THE GRAMMATICAL FUNCTION OF UNDER
AS A HEAD OF PROTASIS:
FROM SPATIAL SENSES TO GRAMMATICAL FUNCTIONS

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The present paper examines the grammatical function of the English preposition under with specific focus on its cognitive foundations. Under has the grammatical function as a head of a protasis of the related main clause (e.g., Under the agreement, agricultural prices would be frozen.). In order to examine this grammatical function of under, the present paper discusses the asymmetrical semantic extensions between over and under, which constitutes an antonymic pair, arguing the following points: first, the grammatical function of under is derived from its spatial sense through the control sense; second, though both over and under have the control sense, they exhibit different types of control; third, the asymmetry along the vertical axis of the perceived world motivates not only asymmetrical semantic extensions but also establishes the grammatical function of under.*

Keywords: under, over, grammatical functions, embodiment, asymmetry

1. Introduction

The present paper examines the grammatical function of the preposition under with specific focus on its cognitive foundations, arguing that the grammatical function of under is derived from its control sense, which in turn has its basis in the preposition’s spatial sense. The preposition under has a grammatical function as a head of protasis1—to specify the region

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1 A protasis is defined as the subordinate clause (usually beginning with if) in a conditional sentence. The other clause is called the apodosis. In this study, the subordinate phrase in a conditional sentence, which is headed by under, is also classified as a protasis.
where the event illustrated by the subjunctive main clause occurs. The examples below, in (1), illustrate the grammatical function of *under*.

(1) a. *Under* the agreement, most agricultural prices *would be frozen* or cut.

   b. *Under* these conditions he *might say* the following …

   c. UK air transport *would be under* national control, but with three separate companies.

(The *British National Corpus (BNC)*) The function of *under* in (1) is similar to that of the conjunction *if*, which serves as the head of a conditional clause. For example, in (1), the phrases headed by *under* function as presuppositions of the event illustrated in the associated main clause—apodosis—and the subjunctive mood is used in the main clauses. The protases headed by *under* are dependent phrases in (1a) and (1b), and a prepositional complement in (1c). In previous studies, these uses of *under* have been classified as the control sense, which is defined as “the TR (trajector) exerts influence or control over the LM (landmark)” (Tyler and Evans (2003: 101)). That is, the sentences in (1) have traditionally been interpreted as illustrating an event where the subject of the main clause is controlled by the complement noun phrase of *under*. However, unlike typical control senses of *under*, which are later shown in (2b), two types of linguistic change are observed here: a semantic extension from the spatial to the control sense; and a functional change from a less grammatical to a more grammatical form.

1.1 Themes Discussed in This Paper

The present paper discusses the cognitive foundations of the grammatical function of *under*, focusing on both semantic extension and functional change. To that end, we examine three senses of *over* and *under*: the prototypical sense, the abstract sense, and the grammatical function.² *Over* and *under* constitute an antonymic pair; however various asymmetrical characteristics are observed between them. Previous studies of cognitive linguistics have revealed that abstract senses of prepositions are derived mostly from their prototypical, spatial senses. The control sense seems to be no

² We use the term “grammatical function” instead of “grammatical sense” because *under* serves as a head of protasis. This use of *under* is similar to the function of *if*, which serves as a head of a conditional clause. Therefore, this use of *under* can be categorized as an instance of function, rather than of sense.
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exception to this rule, as we can see in (2) and (3).

(2) a. He has a strange power \textit{over} his brother.
    b. He has fallen \textit{under} her influence.

(3) a. He put his hand \textit{over} my shoulder.
    b. His wallet fell \textit{under} the bed.

The examples in (2) show the typical control sense of \textit{over} and \textit{under} in that the three major participants of the control sense are linguistically expressed, i.e. a controller (CON-er), a controlee (CON-ee), and a type of power (PWR). In (2a), \textit{he} is CON-er, \textit{his brother} is CON-ee, and \textit{a strange power} is PWR, while, in (2b), \textit{her} is CON-er, \textit{he} is CON-ee, and \textit{influence} is PWR. The examples in (3) are thought to be the spatial foundation of (2). They share the same participants and TR/LM alignment as those in the examples in (2).

This study also focuses on the asymmetrical semantic extension between \textit{over} and \textit{under}. Though both \textit{over} and \textit{under} share the control sense, only the \textit{under} phrase can function as the head of protasis, as in (4).

