examples (13) and (14) depict auditory paths, involving a sound perceiver (“we” or omitted) and a sound producer (“the distant thunder”). Similar to visual paths, auditory paths conceptualize the motion process in both directions. In Example (13), the auditory organs of the Experiencer actively detect sounds from different directions. In Example (14), the Experienced entity, possessing higher salience, produces sounds that diffuse in various directions. The dynamic verb “roll” implies motion, while the preposition “across” indicates the path. The moving process of the auditory path can be diagrammed as follows:

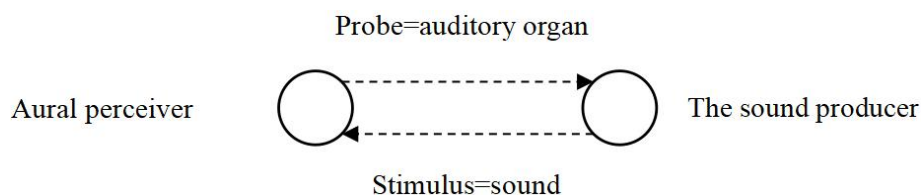


Figure 3. The topological image schema of auditory paths.

Olfactory Paths

(15) Stumbling back to our dorm, we[F] could smell[BE_{loc}] the cheese and dough[G] through the box[-PATH].

(16) Maybe a weird smell[F] coming[MOVE] from the hot box[+PATH][G], or the look of one or some of the ingredients was not up to standard[Co-EVENT].

Examples (15) and (16) illustrate olfactory paths, involving an olfactory perceiver (“we” or omitted) and an odor producer (“cheese and dough” or “weird smell”). Olfactory paths are similarly conceptualized in both directions. In Example (15), the animate Experiencer actively uses olfactory organs to detect the odor-emitting object, with the static sensory verb “smell” and the preposition “through” indicating the path. In Example (16), the odor as a more active object itself undergoes fictive motion, characterized by the dynamic verb “come” and the preposition “from” denoting the path. The moving process of the olfactory path can be diagrammed as follows:

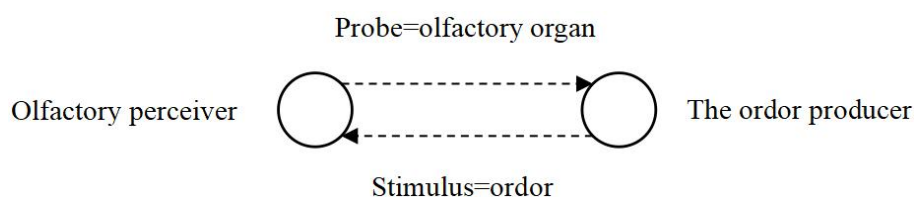


Figure 4. The topological image schema of olfactory paths.

What needs to mention is that visual paths are always encoded into agentive sensory path representation due to the determinative controller-agent, while like sounds, odors are free from control of the agent, and they keep advancing until they terminate at some perceiver [25]. Based on the analysis of the three subcategories, the topological image schema of sensory paths can be generalized as follows:

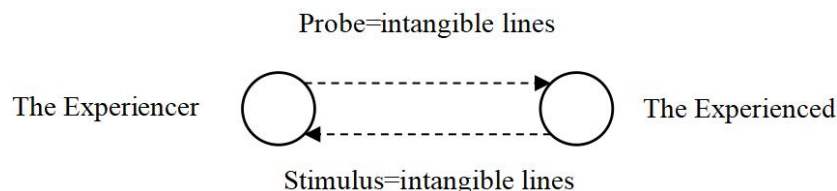


Figure 5. *The topological image schema of sensory paths.*

As defined by Talmy, sensory paths involve two entities (represented by circles)—the Experienter and the Experienced—and an intangible motion (represented by a dotted line with an arrow) between them, moving in opposite directions. This topological image schema then forms the foundation of the spatial structure for understanding the sensory paths fictive motion. A spatial topological relation is constructed as a spatial static or dynamic relation between an entity X and an entity Y [26], in which topological invariant properties play an important role in the schematization process. The topological invariance of the image schema and the topological invariance of the conceptual constructions together determine the topological equivalence on the linguistic representation of sensory paths.

4. Topological Equivalence in Sensory Paths Events

As previously analyzed, sensory paths exhibit topological equivalence in conceptual constructions and image schemas, influenced by the topological invariance of physical space. Two types of sensory paths are divided according to the active or prominent source when perceivers perform subjective processing and cognitive construal operations, motion events undergo a shift from the “ERS” type to the “EDS” type representations. The cognitive construal, referring to the human cognitive ability to process the same scene to form different linguistic expressions [27], constitutes a cognitive mechanism for the semantic formation of sensory paths. Scholars have identified cognitive construal as multifaceted, encompassing mental scanning, viewpoint arrangement, figure-ground organization, perspective, attentional systems, and dynamic hypothetical movement, among others [27,28][1]. This section aims to analyze the cognitive mechanisms of sensory paths, focusing on two core dimensions: perspective selection and figure-ground organization.

