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# Lexical typology and semantic maps: Perspectives and challenges

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**Abstract:** The paper outlines the basics of data collection, analysis and visualization under the frame-based approach to lexical typology and illustrates its methodology using the data of cross-linguistic research on verbs of falling. The framework reveals several challenges to semantic map modelling that usually escape researchers' attention. These are: (1) principles of establishing lexical comparative concepts; (2) the effective ways of visualization for the opposition between direct and figurative meanings of lexical items; (3) the problem of the borderlines between semantic fields, which seem to be very subtle. These problems are discussed in detail in the paper, as well as possible theoretical decisions and semantic modelling techniques that could overcome these bottlenecks.

**Keywords:** lexical typology, frame-based approach, verbs of falling, metaphor, metonymy, semantic continuity

## 1 Introduction

Semantic maps have become one of the staple instruments in linguistic typology. Originally suggested by grammatical typologists, semantic maps (in various designs) have been implemented in numerous studies (see Anderson 1986; van der Auwera and Plungian 1998; Haspelmath 2003; Croft and Poole 2008, among many others). Recently, semantic maps have received recognition as an instrument for research of lexical typology (see Majid and Bowerman 2007; François 2008; Wälchli and Cysouw 2012; Georgakopoulos et al. 2016; Rakhilina and Reznikova 2016). The crucial consequence is that if regular patterns in lexical expression of different conceptual domains can be captured and visualized as semantic maps, this will contribute to the body of empirical evidence confirming that lexicon –

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much like grammar – is an organized system. However, the experience amassed in research shows that lexical meanings are substantially different from the meanings found in grammar (see, for example, Talmy 2000). In order to address the issues that are specific to description of lexical meanings, the existing models of semantic maps need to be modified and adjusted accordingly.

The problem of constructing semantic maps – including lexical ones – has been increasingly discussed by typologists (cf. Croft 2001; Haspelmath 2003; Croft and Poole 2008; Janda 2009; Zwarts 2010; Georgakopoulos and Polis 2018, see also the present volume). The present paper gives an overview of the design of lexical maps which follows the frame-based approach to lexical typology adopted by the MLexT group (for more details, see Koptjevskaja-Tamm et al. 2016; Rakhilina and Reznikova 2016). There is a considerable body of typological studies using the MLexT approach, with a focus on several semantic fields: verbs of motion in a liquid medium (Maisak and Rakhilina 2007; Lander et al. 2012), verbs of rotation (Kruglyakova 2010), verbs of animal sounds (Rakhilina et al. 2017), physical qualities (Rakhilina et al. 2022), and others. These studies have identified three areas which appear to be the most problematic with regard to the design of semantic maps when moving from grammar to lexical data. These three areas will be analyzed in detail in the rest of this paper.

The first problematic area concerns the principles of establishing the basis for cross-linguistic comparison of lexical meanings. This issue is discussed in Section 2. The two other problems are related to heterogeneity of lexical meanings, namely to the ability of words to be used both directly and figuratively. When semantic shifts<sup>1</sup> are based on similarity, they are traditionally referred to as *metaphors*. Metaphorical extensions are usually regarded to be cross-domain mappings, with their target meanings lying outside the source semantic field (see Lakoff and Johnson 2008 [1980]; Kövecses 2010). Due to this, representation of metaphors on semantic maps constitutes a problematic area. Aspects of this problem are examined in Section 3. Meanwhile, contiguity-based shifts, or *metonymies*, are generally known as intra-domain mappings (Kövecses 2010). However, we show that some of them also appear to end up in a semantic field other than that of the primary meaning, and hence metonymy also causes problems for designing semantic maps; such cases are discussed and illustrated with examples in Section 4. Lastly, Section 5 summarizes the discussion and suggests directions for future research.

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<sup>1</sup> Following Zalazniak et al. (2012) and Newman (2016), among others, we will use the term (*semantic*) *shift* to refer to semantic change of any kind.

## 2 First problem: basis for cross-linguistic lexical comparison

### 2.1 Frame as an element of the universal lexical set

In state-of-the-art grammatical typology, *comparative concept* (Haspelmath 2010) is considered to be a key notion for comparison of grammatical data from multiple languages, and it is comparative concepts that are plotted as data points on semantic maps (Haspelmath 2018).

However, researchers differ in their vision of the nature of these concepts. As originally stated in Haspelmath (2010), a set of comparative concepts is created by the researcher, proceeding from the facts of the languages under study for purely practical reasons of their effective comparison. According to this view, there is no universal inventory of comparative concepts. Instead, there are multiple aspects of language comparison, each of which may require its own set of comparative categories. The other vision (adopted in Bybee and Dahl 1989; Mel'čuk 1994; Dahl 2000; Plungian 2011; cf. also Saint-Petersburg school of grammatical typology: Kholodovich 1969; Nedjalkov 2007, etc.) makes a more ambitious assumption, according to which grammatical categories and their members are typically understood as elements of a universally available, language-independent set of elementary grammatical meanings, or *functions*, which in principle can be grammatically coded in language – either by a specialized marker or by a marker shared with another element of the set.

The number of meanings that can be coded by grammatical markers across languages is rather limited (cf. the term *closed-class* concepts in Talmy 2000), which simplifies the task of their comparison. The number of lexical meanings is vastly greater, cf. the following citation from Talmy (2000: 37): “[...] language may have a universally available, limited inventory of concepts and conceptual categories that can ever be represented grammatically. [...] No comparable inventory for lexically expressible concepts exists because open-class forms can for the most part refer to anything within the whole range of potential contents of consciousness.” Yet, some research groups engage in comparison of lexicons across languages – and thus, they explicitly (or implicitly) search for this universal set of lexical meanings.