(4) a. \textit{Under} any other circumstances, I \textit{would} have heckled and walked out.
    b. Certainly, there \textit{would} need to be sound reasons to pursue it \textit{under} such circumstances. \hfill (BNC)

\begin{itemize}
  \item \textit{over}: spatial sense $\rightarrow$ control sense $\rightarrow$ * grammatical function
  \item \textit{under}: spatial sense $\rightarrow$ control sense $\rightarrow$ grammatical function
\end{itemize}

\begin{figure}[h]
\centering
\begin{tikzpicture}
  \node (over) at (0,0) {\textit{over}};
  \node (under) at (1,0) {\textit{under}};
  \node (spatial) at (0,-1) {spatial sense};
  \node (control) at (1,-1) {control sense};
  \node (functional) at (2,-1) {grammatical function};
  \draw [->] (over) -- (spatial);
  \draw [->] (over) -- (control);
  \draw [->] (over) -- (functional);
  \draw [->] (under) -- (spatial);
  \draw [->] (under) -- (control);
  \draw [->] (under) -- (functional);
\end{tikzpicture}
\caption{Asymmetrical semantic extension between \textit{over} and \textit{under}}
\end{figure}

Figure 1 summarizes the asymmetrical semantic extension between \textit{over} and \textit{under}. The asterisk in Figure 1 shows that \textit{over} does not develop its grammatical function. But this figure also raises a fundamental question: what are the motivations that caused this asymmetrical semantic extension? Because antonyms are thought to represent conceptual opposites, it is necessary to explain the motivations that caused this asymmetrical semantic extension between them.

2. Previous Studies of English Prepositions and Their Problems

The present study is classified as a case study of the polysemy of words, because it deals with inherent properties of words. However, it is radically different from previous studies in its research scope. The main focus of the present study is the grammatical function of prepositions that have re-
ceived little attention under the traditional study of polysemy.

2.1 Polysemy of Prepositions

In the wake of the pioneering studies of Brugman (1981) and Lindner (1981), the polysemy of English prepositions has become one of the central interests in cognitive linguistics (Boers (1996), Lindstromberg (2010)). In prior studies of the polysemy of English prepositions, we can identify two methods that have been widely adopted. The first approach is lexical semantics (e.g. Cruse (1986)). In this approach, researchers focus on the notion that synonymous words usually behave similarly whereas antonymic words behave oppositely. Researchers then use the different behaviors among synonyms and the asymmetrical behaviors between antonyms as cues to reveal the idiosyncratic characteristics of each word in synonymous or antonymous relations (Otani (2012b: Ch. 5)).

The second approach that has been widely adopted in prior studies is an embodied view of language, which discusses how linguistic structures are motivated by general cognitive processes (Lakoff and Johnson (1999), Gibbs (2005)). Tyler and Evans (2003), an offspring of the traditional conceptual metaphor theory, adopt this view and resolve various inconsistencies and shortfalls found in previous studies on the polysemy of prepositions. For example, Evans (2009) shows that the various senses that have been classified as the state sense differ greatly among each preposition. That is, though the prepositions *in* and *on* have the “state” sense, their semantic selectional tendencies differ greatly. They analyze the polysemy of prepositions empirically, focusing on the interaction between our body and our environment. The embodied view is, in fact, shared by most cognitive linguists. However, Tyler and Evans (2003) is perhaps the first book to discuss the polysemy of prepositions extensively from this view.

2.2 Two Problems

Tyler and Evans (2003) provide a more objective and empirical method for the study of polysemy. However, there are at least two problems remaining to be discussed. We refer to these as “the asymmetry problem” and “the continuity problem.”

The first problem, the asymmetry problem, relates to the discrepancy between the linguistic and conceptual level. That is, though antonyms are supposed to be conceptually symmetrical, asymmetrical semantic extensions are often observed between them. Generally, one of the antonyms in the relation is more extended in meaning than the other and, therefore, is used
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In wider contexts. For example, words that signify the concepts up and out tend to be more extended than words signifying the concepts down and in. In fact, it seems that asymmetrical characteristics inhere in the antonymic relation and are observed across languages.

The asymmetry problem is partially solved by the embodied view, because some of the asymmetrical characteristics of linguistic units reflect the structure of the perceived world. However, most previous studies use the embodied view not to explain the foundation of asymmetrical semantic extensions between antonyms but to explain that of symmetrical semantic extensions. For example, Tyler and Evans (2003: 124–125) note that both over and under share a similar control sense: “an important insight offered by the principled polysemy approach is [that] both over and under, which are traditionally represented as opposites, should both develop a similar meaning component, a Control Sense.”

The second problem is the continuity problem. Most previous studies of the polysemy of prepositions have dealt exclusively with the semantic extension of prepositions, ignoring the continuity between lexical senses and grammatical functions. These previous studies usually restricted their research scope to the domain of semantics, eliminating various grammatical functions from the network of polysemy.

However, English prepositions exhibit grammatical and discourse functions, as in (5).