4.1. Perspective transformation

Essentially, fictive motion is a dynamic human literacy of static scenes from the psychological to the visual level, and the realization of fictive movement relies on the process of mental simulation and virtual visual processing by the observer. Therefore, the formation and understanding of sensory relies on the subjective processing of the observer’s perspective. Wen [12] has mentioned that Casati’s classification of spatial representations in *Topology and Cognition* into “non-intrusive” (non-perspective-dependent) and “intrusive” (perspective-dependent) types, arguing that spatial representations related to topology belong to the “non-intrusive” type. In sensory paths, the Experienter or perceiver plays a significant role in the “Experienter as

source” type, which relies on a first-person perspective to actively probe perceived entities. In contrast, the EDS type requires a third-person perspective to observe and describe the development of fictive motion from a bystander’s viewpoint, aligning with the non-intrusive perspective.

(17)As I[F] looked[BE_{loc}] out the window[-PATH], the beautiful scenery of the mountains and valleys[G>F] entered[MOVE] my view[+PATH][G], soothing my mind.

(18)She[F] could hear[BE_{loc}][-PATH] the faint music[G>F] playing softly from the next room, drifting[MOVE] through the thin wall[+PATH][G].

(19)I[F] feel[BE_{loc}][-PATH] the smell of damp earth and sharp, bitter -- blood[G>F], coming[MOVE] from the next room[+PATH][G].

Examples (17)-(19) illustrate visual, auditory, and olfactory paths, respectively. Each sentence is characterized by a shift in perspective: the first half represents the ERS type, while the second half transitions to the EDS) type. In the first half of these sentences, the subject (“I”, “she”, and “I”) are the perceivers who actively probe the perceived objects (“mountains”, “music”, and “smell”) using a first-person perspective, as depicted in Figure 6a. In contrast, the second half describes the objective scenario, where the perceived entities become the logical subjects of the latter clauses, followed by motion verbs (“enter”, “drift”, and “come”) and prepositions (“through” and “from”) emphasizing the path. This representation requires a third-person perspective to describe the entire scene, as shown in Figure 6b.

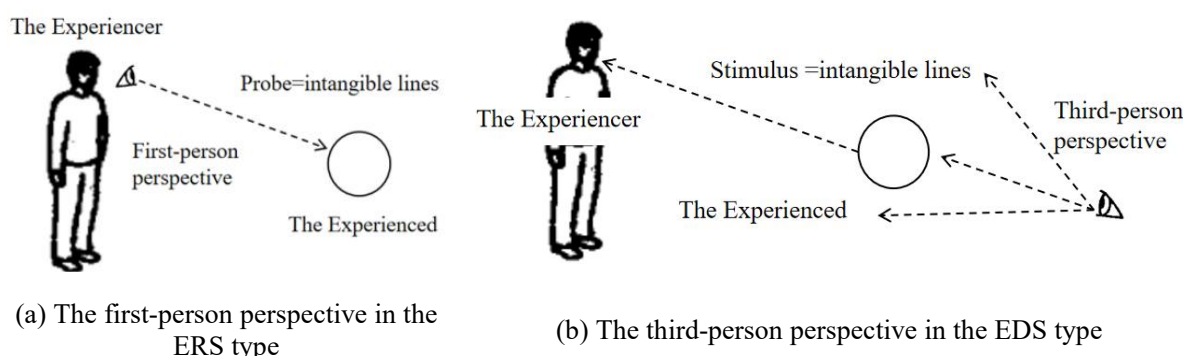


Figure 6. Perspective transformation in sensory paths.

Figure 6 show the process of perspective transformation process. Figure 6 illustrates the process of perspective transformation. Taking example (18) as an illustration, the Experiencer (“she”) acts as the active source, employing a first-person perspective to explore the sound, thereby encoding her as the sentence’s subject. Conversely, the Experienced entity (“the faint music”) later becomes the figure for displacement, encoded as the logical subject of a non-predicate verb “drifting”, moving along the path indicated by the preposition. This representation necessitates a freestanding third-person perspective to observe and describe the scene. Levinson [29] suggests that people use a “relative frame of reference” when dealing with spatial figure-ground relationships, including an observer-centered reference system and others-centered reference system. This flexibility allows individuals to shift from a subjective first-person perspective to an objective third-person perspective, enabling the topological conversion of narrative descriptions of spatial dynamics into virtual representations of static scenes.