Currently, there are several approaches to designing the network of universal lexical meanings that are practiced by the community. First and foremost, typologically relevant elementary meanings can equate to dictionary subsenses – as, for instance, in the work of François (2008) or Youn et al. (2016). A similar strategy is adopted in CLICS<sup>3</sup>, the largest lexical database (Rzyski et al. 2020), which

serves as a source of data for lexico-typological investigations, amongst others (see, e. g., Georgakopoulos and Polis 2021; Georgakopoulos et al. 2021). Secondly, segments of extralinguistic reality can be taken to represent the basis for comparison; this strategy is natural for the denotation-based approach to the study of lexicon (Majid 2015), which is in line with a traditional onomasiological framework (see Fernández-Domínguez 2019). Thus, body parts can act as universally available anchors for comparison in the analysis of body part terms (Majid et al. 2006); shades of different colors defined by the physical parameters of hue, lightness, and chroma can be used to investigate color terms (Berlin and Kay 1969; Kay et al. 2009); certain chemical compounds can be instrumental when studying gustatory and olfactory lexical fields (Wnuk and Majid 2014). Within this approach, a set of elementary meanings usually takes the form of an *etic grid* (Evans 2010) comprised of all logically possible combinations of all the relevant parameter values.

A remarkable approach to analysis of lexical semantics – including cross-linguistic analysis – is promoted by the theory of Natural Semantic Metalanguage, developed by Wierzbicka and Goddard (see, e. g., Goddard and Wierzbicka 1994). According to this theory, the meaning of any word in any language is composed of semantic primitives (such as ‘someone’, ‘something’, ‘big’, ‘small’, ‘do’, etc. – about 60, in total in its current form). Nevertheless, semantic primitives can hardly be regarded as a direct lexical analogue to a presumable language-independent universally available inventory of grammatical concepts, due to the fact that they combine in accordance with special syntactic rules and represent the “building blocks” for lexical meanings rather than lexical meanings as such. As a consequence, semantic primitives are far too complex to be graphed in a semantic map. Not surprisingly, the theory of Natural Semantic Metalanguage usually does not make use of the semantic mapping method (cf., however, a complex 3D semantic map model built on the basis of semantic primitives in Martín Arista 2018).

In addition to the existing approaches, we have developed our own methodology for establishing concepts for lexical cross-linguistic comparison, which can be called *frame-based* (Rakhilina and Reznikova 2016), and have applied it in multiple studies of lexical typological data. Unlike Haspelmath’s comparative concepts, our conceptual categories are not invented by typologists. Rather, we see them as elements of a basic universal structure underlying every individual lexical system, and the main objective of our studies consists in uncovering this structure. We identify elementary meanings using contextual distributions of lexemes which constitute the field under examination. This is why Koptjevskaja-Tamm et al. (2016) call this approach *distributional*. In scrutinizing the words’ distributional properties, we follow the tradition of the Moscow Semantic School with

its rich body of experience in comparing the meanings of close synonyms via in-depth analysis and comparison of the contexts of their usage (Apresjan 2000).

In our approach, a concept for comparison, or a node on a semantic map, is a prototypical situation belonging to the semantic field in question, which can be described by a dedicated lexical item in a certain language, *L*. For example, there is a whole range of physically perceivable situations which can be classified as ‘falling’. Among them is a specific class of falling events presupposing a vertically oriented solid object which unintentionally loses its vertical orientation (cf. the falling of a tree). This situation type clearly differs from situations in which an object as a whole falls from an elevated surface (cf. a cup falling from a table), as well as from some other falling events (see the details in Section 2.3 below). And indeed, we find languages in which loss of vertical orientation is denoted with a dedicated lexeme and thus is lexically opposed to falling from an elevated surface (cf. *taoreru* versus *ochiru* in Japanese). We interpret each semantic field as a set of such situations.<sup>2</sup> Similarly to elementary meanings in grammar (cf. Bybee and Dahl 1989; Dahl 2000; Plungian 2011), these situations could be termed as elementary lexical meanings; some situations are semantically closer to each other, while others are more distant – thus, they form a structure. In the first case, the probability that the two meanings will be covered with a single lexical item in *L* – i. e. they will be *colexified*, in terms of François (2008) – will be high. In the second scenario, there is a higher probability for the two meanings to be covered by two distinct words (i. e. they will be *dislexified*; see also François 2022). Prototypical situations with their participants, such as loss of vertical orientation by a solid elongated object within the field of FALLING, are referred to as *frames*. The set of frames constituting the field under study, along with the relative semantic distances between them (which are quantified as the frequency of colexification of frames) correspond to the frame structure of the field which is depicted in our semantic maps.

Our frames are inspired by Charles Fillmore’s frame semantics (Fillmore 1976): we also determine the semantics of lexemes (predominantly, physical qualities and verbs) by means of the situation, or scenario, they denote. However, while in the traditional Fillmorian definition which is widely accepted in studies of syntactic semantics, knowledge of generalized semantic roles of the participants and their syntactic expressions is sufficient to differentiate frames from each other, lexical typology requires more fine-grained semantic features,

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<sup>2</sup> In this paper, we are dealing mostly with verbs, which most naturally lend themselves to analysis via situation types. However, we use the same framework when studying adjectives (see Rakhilina et al. 2022) and even nouns (see Kyuseva et al. under review).

such as the taxonomic or topological type of each participant. Fillmore was well aware of this fact; when comparing the semantics of different languages, he placed emphasis on the semantic restrictions imposed on the participants of a situation – as demonstrated in Fillmore and Atkins (2000) which discusses the English verb *crawl* in comparison with its French translation equivalent *ramper*. Originally, however, the system of frames (including the one used in FrameNet<sup>3</sup>) was created for other purposes (such as semantic role labelling) rather than for lexico-semantic tasks.

To illustrate our claims, we will keep referring to the semantic field of *FALLING* throughout this paper. In FrameNet, the central English verb of falling, *fall*, is placed in the frame *Motion\_directional* which is defined as follows: “In this frame a Theme moves in a certain Direction which is often determined by gravity or other natural, physical forces. The Theme is not necessarily a self-mover.”<sup>4</sup> This definition is apparently very generic and could possibly fit more than one verb, e. g. *fall*, *descend*, *rise*, *plummet*, *plunge*, *slant*, and others. Since we aim to identify elementary lexical meanings, we narrow this definition down so that the resultant types of situations allowed us to capture the differences in usage of the words under consideration. This is achieved by adding semantic restrictions both on the situation itself and on all its participants. We define these semantic restrictions through the analysis of contexts of the particular verbs’ usage, paying attention to taxonomic and topological classes of words appearing as their arguments, in the same way as Fillmore and Atkins (2000) do. For example, the Japanese verb *taoreru*, denoting loss of vertical orientation (Panina 2020), requires that its subject should be expressed by noun phrases referring to elongated solid physical objects with a canonic vertical orientation, such as tree, pivot, or person, and is not compatible with objects of other shapes (topological types); the same restriction holds in many other languages (Czech, Adyghe, Hungarian, and others) which distinguish this situation type lexically. Such linguistic evidence encourages us to establish a specific frame of loss of vertical orientation which has no analogue in FrameNet and which would be considered as an instance of the *Motion\_directional* frame within the Fillmorian frame system.