(5) a. They wouldn’t give you loans except on condition you left the independent union.

b. Politics aside, the Vietnam industry is a profitable one. (BNC)

In (5a), the protasis headed by on functions to introduce the subjunctive main clause as if-clauses do. In (5b), the dependent phrase headed by aside has a discourse-organizing function that shifts the focus from an old topic mentioned in a previous context to a new topic introduced in the following main clause. In (5), the grammatical and discourse functions of

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3 See Otani (2007) for further discussion. This paper discusses how characteristics of the ground in the perceived world motivate the three stable senses of down in terms of the embodied view.

4 We do not mean that the grammatical functions of lexical items have not been discussed in any field of linguistics. There is some research that focuses on the grammatical function of lexical items. However, the point of the continuity problem is that the grammatical functions of lexical items have been largely ignored in the study of lexical semantics and cognitive linguistics.
prepositions are derived from their prototypical, spatial sense: They share the same image-schema and TR/LM alignment. However, though they share various characteristics, these functions received little attention in previous studies of polysemy; that is, they are never located in a network of polysemous meanings.

3. Background of This Study

To deal with the two problems mentioned above, we offer two theoretical perspectives. The first perspective is a more fine-grained embodied view of language, which focuses closely on asymmetrical characteristics in the perceived world. The embodied view of language is crucial for dealing with both symmetrical and asymmetrical characteristics of antonyms. Here, it is important to be aware of a level of specificity, i.e., how closely we look at the world (Langacker (1990: 7)). We can see the world through either a coarse-grained or a fine-grained view, though this is matter of degree. If we view the world through a coarse-grained perspective, various characteristics are abstracted away and symmetrical characteristics are foregrounded. Figure 2 depicts a coarse-grained view of the four positions of above, over, under, and below along the vertical axis. It illustrates the four prepositions symmetrically. In Figure 2, the dots show the TR and the bold line shows the LM.

![Figure 2](image)

In contrast, in a fine-grained view, the asymmetrical characteristics in the perceived world would be foregrounded, because most things in the world are structured asymmetrically. For example, Evans and Green (2006: 178) note “an up-down or top-bottom asymmetry” of our body. They write that, “given that humans walk upright, and because we have a head at the top of our bodies and feet at the bottom, and given the presence of gravity which attracts unsupported objects, the vertical axis of the human body is function-
ally asymmetrical.”

Once we take into consideration the role of gravity, we realize that various asymmetries lie along the vertical axis: for instance, how a physical TR interacts with its upper/lower LM. Due to the presence of gravity, a physical TR such as our body interacts with a lower/upper LM differently, as in Figures 3 and 4.

![Figure 3](image1.png)  Upper TR and its lower LM

![Figure 4](image2.png)  Lower TR and its upper LM

Figures 3 and 4 illustrate a typical spatial relation between a TR and an upper/lower LM: An upper TR tends to come into contact with a lower LM (e.g. a floor) while a lower TR tends not to come into contact with an upper LM (e.g. a ceiling). In Figure 3, the downward arrows indicate the pressure from the upper TR. In Figure 4, the TR is, in general, supported by the ground, which goes unexpressed. The function of the upper LM is to specify a region where the TR exists. Thus, in taking a fine-grained view, we can better understand the various asymmetries that exist in the perceived world. These asymmetries indeed motivate asymmetrical semantic extensions at the linguistic level.

The second perspective takes a dynamic view of language in which new meaning and function is understood as emerging through language use. This view enables us to deal simultaneously with multiple linguistic changes because it holds that certain linguistic changes are epiphenomenal, occurring contemporaneously and in a related way. For example, semantic fusion and phonological reduction are usually observed in the process of grammaticalization (e.g. Hopper and Traugott (2003)). In this dynamic view, the continuity between lexical and functional units is foregrounded, which allows us to place semantic extension and functional change on the same scale, as in Figure 5.

![Figure 5](image3.png)  Grammaticalization and semantic extension
Assuming a dynamic view of language allows us to deal with the cognitive foundations of grammatical functions. In previous studies of prepositions, researchers have exclusively discussed the cognitive foundations of abstract senses. However, if we focus on the continuity between abstract senses and grammatical functions, we can treat the cognitive foundations of grammatical functions as well.

4. The Cognitive Foundations of the Grammatical Function of *Under*

This section discusses the cognitive foundations of the grammatical function of *under*. As mentioned in §1, *under* grammatically functions as a head of protasis as in (6).

(6) *Under* the previous law, the offence *could be* committed in public only. \( (BNC) \)

To discuss the cognitive foundations of this grammatical function, we will analyze the different characteristics of the control senses of *over* and *under* in §4.1, the spatial foundations of the control senses in §4.2, and, how the grammatical function of *under* is derived from its control sense in §4.3.