4.2. Figure-Ground transformation

As outlined in Section 3.1, Talmy [14] identifies the semantic elements of a motion event as consisting of a [FIGURE] and a [GROUND], which constitute a pair of cognitive-semantic categories. The general conceptualization of Figure and Ground in language is that the Figure is generally a moving or conceptually movable entity whose path, site and orientation is conceived as a variable value, while the Ground is a stationary setting [1]. According to the active-determinative principle and the image schema that have analyzed in Section 3.2, the perceiver, as a more active source, emits a line of perception that moves from their sensory organs (e.g., eyeballs) to the perceived entities (This process can be visualized as an arrow is on the eyeball at the onset, and then move itself to the end of some objects.) in ERS type. Consequently, the human perceiver, as the bearer of sensory organs, is often metaphorized as the Figure, while the perceived entity is conceptualized as the Ground. On the contrary, the Experienced in the EDS type is more like a determinative entity which emitting stimuli that move toward the Experiencer's sensory organs. (This can be visualized as an arrow ejaculating from some objects at the onset, and then move itself to the end of animate creature). In this case, the perceived entity is conceptualized as the moving Figure, while the perceiver becomes the static Ground.

(20) When I[F] looked[BE_{loc}] at[-PATH] the book[G>F], the intricate illustrations[G>F] leaped off the pages and entered[MOVE] my eyes[+PATH][G], captivating my imagination[Co-EVENT].

(21) In the quiet library, I[F] could hear[BE_{loc}][-PATH] the melodic sound of the piano[G>F], which flowed[MOVE] through the concert hall[+PATH][G], captivating the audience's attention[Co-EVENT].

(22) I[F] could feel[BE_{loc}][-PATH] the smell of olive oil, lemon, garlic and oregano[G>F] seeping out[MOVE] from behind the windows and doors[+PATH][G].

Examples (20)-(22) illustrate visual, auditory, and olfactory paths, respectively. Each sentence is characterized by a shift from the ERS type in the first half to the EDS type in the second half. The first half of three sentences corresponds with the conceptual constructions of the ERS type, featuring the Experiencer ("I") as the subject, static sensory verbs ("look", "hear", and "feel"), and the perceived entities ("the book", "the sound of the piano", and "the smell") as the Ground. The second half part of sentences are consistent with the conceptual constructions of the EDS type, where the Experienced entities as the active source are encoded as the logical subjects, or the Figure, accompanied by motion verbs ("enter", "flow", and "seep") and prepositions indicating the path. Notably, the Experiencer, initially conceptualized as the Ground, transitions into the Figure with a moving tendency, as marked by the symbol ">". Wang [31] points out that Figures generally have the semantic characteristics of [+moving] [+smaller] [+higher degree of convexity]; while Grounds typically display [+static], [+larger], and [+lower degree of convexity]. Combined with the active-determinative principle, the Experienced entity undergoes a transformation from a static, low-salience attribute to a virtual, dynamic, high-salience attribute. This shift is facilitated by a change in perspective, transitioning from the first-person perspective of the perceiver to an independent third-person perspective. As a result, the Experienced entity moves from a passive to an active state. Specifically, the interplay between shifts in perspective and Figure-Ground roles forms the cognitive basis for the linguistic representation of sensory paths.

5. Conclusions

This study systematically investigates the topological equivalence and transformation mechanisms underlying sensory paths representations through the lens of linguistic topology. The findings reveal two fundamental aspects: (1) Topological equivalence manifests in the conceptual isomorphism of motion relations between objects in physical space, serving as the spatial conceptual foundation for linguistic representations of sensory paths. The topological invariance of sensory paths is evident in both compositional and schematic dimensions, where different origin representations of the same motion event demonstrate this equivalence. (2) The cognitive mechanisms of sensory paths are constituted through perspective transformation and figure-ground intermodulation, which result from the visual subject's subjective processing of topological literacy. The theoretical implications of this research are threefold. First, it establishes a comprehensive framework that traces the transformation from physical space topology through conceptual topology to linguistic topology, providing a robust explanatory model for linguistic textual representations. Second, it offers novel insights into the cognitive processes underlying virtual displacement phenomena in language. Third, it bridges the gap between spatial cognition and linguistic representation through topological analysis. Future research directions should focus on some areas, i.e.:the syntactic representation of sensory paths, particularly in cross-linguistic contexts, and the deeper effects of figure-ground transformations on syntactic components, including their potential influence on sentence processing and comprehension. These investigations could further elucidate the intricate relationship between spatial cognition and linguistic structure, potentially contributing to both linguistic theory and cognitive science applications.

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this article.

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