Thus, for studies in lexical typology, we differentiate downward – and moreover, uncontrolled – motion as a separate field with juxtapositions which are exclusive to it and which cannot be found either in directional upward motion (‘rising’) or in controlled downward motion (‘descending’). The juxtapositions and the

<sup>3</sup> <https://framenet.icsi.berkeley.edu/> (30 July 2021).

<sup>4</sup> [https://framenet2.icsi.berkeley.edu/fnReports/data/frameIndex.xml?frame=Motion\\_directional](https://framenet2.icsi.berkeley.edu/fnReports/data/frameIndex.xml?frame=Motion_directional) (30 July 2021).

procedure for identification of elementary lexical meanings will be dwelt on in the subsequent sections of this paper.

## 2.2 The frame identification procedure

In our experience, depending on theoretical premises alone is unlikely to predict which of the hypothesized juxtapositions will actually be lexicalized in the languages of the world. Therefore, we take a data-driven approach: in order to outline the set of frames for a semantic field, we start by conducting in-depth analysis of data from the researchers' native language (in our case Russian), since this language is the most accessible to them. Note that Russian is a well-resourced language in the sense that a sufficient number of corpora and dictionaries are available for it. At this point, we examine the words which we expect to belong to the field. We scrutinize the distribution of each word, i. e. analyze the contexts of its usage, which enables us to determine the sets of participants evoked by these words, as well as the semantic (taxonomic and topological) restrictions on selection of each participant. The obtained information shapes our preliminary understanding of the situations/frames constituting the field, and we design the pilot version of the questionnaire for analysis of other languages.

It should be noted that the central criterion for identification of frames in our paradigm is the possibility for a given situation type to be denoted by a dedicated lexical means, which makes our approach data-driven and replicable. Of course, in such an approach, it is insufficient to rely on data from only one language in order to compile the inventory of typologically relevant lexical meanings. Thus, for example, Russian data does not allow us to confidently ascertain the frame of loss of vertical orientation, since the Russian verb *padat'* colexifies it with downward falling as well as with several other types of falling. Still, evidence from only one language may be sufficient enough for us to predict that this opposition may be lexicalized in other languages, because, when analyzing the distribution of the verb *padat'*, we notice that it can denote situations with different sets of participants and different restrictions on them, cf. movement of an object between initial location and final destination versus change in spatial orientation of solid elongated objects. Nevertheless, the known problem of differentiating between vagueness and polysemy, which is crucial in intra-language studies (see Geeraerts 2016), does not affect us, because in the resultant set of frames we include only such meanings that can be identified lexically in at least one language of the sample.

At the next step, we repeat the procedure with translation equivalents of the Russian words in several other languages,<sup>5</sup> giving preference to well-resourced languages. Detailed analysis of these lexemes is entrusted to experts in the respective languages who examine data retrieved from corpora (if available) and interviews with native speakers. The collected information allows us to extend and modify the pilot questionnaire by adding new subtypes of situations/frames which were previously “invisible” (i. e. colexified) in Russian. At this point, we can corroborate presence of opposition between downward falling and loss of vertical orientation (as attested, for example, in Japanese data). Moreover, we may notice additional, more fine-grained oppositions which could not be easily identified beforehand. For example, there are two verbs of loss of vertical orientation in Nenets, one of which (*t'indas'*) describes falling of a person with their face downwards, and the other (*l'asas'*) falling on one's back. There is no dedicated verb for either falling face downwards or for falling on one's back in Russian. Thus, contexts for testing this distinction are added to our questionnaire only after we have faced the Nenets data. However, our procedure has a helix structure: once we find a new lexical opposition, we return to the languages that have been analyzed previously, and we check for this opposition in them as well. In this way, for example, we found that in Russian, as well as in many other European languages, the opposition between falling face downwards and falling backwards is expressed by adverbial modifiers (cf. *ničkom* ‘face downwards’ and *navznič'* ‘on one's back, backwards’). This helix structure ensures that, as a result of the research, we arrive at the same frame structure of the semantic field in question, regardless of the language we start from.

The resulting questionnaire is used in subsequent studies of other languages, including languages for which there are no available corpora or adequate dictionaries (for a more detailed step-by-step description of our methodology, see Rakhilina and Reznikova 2016; Ryzhova et al. 2019; Kyuseva et al. 2022). The ready-to-use questionnaire consists of a (preliminary) set of frames, i. e. of diagnostic contexts representing the types of situations that are relevant for the given semantic field. We consider them to be elementary lexical meanings, or elements of the universal lexical inventory. Data from languages that are added at the subsequent stages in order to expand and diversify the sample, enables us to finalize the set of frames and to measure the semantic distances between them. The next step consists in compiling the lexico-semantic map in order to visualize the frame structure of the field.

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<sup>5</sup> Our experience shows that a thorough analysis of 3–5 languages is enough to sketch the frame structure of the domain in question, see Rakhilina and Reznikova (2016) for more details.