4.1. Characteristics of the Control Senses

The control sense is usually defined as “the TR exert[ing] influence or control over the LM” (Tyler and Evans (2003: 101)). It typically has three participants: CON-er, CON-ee, and PWR, as shown in (7).

\[
\begin{align*}
\text{(7) a. I} & \quad \text{have no control} \quad \text{over} \quad \text{what she says.} \\
& \quad \text{CON-er} \quad \text{PWR} \quad \text{CON-ee}
\end{align*}
\]

\[
\begin{align*}
\text{b. We} & \quad \text{are under his control.} \\
& \quad \text{CON-ee} \quad \text{CON-er} \quad \text{PWR}
\end{align*}
\]

However, upon closer examination, we can see that the control senses of *over* and *under* illustrate different types of control. Put simply, *over* describes the direct control by the CON-er, while *under* describes the situation where a CON-ee is located under the influence of the CON-er. Tyler and Evans (2003: 102) present two elements associated with the concept of control: “the first is up, and the second is physical proximity.” However, this is only true of the control sense of *over*. The control sense of *under* has quite different characteristics.

We will first discuss the control sense of *over*. The sentences in (8) are typical examples of the control sense of *over* in that the three participants are expressed linguistically.
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(8) a. He has no control over the length of speeches.
    b. The president holds sway over all the important decisions.
    c. China exercises sovereignty over Hong Kong.

In (8), CON-er, PWR, and CON-ee are realized as the subject, the object, and the complement of over, respectively. The characteristics of the control sense of over are summarized as follows: CON-er, appearing as the subject, tends to be a human being or organization having a will and power; the object shows PWR, usually expressed by abstract nouns such as power, and influence; and CON-ee, followed by the object nouns, appears as the complement of over. Furthermore, verbs used with the control sense of over are typically either verbs of possession or acquisition as in (8a) and (8b), or verbs that express the exertion of power as in (8c).

Next, the sentences in (9) illustrate the typical control sense of under. These examples indicate that the control sense of under has characteristics quite different from those of over.

(9) a. They are under contract.
    b. She came under the influence of Herbert Spencer.

In (9), the three participants are realized as follows: CON-ee appears in the subject, PWR appears as the complement of under, and the CON-er optionally appears in the under phrase with a genitive case. Typical verbs used with the control sense of under are copula verbs as shown in (9a), or intransitive verbs as in (9b).

Based on these contextual characteristics of over and under, we can form a general image of the typical constructions in which these two control senses are used, as in (10) and (11):

(10) a. [CON-er] + [transitive verbs (possession/acquisition)] + [PWR] + [over] + [CON-ee]
    b. [CON-er] + [transitive verbs (exertion of force)] + [PWR] + [over] + [CON-ee]

(11) a. [CON-ee] + [copula verbs] + [under] + [PWR (+ CON-er)]
    b. [CON-ee] + [intransitive verbs (change in state)] + [under] + [PWR (+ CON-er)]

(10a) and (10b) exemplify the prototypical constructions of the control sense of over, while (11a) and (11b) show those of under. As these typical constructions illustrate, the control senses of over and under display two key differences. First, the over phrase is located within the object noun phrase,
while the *under* phrase tends to appear as an adjunct or complement.\(^5\) This is suggested by the type of verbs that are used in these constructions: *over* tends to co-occur with transitive verbs, while *under* tends to co-occur with less transitive verbs such as intransitive or copula verbs.

The second salient difference concerns the relation of the prepositions to power. *Over* shows a direct relation to a specific form of power, while *under* is less specific in this regard. This is suggested by the grammatical use of CON-er. In *over*, CON-er appears in the subject position and is therefore obligatory. The subject, typically a particular human or organization, tends to exert its power directly on the CON-ee. In contrast, the control sense of *under* signifies a region where CON-ee is dominated, rather than a specific form of power. For example, though the sentence in (9b) shows that the subject *she* is influenced by *Herbert Spencer*, *Herbert Spencer* does not have a will to exert a specific power over the subject *she*. The *under* phrase illustrates the region that is dominated by PWR. Here, CON-er appears within the *under* phrase as a genitive case, and is therefore optional. In an extreme case, CON-er is not expressed linguistically because it is very general, as in (9a).

The different characteristics that divide the control senses of *over* and *under* are summarized in Table 1.

| types of control   | control sense of *over* | control sense of *under* |
|--------------------|-------------------------|--------------------------|
|                    | active                  | situational              |
|                    | (controller’s active    | (controlee is located    |
|                    | control)                | under control)           |
| grammatical        | part of object noun     | adjunct or complement    |
| status             | phrase                  |                          |
| transitivity       | more transitive / direct| less transitive / indirect|
| types of power     | more specific           | less specific            |

\(^5\) A reviewer asked us to show data that supports this characteristic of the *under* phrase. This generalization is based on Ohta’s (2009) quantitative study of frequently-occurring patterns in *BNC*. Ohta (2009) examines the grammatical relation of the control sense of *under* to its main verb. The result shows the *under* phrase usually co-occurs with either intransitive verbs or copula verbs, and rarely co-occurs with transitive verbs. Thus, we can conclude that *under* phrases can be used as an adjunct with intransitive verbs, or as a complement with copula verbs.
The data in Table 1 suggest that the control senses of *over* and *under* signify different types of control: *Over* usually refers to direct and active control of CON-er, while *under* refers to a state in which the CON-ee is dominated. This characteristic of *under* is important because it serves as the foundation for the preposition’s grammatical function as a head of a protasis.

### 4.2 The Spatial Foundation of the Control Sense

In this section, we argue that the control senses of *over* and *under* are derived from different types of spatial sense or, alternately phrased, that their differences are motivated by different types of spatial experience. In discussing the spatial foundations of these control senses, we will focus on various asymmetrical characteristics along the vertical axis in the perceived world, because vertical elevation is experientially associated with control or power (see Tyler and Evans (2001: 758)). In the perceived world, our experience informs us that gravity always causes things to drop to the ground. This characteristic makes up part of our encyclopedic knowledge and greatly influences our understanding of *over* and *under*. That is, asymmetries along the vertical axis of the perceived world motivate asymmetrical semantic extensions at the linguistic level.

The sentences in (12) are usually interpreted as illustrating different types of events. Though they are a minimal pair of sentences, many contrastive behaviors are observed.

(12) a. He walked *over* the bridge.
    b. He walked *under* the bridge. (Otani (2012a: 48))

The example in (12a) is understood as *he* (the TR) walked across (and, hence, upon) *the bridge* (the LM). In contrast, the example in (12b) is interpreted as the TR walked, not on the LM, but on the ground, which is not

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6 A reviewer asked us to show the supporting data of this statement. As we mentioned above, the CON-er in the control sense of *over* and *under* have quite different characteristics. The CON-er with the control sense of *over* appears in the subject position and tends to be a human being or organization. They have a will and tend to exert power directly. In contrast, the CON-er of the control sense of *under* is usually very general, such as non-human as in (9b), or sometimes not expressed as in (9a). When the CON-er is general, it has no will and the CON-ee is thought to be located under some kind of general PWR.

7 Tyler and Evans (2003: 101) note that “[f]or most of human history, when one person has been in physical control of another person, control has been experienced as the controller being physically higher. … Hence an important element of how we actually experience control … is that of being physically higher than that which is controlled.”
linguistically expressed. In (12b), the LM functions as a setting for a situation under which the event of walking occurs. The point here is that the different interpretation is caused by asymmetrical characteristics along the vertical axis. We know that humans cannot walk on the underside of the bridge due to gravity.

Moreover, the difference in interpretations in (12) reflects further asymmetries along the vertical axis. One of the asymmetries is contact-ness, which is observed between two physical objects. When two objects are in contact, a transmission of energy occurs between them. In (12a), the lower LM, the bridge, experiences direct pressure from the upper TR, he, due to gravity, while in (12b), the lower TR, he, receives no pressure from the upper LM, the bridge, because the two are not in direct contact.

This direct pressure imported from the upper TR to the lower LM is generally thought to be the foundation for the control sense. For example, Tyler and Evans (2003: 102) note that “to be able to exert control, one must be physically proximal to the subject, in order to affect the subject’s actions.” Let us turn to the example in (13).

(13) The fight ended with John standing over Mac, his fist raised.

(Tyler and Evans (2003: 101))

The example in (13) shows that the spatially upper TR also physically controls the lower LM.

However, it seems that the control sense of under is derived from a different spatial foundation. That is to say, in the two elements associated with the concept of control, being physically higher and being physically proximal, the latter is not crucial for the control sense of under. In the control sense of under, the TR and the LM tend not to be in contact, similar to the spatial relation between the lower TR and upper LM in (12b). In such a situation, energy cannot be transmitted directly between the two objects.

Therefore, in order to discuss the foundation of the control sense of under, we need to deal with another asymmetrical characteristic in the perceived world. Here, we focus on the asymmetry in the role of the LM. Revisit the contrastive examples in (12). They suggest that, if some event occurs over the LM, it happens on it (see Figure 3). In contrast, if some event happens under the LM, it does not usually occur on the underside of the LM, rather it tends to occur on the unexpressed ground which supports the TR (see Figure 4). In this case, the LM functions as a general setting that specifies the region where various events occur.

It should be noted that this different characteristic—the function of under
The grammatical function of *under* as a head of protasis—
is caused by another asymmetry in the vertical axis, i.e. the
boundedness of the regions that are located over or under LMs. If we
compare the two regions, the region under the LM is more specified than
the region over the LM. We next turn to the examples in (14) and (15).