## 2.3 Illustrations: frame structures of selected semantic fields

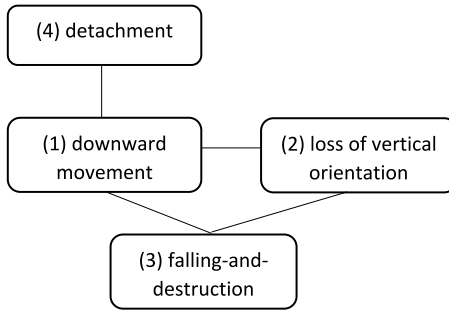
Let us return to the semantic field of falling. In our typological project, we have analyzed this field by applying our approach to a sample of about 40 languages. Overall, it is a complex and, in most languages, a lexically rich domain. A somewhat simplified version<sup>6</sup> of the field of falling contains four types of situations (i. e. frames) which are often lexically juxtaposed across the languages:

- (1) Downward falling of an object (i. e. uncontrolled motion from the initial position which is located above the final position; the motion is caused by gravity): e. g., when a cup falls from a table, a book falls from a shelf, an apple falls on a head, etc.;
- (2) Loss of initial vertical orientation by objects which are upright and attached to the surface at their bottom end: e. g., when a tree or a pole fall, or when a vehicle falls sideways, etc.;
- (3) Falling-and-destruction (the object disintegrates, and its fragments fall down): as when a building, a bridge, or a riverbank collapse;
- (4) Falling of an object which results from its (unexpected) detachment from the initial position where it used to be attached: e. g. when a rope slips from a nail, a ring slips from a finger, or when teeth or hair fall out.

In some languages (for example, in English, Punjabi, Basque, or Kabardian) all the identified frames can be denoted with a single verb – we use the term *dominant systems* to refer to them, bearing in mind that there is one lexical item within this lexical field, dominating other possible lexemes. All the other available lexemes are more specialized in meaning and compete with the dominant one only in a narrow set of contexts. In other languages (for example, in Khmer, Adyghe, Hungarian, and Chukchi) on the contrary, we attest *distributive systems* in which each of the frames is expressed by a specialized lexical item. Both types of systems are essential for semantic maps: while the dominant system outlines the boundaries of the field, the distributive system highlights the cognitively relevant situations/frames. Meanwhile, some languages feature lexemes that cover various combinations of two or three frames. This allows us to rank the frames in relation to each other by measuring their proximity: following the traditions of semantic mapping, we presume that frames that are covered with the same lexical item are closer to each other. The results of our investigations of the lexical systems of falling can be represented in the form of a classical semantic map (Georgakopou-

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<sup>6</sup> In particular, for the sake of simplicity we will for now exclude from consideration the falling of liquid and granular or powder-like substances, as well as minor distinctions such as falling face downwards versus falling on one's back that we mentioned above.



**Figure 1:** Semantic map of the field of falling.

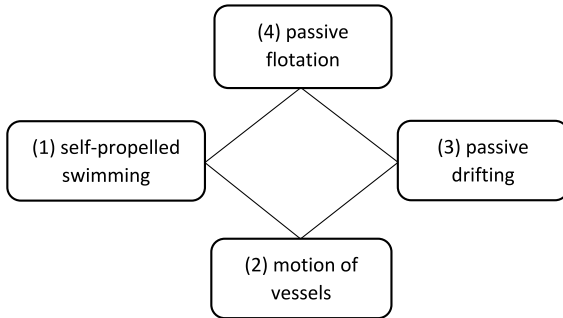
los and Polis 2018), as shown in Figure 1. According to it, none of the languages in our sample manifested the following combinations of frames: ‘loss of vertical orientation’ (2) and ‘detachment’ (4); ‘falling-and-destruction’ (3) and ‘detachment’ (4); ‘loss of vertical orientation’ (2) and ‘falling-and-destruction’ (3); ‘falling-and-destruction’ (3) and ‘detachment’ (4).

In other words, the following implications may be formulated from this map:

- if a lexeme covers the ‘detachment’ and ‘falling-and-destruction’ frames, then it also covers ‘downward movement’;
- if a lexeme covers ‘detachment’ and ‘loss of vertical orientation’, then it expresses ‘downward movement’ as well.

We choose to use classical implicational graph-like model rather than probabilistic continuous maps, since the former model is favored by the type of data we deal with. We identify frames, i. e. the nodes of the map, before we proceed to the mapping. In most cases, the number of nodes is rather small, so the main purpose of our maps consists in visualizing the constraints as to which combinations of frames, according to our data, are possible in languages, and which are very unlikely – whereas continuous maps are not suited for straightforward inference of constraints and require themselves an interpretation. Continuous maps are more suitable for the task of frame identification in large noisy data (e. g. in parallel corpora, as in Wälchli and Cysouw 2012). For a more detailed comparison of the two types of maps, see Georgakopoulos and Polis (2018).

One more illustrative example of frame structure and its visualization can be provided from the field of motion in a liquid medium, which has been extensively studied on a sample of more than 50 languages, diverse both areally and genetically (Maisak and Rakhilina 2007; Lander et al. 2012). This field also contains four major frames:



**Figure 2:** Semantic map of the field of AQUA-motion.

- (1) Self-propelled motion of humans and animals;
- (2) Motion of vessels and of humans by means of vessels;
- (3) Passive motion of an object (for example, a piece of driftwood) propelled by a current of water;
- (4) Passive flotation of an object on the surface of water (such as a leaf on water surface, or a slice of carrot in soup).

Slavic languages mainly feature dominant systems, with one verb covering the four types of situations described above. English represents the distributive system, that is, different verbs are used to denote the four frames: *swim*, *sail*, *drift*, and *float*, respectively. Meanwhile in German, for instance, there exists one dominant verb, *schwimmen*, which covers all the situation types, but along with it there is a number of frame-specific lexemes: *segeln* for motion of sailing vessels (frame 2), and *treiben* and *driften* for the zone of passive drifting and flotation (frames 3 and 4). Thus, the proposed set of situations/frames allows us to compare verbs of motion in a liquid medium across languages, as well as to differentiate quasi-synonyms within one language. The possible combinations of the four frames can be represented on a semantic map (see Figure 2).

It should be emphasized that each semantic field has its own set of frames which is exclusive to it. Overall, the set of frames must be defined for each semantic field individually on the basis of the analysis of language data. The same happens in research of grammatical categories, but the difference is that the number of lexical meanings in language seems to exceed the number of grammatical meanings by hundreds of times. Furthermore, while it may be considered that the set of universal grammatical meanings has been generally defined, even a crude approximation of the universal lexical set is still a matter of future typological studies.

Of course, the elements of the lexical universal inventory we suggest differ from denotation-based as well as from dictionary-based ones; however, common points can also be found. For adherents of the denotation-based approach, it is essential to determine which of the real, extralinguistic physical juxtapositions hold the potential for lexicalization in natural human language (see, for example, Levinson and Majid 2014). In this methodology, research of falling would require using pictures or video clips of different falling objects as stimuli in questionnaires. As for our approach, we are interested rather in purely linguistic processes and patterns; therefore, we strive to “purge” our data of physical parameters which are irrelevant for lexicalization of the semantic field under investigation as early as possible; that is, we eliminate the physical parameters and bear on evidence from dictionaries, corpora, and interviews with native speakers. Studies of different languages appear to suggest that, for example, in systems of ‘falling’ the characteristics of the object that is falling from an elevated surface is of no relevance – it does not matter whether it is round, long, or vertically positioned, and what its inherent function may be – all objects represent the same frame. On the contrary, the difference between a surface and a container as the starting point of the falling can in some languages be lexicalized. Such nuances can be captured and tested by means of respective pictures and videos; we borrow this methodology from the denotation-based approach in order to elaborate the frames of falling after the main hypotheses about the patterns of lexicalization in the field have been generated.

In terms of theoretical compatibility, our frames may also correlate with dictionary definitions. This can be observed when comparing our maps with the graph representations of semantic fields from the CLICS<sup>3</sup> database. CLICS<sup>3</sup> aggregates published and publicly available data about colexification of various meanings; its main sources are wordlists filled with data from different languages in accordance with uniform guidelines (see the project Intercontinental Dictionary Series, IDS, in Key and Comrie 2015). The entries in the wordlists – the presumed lexical subsenses – in a number of cases expectedly correspond to our frames. For instance, the cluster of meanings related to the concept ‘swim’ contains all the meanings established by us, with the exception of frame 3 (‘drifting’), see Figure 3.<sup>7</sup>

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<sup>7</sup> In the fields of swimming and falling, the respective clusters of CLICS<sup>3</sup> also contain a large number of meanings which are not distinguished in our maps. Yet, they all eventually boil down to the two major types: either “external” meanings which are colexified with a concept from the field in question in a very small number of languages, such as ‘walk’ or ‘dig’ in the ‘swim’ cluster, or meanings that are connected with a nuclear one via causative relations, such as ‘cut down’ or ‘drop (something)’ in the ‘fall’ cluster, which we systematically exclude from analysis.

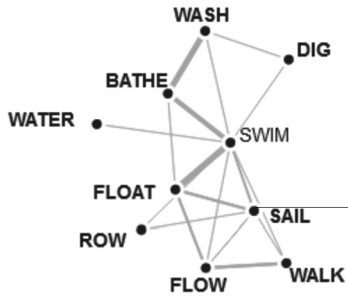


Figure 3: CLICS<sup>3</sup>: subgraph 'swim'.

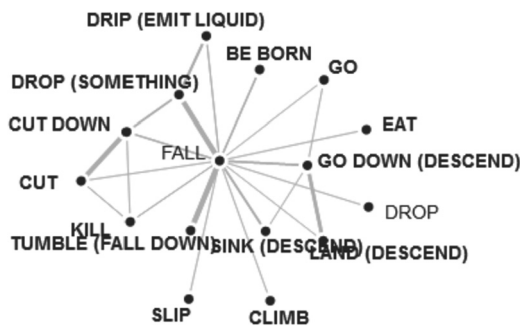


Figure 4: CLICS<sup>3</sup>: subgraph 'fall'.

The field of motion in a liquid medium is not the only case when a MLexT map bears similarity to CLICS<sup>3</sup>. However, in the majority of cases our results do not match. This can be easily seen on the graph of meanings which belong to the cluster 'fall' in the CLICS<sup>3</sup> database (see Figure 4). Presumably, dictionary data do not capture the distinction between 'downward falling' and 'loss of vertical orientation', although many languages in our sample consistently mark it by specific lexical means. Moreover, presence of the frame of detachment is vaguely suggested by the meaning 'slip' (indeed, situations belonging to this frame in some languages can be covered by a verb from the adjacent field of slipping, see Punjabi *latthṇā* or Russian *soskol'znut*).

Such disagreements may be attributed to many reasons. No finalized version of the universal lexical set currently exists, and even explanatory dictionaries, let alone wordlists, do not reflect many lexical juxtapositions which on closer examination prove to be typologically relevant. In fact, the currently existing sets of dictionary (sub)senses are dependent on a very large number of diverse factors

– mainly, on the size and the purpose of the dictionary, on the metalanguage of the wordlist, and even on the semantic intuitions of the authors. The method for establishing lexical elementary meanings suggested by us is designed in pursuit of grasping a more objective linguistic reality. To achieve this objectivity, we draw our set of elementary meanings on the basis of preliminary typological observations. Thus, the inventory of meanings for us is not the point of departure in our typological investigation, but rather one of its most important results.

We hope that the proposed method will allow us to define the object of our research no less precisely than it is done in grammatical typology,<sup>8</sup> and to progressively build up the basis for new, more fine-grained and comparable semantic dictionaries.<sup>9</sup>

### 3 Second problem: Metaphoric shifts

Thus far, we have focused on direct, literal word usage. However, words often develop figurative meanings – most notably, metaphoric ones, when the name of a physical situation, for example, ‘the boiling of water’ or a physical quality, such as ‘smooth (about a surface)’ or a physical object, such as ‘a window’ is transferred onto abstract entities which are not accessible for visual, tactile, or other physiological perception. Such a transfer structures the realm of the abstract in terms of the physical world. Thus, we speak of emotions (*to be seething with indignation*), intangible characteristics of processes (*smooth talk*), or virtual spaces (*a window into another world*). Surely, not all metaphors occur in the direction from physical meanings towards abstract ones – yet a prototypical metaphoric shift will have this directionality (see, for example, Lakoff and Johnson 2008 [1980]). For the sake of simplicity, this paper will discuss only such, relatively uncomplicated, cases, and will consider all abstract meanings to be metaphoric, and all physical

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**8** In particular, we conducted a number of successful experiments in automatic identification of frames (Paperno and Ryzhova 2019; Ryzhova and Paperno 2022) which yielded support to our hypothesis that our lexical elementary meanings may indeed be grounded in certain objective linguistic reality.