(14)  a. *Under* the table is dark.
     b.*Over* the table is dark.

(15)  a. The mosquito flew from *under* the table.
     b.*Over* the table.

In (14) and (15), the prepositional phrases are used as nominals. Generally,
prepositional phrases can be used as nominals when they specify a specific
region (see Langacker (1987)). So different acceptability between each pair
in (14) and (15) suggests that the region bounded by the *under* phrase is
more specific and clear than the region bounded by the *over* phrase.8

The point here is that these contrasting behaviors are also observed in the perceived world. For example, if we compare the region over the table and
the region under the table, the region under the table is much easier to be
specified, because it is bounded by a tabletop, four legs and the ground,
while the region over the table is usually not as clearly bounded.

Moreover, this difference as to the boundedness of the two regions moti-
vates the grammatical behaviors of the two prepositional phrases. That is,
in (16), the *over* phrase has the status of a complement, while the *under*
phrase has the status of an adjunct prepositional phrase. This difference is
suggested by the examples in (16).

(16)  a. #It is *over* the bridge where he walked.9
     b. It is *under* the bridge where he walked.

In (16), the two prepositional phrases are pre-posed. Huddleston and Pul-
lum (2002: 1418) note the contrastive behaviors of prepositional adjunct
phrases and prepositional complements. They argue that adjuncts, which
are independent of the event described by the verb, can be pre-posed, be-
cause they can be focused individually, while complements, inseparable
parts of the event illustrated by the verb, are less likely to be pre-posed

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8 Note that (14b) is acceptable in a situation such as the one where the lamp is above
the table in a dark room. But, here, the region over the table is bounded by the reach of
the light.

9 (16a) is acceptable when the *over* phrase is interpreted as showing a setting rather
than a path. But, *over* in (16a) has a tendency to be interpreted as illustrating the path
of the TR.
because they cannot be focused individually. Therefore, the contrastive behaviors in (16) suggest that the under phrase, illustrating the general situational setting, is an adjunct, while the over phrase, illustrating the path of the TR, is a complement.

The discussion above suggests that we generally see under, rather than over, used in the creation of a setting. And it is this usage that functions as the foundation of the control sense of under. That is, we regard the existence of someone under a physical region as a situation where someone is under the control of something. The differences between the spatial sense and the control sense belong to the type of regions—a spatial region or a region controlled by the CON-er.

The foundations of the two control senses are summarized in Table 2.

Table 2  Characteristics of the two control senses and their spatial foundations

|                      | the spatial sense | the control sense |
|----------------------|-------------------|-------------------|
|                      | over              | under             | over              | under             |
| type of event        | dynamic           | stative           | active            | situational       |
| TR/LM relation       | contact\(^{11}\)  | separate          | direct            | indirect          |
| grammatical status   | complement        | adjunct            | complement        | adjunct            |

To sum up, the control sense of over is motivated by the experience of a spatially upper TR exerting its power upon the spatially lower LM. In contrast, the control sense of under is motivated by the experience of the TR located under the region of the LM. Here, the TR and the LM do not necessarily approximate each other. In this case, the LM functions as a setting under which some event occurs, and the under phrase tends to be used as an adjunct. The point here is that these different characteristics of the two control senses are motivated by our experience, reflecting various asymme-

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\(^{10}\) See Huddleston and Pullum (2002: 1418) for a more detailed discussion. They note “[w]here the function is that of the adjunct rather than complement, it depends very much on the semantic category of the adjunct whether foregrounding is possible.”

\(^{11}\) The TR and LM are not in contact in the prototypical sense of over as in (i) and (ii).

(i) The lamp is over the table. (static sense)
(ii) The plane flew over the hill. (dynamic sense)

However, with regard to the spatial foundations of the control sense, the TR and LM are in contact. Therefore, the spatially upper TR can apply direct pressure upon the lower LM.
tries along the vertical axis in the perceived world.

4.3. From the Control Sense to the Grammatical Function

In this section, we will discuss how the grammatical function of *under* as a head of protasis is derived from the control sense. As we discussed above, *over* and *under* differ in their control sense. Though *over* depicts the direct control of a CON-er over the CON-ee, *under* illustrates a situation where the CON-ee is located within an abstract region, as in (17).

(17) a. *Under* the old law of larceny he may not have been guilty of attempted larceny.

b. These schools come under the control of the Department of Education.

c. She was obviously under the influence of drugs. \( (BNC) \)

In each sentence in (17), the phrase headed by *under* specifies the abstract region that controls either the event illustrated by the main clause as in (17a) and (17b), or the subject of the sentence as in (17c). This control sense of *under* is the foundation of its grammatical use as a head of subjunctive protasis. We next turn to the examples in (18).

(18) a. He will not be able to tell them how much they would pay under the Labour party system.

b. *Under* a Labour government, the situation might not be that different. \( (BNC) \)

The examples in (18) feature the three participants of the control sense. For example, in (18a), *the Labour party* is CON-er, *they* is CON-ee, and *system* is PWR. However, at the same time, the region controlled by the controller can function as a protasis. That is, the *under* phrase functions as a presupposition that is controlled by a particular condition, and the subject in the main clause is located under that condition.

This protasis use of the *under* phrase has a similar function to *if*-clauses, and can be paraphrased as such in certain contexts.

(19) a. *Under* the agreement, the prices would increase.

b. *If* they were under the agreement, the prices would increase.

(20) a. *Under* his father’s control, he would be happy.

b. *If* he were under his father’s control, he would be happy.

In the sentences in (19) and (20), the apodosis becomes strange without its protasis, because the space where hypothetical events occur needs to be specified. Here it seems that the *under* phrase has a function to ‘introduce’ the region where the events illustrated by the associated main subjunctive clauses occur.
However, there are some differences between the functions of the protases headed by under and if. That is, because the function of the apodosis headed by under is derived from the control sense, the referent illustrated by a complement NP should be a specific region.

(21)  a. Under the agreement, the prices would increase.
      b. ?Under no agreement concerning the matter, the prices would increase.
      c. ??Under no agreement, the prices would increase.

(22)  a. Under his father’s control, he would be happy.
      b. ?Under no control of his father, he would be happy.
      c. ??Under no control, he would be happy.

In (21) and (22), the different acceptability of the three sentences is determined by the type of referent illustrated by the complement NP of under. The sentences in (21a) and (22a) are acceptable because the agreement and his father’s control can be regarded as abstract regions. However, the acceptability decreases in (21b) and (22b) where the referents of the complement NPs do not clearly show a specific region. Finally, in (21c) and (22c), the referents of the complement NPs—no agreement and no control—are difficult to regard as regions; therefore, the sentences become very strange or almost ungrammatical.

In contrast, the protasis headed by the conjunction if can be used in wider linguistic contexts than that of under. The sentences in (21) and (22) can be paraphrased as the sentences in (23) and (24). All sentences are acceptable.

(23)  a. If there were an agreement, the prices would increase.
      b. If there were no agreement concerning the matter, the prices would increase.
      c. If there were no agreement, the prices would increase.

(24)  a. If his father exerted control, he would be happy.
      b. If his father exerted no control, he would be happy.
      c. If no control were exerted, he would be happy.

The behaviors of (23) and (24) are contrastive to those of (21) and (22). This contrast suggests that under is still in the process of grammaticalization. That is, even when under is used as a head of protases, it still holds its spatial images.

Table 3 summarizes the foundations of the grammatical function of under.
Table 3  Characteristics of the control sense and the grammatical function of *under*

| region depicted by *under* phrase | the control sense | the grammatical function               |
|-----------------------------------|-------------------|----------------------------------------|
| the role of subject               | controlee         | sb/sth under a condition                |
| the role of *under* phrase        | controller        | general condition                       |

Table 3 shows that the *under* phrase in both the control sense and the grammatical function specifies the region where the subject is located. When the region is controlled by the CON-er, we classify the use of *under* as the control sense. However, when the region is dominated by some condition, the subjunctive mood can be used in the main clause and the use of *under* is classified as the grammatical function.

Finally, we will mention that there are some differences between the typical control sense and the grammatical function of *under*. One prominent difference is that in the control sense, someone or something that controls the situation (i.e. the CON-er) is crucial and must generally be expressed. However, in the grammatical function, the *under* phrase only illustrates a situation in which the CON-ee is located. Here, the CON-er that dominates the situation is usually backgrounded, making the CON-er likely to go unexpressed. In protasis use, the CON-er does not play an important role. Another difference is observed in the order of protasis and apodosis. Though the control sense of *under* tends to appear within the main clause or after the main clause, the grammatical function of *under* tends to appear before the main clause.

5.  Theoretical Implications

5.1. Need for a More Fine-Grained Embodied View of Language

This section attempts to relate the findings above to more general linguistic phenomena, and suggests solutions to the two problems raised in §2.2. One of the findings of this study is that the asymmetrical characteristics between *over* and *under* are motivated by various asymmetrical characteristics along the vertical axis in the perceived world. This suggests a need for a more fine-grained view of the embodiment of language, because the asymmetrical characteristics of the perceived world are foregrounded
only through a fine-grained view.

Both the coarse-grained view and fine-grained view are essential perspectives in any discussion of antonymy. Taking the vertical axis as an example, the coarse-grained view yields a simplified view of the world, abstracting away excess information. It is this abstraction that enables us to recognize the antonymic relations between seemingly unrelated concepts, such as in Figure 2 above. In contrast, as shown in this study, through the fine-grained view, we can realize that the vertical axis in the perceived world is structured asymmetrically, and that the various asymmetrical characteristics along the vertical axis, in turn, motivate asymmetrical characteristics between antonyms both semantically and grammatically.