**9** It should be noted here that lexicographic traditions differ in their principles of establishing lexical meanings within a concrete language. While Geeraerts (2016: 237) claims that “[d]efinitions of lexical items should be maximally general in the sense that they should cover as large a subset of the extension of an item as possible,” the Moscow Semantic School tradition favors much more specialized definitions (Apresjan 2000). Consequently, dictionary (sub)senses may happen to be less or even more fine-grained than our frames; in any case, they are always established on the basis of an individual language, and as such often appear to be incompatible with data coming from other languages and lexicographic traditions.

meanings to be either direct or metonymic. Undoubtedly, there exist more intricate cases – of shifts between two physical meanings, when the nature of the semantic link between the two types of the word usage is not fully clear (for instance, consider the known problem of perception metaphor, i. e. change of perceptual channel: e. g. *sweet candies* versus *sweet music*, which is extensively discussed in the literature; cf. the recent volume Speed et al. 2019); however, we will not discuss them here.

In the wake of the grammatical tradition, where the meanings of different levels of abstraction can be placed on the same map on an equal footing (see, e. g., Rice and Kabata 2007), direct and figurative lexical meanings are not differentiated and are plotted on semantic maps together – as, for example, in François (2008); the CLICS<sup>3</sup> database also adheres to this tradition. Meanwhile, direct and figurative lexical meanings are inherently different and display different typological regularities. Lexicographers are well aware of this fact, as they rank subsenses in dictionaries and accompany them with special tags. The difference is particularly apparent in the denotation-based approach to analysis of lexical meanings. Experimental methods prove efficient only for certain types of shifts, when the semantics of a word does not trespass beyond the boundaries of the physical domain. Such shifts can be illustrated by means of an extralinguistic stimulus, as is the case in Dolscheid et al. (2013), where experimental methods are used to test the relationship between sound perception and the spatial mental representations that constitute the basis for conceptualization of sound in language. In order to analyze metaphoric shifts which give rise to abstract meanings, other methods are used, predominantly, corpus-based ones (see Winter 2019). From the standpoint of the theory of semantic mapping, it would be more logical to differentiate metaphoric shifts from links connecting direct meanings if only because their targets, by definition, lie beyond the boundaries of the source semantic field; conflating these two fields in one map would be counterintuitive. This has been pointed out already in François' study, where figurative meanings are located on the map along with the direct ones, but an explicit remark is made that one of the possible directions for improvement of the suggested model is to distinguish metaphors from metonymies and literal meanings (François 2008: 193).

Our experience indicates that metaphoric shifts are motivated by the semantic potentials of individual frames, or individual direct senses of a word. Due to this reason, words that cover entire clusters of frames tend to give rise to a large number of diverse metaphors<sup>10</sup> – and the same reason accounts for the fact that words

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<sup>10</sup> As is known, polysemous words tend to change more rapidly (i. e., *inter alia*, they develop more new meanings), see, for example, Hamilton et al. (2016). However, the reasons of this ten-

with originally similar semantics evoke similar metaphoric shifts (see Vanhove 2008; Maisak and Rakhilina 2007; Speed et al. 2019, among others). This means that showing these relationships on a semantic map is in principle possible and reasonable.

To demonstrate this, let us consider again the semantic field of falling, which is a source of abundant metaphoric shifts. Importantly, different frames evoke different metaphors, and models of these shifts have been found to replicate themselves across languages, even quite distant ones. The most known example is the parametric metaphor LESS IS DOWN (see Lakoff and Johnson 2008 [1980]) which is claimed to be a universal metaphor. Indeed, it is attested in almost every language of our sample (although sometimes these metaphors might be considered as calques, for example, from English), cf. *the temperature is falling* (English), *matippu vīzntatu* ‘the price fell’ (Tamil), *wasexer qjefexəv* ‘prices fell’ (Adyghe), etc. Most likely, the source frame for this shift is ‘downward falling from an elevated surface’ (frame 1). This is clearly seen in distributive systems (in this particular case, at least in Adyghe), because it is exactly the word of falling from an elevated surface that develops the figurative meaning there. The other frames, such as ‘loss of vertical orientation’ or ‘falling as a result of detachment’, i. e. the words dedicated to them, are not prone to developing such an extension.

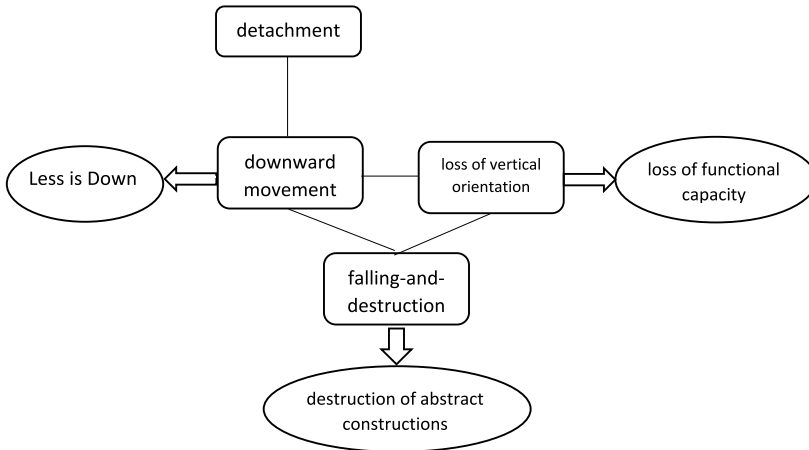
However, beside this metaphor, the verbs of falling also abound in figurative meanings related to the other frames. Thus, ‘loss of vertical orientation’ (frame 2) develops the meaning of loss of functional capacity (cf. Russian *svalilsja s grippom* ‘smb collapsed with flu’, or English *fall* ‘to be killed in a war’), while ‘falling-and-destruction’ (frame 3) gives rise to the meaning of destruction of various abstract constructions, such as plans, business, or political regimes, cf. Finnish *rapautua* ‘to collapse’ – about buildings, as well as about systems, plans or ideas.

Relations between direct and figurative meanings can be more or less reliably established via analysis of metaphorically used words with narrow original semantics: if a verb covers only one frame, all the metaphoric shifts developed by this verb are likely to stem from this particular frame. Such relations could be depicted in semantic maps, where meanings of different types should be visually delineated, and different kinds of relations should be marked. Figure 5 demonstrates a tentative design of such map.

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dency are usually passed over in silence. We, for one, are interested in this very aspect. Based on our data, we assert that the reason lies exactly in the ability of different source meanings to give rise to various types of shifts. Hence, broader sets of initial meanings lead to more diverse sets of possible figurative meanings, i. e. the lexeme will have a richer semantic potential.





**Figure 5:** Semantic map of the field of falling with some metaphoric extensions.

As we have shown, visualizing metaphors on a semantic map is in principle feasible; yet, the task of establishing the links between direct and metaphoric meanings is fraught with a number of complications.

First, metaphors typically reflect prior stages in the development of a language. It may well be the case that the scope of usage of the direct meanings of a word is limited in the synchronic perspective, but this does not exclude the possibility that at the earlier stages this word had much broader semantics. In such a case, it is very likely that the currently existing metaphoric meanings in fact trace their origins to one of its extinct direct meanings. Such a situation is observed in modern Hindi-Urdu and Punjabi, where the cognate verbs *paṛ-ṇā* and *pæ-ṇā* (respectively) have a very wide range of metaphoric meanings. Meanwhile, of all the physical meanings of uncontrolled downward motion, they synchronically retained only the capacity to denote the falling of precipitation. However, available evidence suggests that in the earlier stages in the development of these languages the two verbs were dominant in the semantic field of falling. Thus, they originate from the Old Indo-Aryan *vPAT* ‘to fly, to fall’. In Gujarati, which is genetically close to Hindi-Urdu and Punjabi, the reflex of this stem continues to function as the main verb of falling covering all the frames of this field (Khokhlova 2020). Unfortunately, in many cases such an assumption cannot be tested since diachronic data is not always available.

Second, the amount of data required to reliably establish the links between direct and figurative meanings is much greater than when revealing the major patterns in semantic relations between direct meanings (Kyuseva et al. 2022; Panina

and Tagabileva 2022). The reason is that the majority of metaphors as a rule are developed by dominant words which cover all or nearly all the frames of the direct meanings of a field. With such data, it is virtually impossible to trace the origin of each individual metaphor.

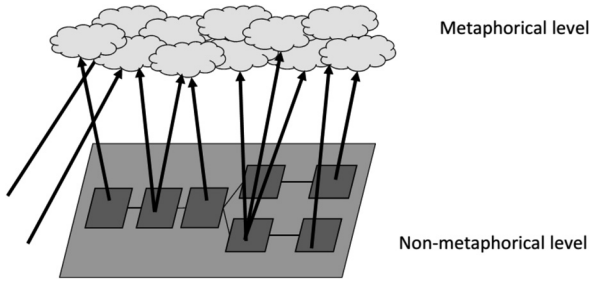
Third, there may be no one-to-one relation between direct meanings and metaphors: one metaphor may develop from multiple sources to the extent that the sources may be coming from different semantic fields (see Kövecses 2010, among others). For instance, the field of falling in some languages (such as in Izhma Komi, see Kashkin 2017: 93) features the metaphor of transformation which is related to the frame of loss of vertical orientation, i. e. TRANSFORMATION IS LOSS OF VERTICAL ORIENTATION, cf. (1).

- (1) Izhma Komi  
*va-ys*            *pər-is*    *ji-e*  
 water-POSS.3SG fall-PST.3 ice-ILL  
 ‘Water turns into ice’  
 (Kashkin 2017: 93)

At the same time, there is ample evidence from European languages of this metaphor evolving from the semantics of spatial turning or change of physical form, i. e. TRANSFORMATION IS TURNING OR TRANSFORMATION IS CHANGE OF FORM, cf. English *to turn into* or *to transform*.

At first glance, the sources of this metaphor are different. It seems, however, that all the shifts are grounded in the same physical idea of radical change taking place in an object, which can occur in a variety of ways: via the change in shape, or the change in orientation from vertical to horizontal, or by changing from displaying the frontal side of something to the rear side. In all these scenarios of metaphorization, much the same as in grammaticalization, the path from the concrete meaning to the abstract metaphoric meaning – ‘transformation of an object’ – passes through semantic bleaching which erases the physical characteristics which evoked the transformation.

The fourth issue is purely technical: direct and figurative meanings are difficult to arrange simultaneously on a two-dimensional plane along with all their relevant relations. Metaphors require an extra dimension (or other conventions, such as different types of lines, see Georgakopoulos and Polis 2021) which would reflect the transition from physical to abstract meanings – much as radial categories, or schematic network sets did in the cognitive linguistic studies of the last decades of the 20<sup>th</sup> century (see Lakoff 1987; Langacker 1987; Lewandowska-Tomaszczyk 2007). In other words, this brings up the question of how to visualize the bound-



**Figure 6:** A visual metaphor of the metaphorical and the non-metaphorical levels.

ary between the data points of direct versus figurative meanings. Figure 6 depicts the visual metaphor of a possible design of such maps.

Of course, the most straightforward solution would be not to clutter the visual representation of data and completely eliminate metaphors from semantic maps – the more so because this data is not always fully reliable. In most of our studies, we minimize this part by either not showing metaphors on the maps (cf. Lander et al. 2012; Rakhilina et al. 2022), or by dismissing whatsoever the task of typological analysis of metaphors related to the physical meanings under examination. In doing so, we nevertheless stay aware of the fact that, by pushing metaphors beyond the scope of our investigation, we lose the important layer of information about the principles of organization of lexical meanings. Since in many cases metaphors are related to specific frames, it is not uncommon that their analysis helps to clarify the frame structure of the field.