Most cognitive linguistics research has already adopted the embodied view. We, however, emphasize the importance of the “fine-grained view,” arguing that the various asymmetries observed between antonyms can only be discussed through such a perspective. In other words, through the fine-grained view, we can better understand how the numerous asymmetries that develop at the linguistic level result from asymmetries in the perceived world, or background domains in the case of abstract antonyms such as big-small and happy-sad.

5.2. The Cognitive Foundation of Grammatical Functions

This study also found that the grammatical function of under is derived from its control sense, and that the control sense has its basis in the preposition’s spatial sense. This finding allows us to focus on the continuity problem. That is, it demonstrates the continuity between under’s lexical sense and its grammatical function, a fact which many previous studies of prepositions have ignored.

Figure 6 shows that no clear boundary exists between the control sense and the grammatical function of under.

![Figure 6](image-url)  
**Figure 6** Various linguistic changes observed in *under*

Figure 6 also suggests that the two types of linguistic change—semantic extension and functional change—share the same cognitive foundations. In *under*, both the control sense and the grammatical function are derived from the spatial sense. The only difference between them is whether the abstract region specified by the *under* phrase is controlled by a CON-er or by an
overarching condition. In the latter case, the verb in the main clause could be used in the subjunctive. Once we acknowledge the continuity between the abstract (i.e. control) sense and the grammatical function, we can better understand how the ways in which we perceive the world motivate both semantic extension and functional change.\textsuperscript{12}

6. Conclusion

The present paper discussed the cognitive foundations of the grammatical function of \textit{under} by focusing on the asymmetrical semantic extension between \textit{over} and \textit{under}. It argued the following points: first, the grammatical function of \textit{under} is derived from the control sense of the preposition, which in turn has its basis in the preposition’s spatial sense; second, though the control senses of \textit{over} and \textit{under} have traditionally been placed in the same category, they exhibit different types of control; third, the asymmetry along the vertical axis of the perceived world motivates not only asymmetrical semantic extensions but also establishes the grammatical function of \textit{under}.

These findings have two implications for general linguistic research. First, they offer a practical method for the study of linguistic embodiment. That is, comparing asymmetrical semantic extensions between antonyms is useful to reveal the cognitive foundations of linguistic structures. By focusing on asymmetrical semantic extensions between antonyms, which are typically thought of as conceptually symmetrical, we can better understand how our conception of the world motivates the development of linguistic structures.

Second, this study broadens the scope of research on polysemy, espe-

\textsuperscript{12} A reviewer pointed out to the authors that \textit{under} does not acquire a new grammatical function, because \textit{under} is used as a preposition in any use. It is true that the word class of \textit{under} does not change, and that \textit{under} is still in the process of grammaticalization. But, the function of \textit{under} definitely changes in that it can be used as a head of protases (see footnote 2).

Traugott (1995) shows a similar type of grammaticalization, from propositional to textual.

(i) Mary read while Bill sang. (temporal connective)

(ii) Mary liked oysters while Bill hated them. (concessive connective)

Though the two \textit{whiles} in (i) and (ii) are both conjunctions, \textit{while} in (ii) is “more subjective in meaning, more grammaticalized, and historically later in development than its cognate” in (i) (Traugott (1995: 30)).
cially the polysemy of English prepositions. Previous studies have dealt exclusively with the semantic extension of prepositions and their cognitive foundations. They usually restricted their research scope to the domain of semantics, eliminating various grammatical functions from the network of polysemy. In contrast, this study has discussed the cognitive foundations of the grammatical function of prepositions by focusing on the continuity among spatial senses, abstract senses, and grammatical functions. This suggests that we can extend the scope of research on polysemy and relate it to more general fields of linguistics such as grammaticalization.

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A reviewer asked the authors whether the continuity problem really exists or not. In traditional studies of polysemy, which delimit their research scope within semantics, the continuity problem may not exist. But, considering that general linguistic changes are inherently gradual, it is hard to draw a rigid line between senses and functions. By focusing on this continuity, we can deal with various aspects of prepositions that many previous studies have ignored. The table below shows the emphases of traditional studies and this study.

|                           | traditional studies                          | this study                           |
|----------------------------|---------------------------------------------|--------------------------------------|
| research background        | discreteness between sense and function     | continuity between sense and function|
| research object            | lexical sense                               | lexical sense and function           |
| research emphasis          | stable properties that lexical items have   | dynamic properties that emerge in discourse |
| research field             | semantics                                   | semantics, pragmatics, grammar, discourse theory |
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