For example, in the field *HEAVY*, beside the frame ‘A person displays an object with difficulty, because of its weight’, there is another one: ‘A person estimates the weight of an object’. To differentiate the latter (‘weighing’) from the first (‘displacement’) one is problematic, since assessing the weight of an object prototypically suggests its displacement. Some languages have a dedicated word for ‘weighing’ (cf. English *weighty*). However, as a rule, these words are very infrequent in use and they collocate with a highly limited range of nouns, so that capturing their semantics is no easy matter. It is metaphors that allow us to shed the necessary light on the nature of this opposition: it turns out that words which denote ‘displacement’ – but not ‘weighing’ – are capable of developing figurative meanings with only negative connotations, whereas words which denote ‘weighing’ develop neutral and even positively colored metaphoric meanings. This observation enables differentiating between situations causing discomfort to the subject and neutral situations of more or less objective assessment of the weight of an object (for more details, see Ryzhova et al. 2019).

## 4 Third problem: Special types of contiguity

In Section 3, we examined the issues associated with metaphor, that is, with similarity-based semantic shifts. This Section discusses the problems of shifts which are based on contiguity, i. e. metonymy – in its classical and less conventional forms.

As mentioned above, similarity-based shifts in most cases serve as “vertical” relations between the physical and the abstract semantic levels (see Figure 6). Contiguity-based shifts, on the contrary, form the “horizontal” relations, i. e. the links between the meanings of one level. For example, in the field of motion in a liquid medium, the same verb is nearly always used to denote both motion of a vessel and motion of a passenger travelling aboard a vessel (cf. English *A man/boat sails/navigates*). This is a well-known type of metonymy, based on one of the semantic shifts CONTROLLED FOR CONTROLLER OR CONTROLLER FOR CONTROLLED (see Radden and Kövecses 1999), which in more generic terms can be subsumed under part-whole relations. In fact, a passenger is a part of a vessel, in a certain sense. Usually, the verbal or the physical quality lexeme participating in the shift remains intact, cf.: *sharp blade – sharp knife, somebody has read the first page – ... the text on the first page, to open the room – to open the door – to open the lock*.<sup>11</sup>

It should be noted that this shift is generally not typical for the frames of the field of falling because falling of a part does not entail falling of the whole in none of the four major frames: one cannot say that the kettle fell down if it was only the lid that fell. On the periphery of the field, however, such shift is possible. For example, in the frame of subsidence (about a layer or an elevated surface), both expressions are possible: ‘the floor caved in’ (whole) and ‘the rotten floor planks caved in’ (part); some languages even admit of ‘the person caved in’, about a person who was standing on a surface, i. e. maintained close contact with it (in terms of Peirsman and Geeraerts 2006).

As a rule, such shifts are quite trivial, and they fall under the definition of metonymy as a shift within one domain or domain matrix (Kövecses 2010). In our terms, such shifts occur within a frame, and thus they do not introduce any dramatic changes into the situation. Therefore, we do not show them on our semantic maps. If we wished to do so, we would depict them as horizontal links – similarly to the relations between direct meanings of a lexeme.

In this regard, a more interesting case is another type of metonymy which is far more infrequent, yet it has been addressed in research (see Brugman 1988

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<sup>11</sup> Such “horizontal” metonymic shifts also frequently occur between metaphoric meanings (cf. *the dollar fell – the exchange rate of dollar fell*).

and Lakoff 1987, among others): the semantic shift of the PROCESS FOR RESULT type (or *end-point* metonymy). Typically, it is discussed from the viewpoint of actionality in terms of Vendler (1957) involving stativization of the originally processual situation, cf. the Russian example (2),<sup>12</sup> or the example (3) from Bennett (1975) cited in Lakoff (1987).<sup>13</sup> In the field of AQUA-motion, this type of metonymy is represented by colexification of the frames of rising to the surface and of floating on the surface (for more details see Maisak and Rakhilina 2007; Rakhilina and Reznikova 2016), which is found in Japanese *uku/ukabu*, Arabic *tafa:*, Balkar *-k"alk"*. Nevertheless, these are different situations which in most languages are covered by different verbs. In a certain perspective, these situations may even be treated as belonging to different semantic fields – to vertical and to horizontal motion through water. As such, they can hardly be considered as belonging to one and the same domain, domain matrix, or frame, but they are still contiguous, and contiguity is believed to be an inherent property of metonymic shifts (cf. Peirsman and Geeraerts 2006).

(2) Russian

- a. *On ogoraživa-et učastok zabor-om*  
 he(NOM) surround-PRS:3SG site(ACC) fence-INS:SG  
 ‘He surrounds the site with a fence’
- b. *Zabor ogoraživa-et učastok*  
 fence(NOM) surround-PRS:3SG site(ACC)  
 ‘The fence surrounds the site’

(3) *Sam walked over the hill* → *Sam lives over the hill*.

(see Bennett 1975, Lakoff 1987)

Yet, while the situations of rising to the surface and floating on the surface could refer to the same semantic field of motion in a liquid medium (although with some reservations), the following example from the Beserman dialect of the Udmurt language (from the Finno-Ugric group of the Uralic language family) brings out the issues in semantic mapping the metonymic shift of the PROCESS FOR RESULT type more acutely. The Beserman denominal verb *tɛlanə* (derived from *tɛl* ‘wind’) combines the idea of moving in the wind (about clothes or leaves) and drying when

<sup>12</sup> Similar examples are extensively discussed in Paducheva (2004).

<sup>13</sup> Radden and Kövecses (1999) also discuss examples of the type *He speaks Spanish*, where the initially dynamic verb *to speak* denotes an inherent quality of the subject rather than an action. Such cases are different from end-point metonymies. However, they also involve stativization and, consequently, a change in actionality of the predicate.



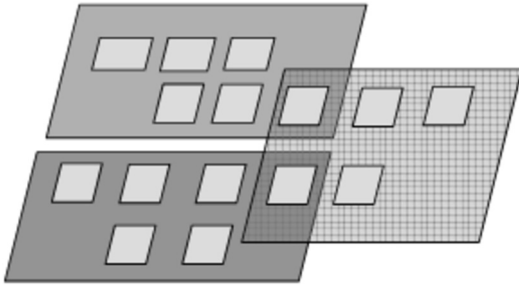


Figure 7: Schematic representation of semantic contiguity.

We do not know thus far which lexical fields can be contiguous and which cannot, and we do not possess sufficient data to attempt to suggest a plausible model – we only have hypotheses. We hypothesize that contiguity arises when metonymy is not associated with change of arguments – when it is events, not their participants, that are linked by the part-whole relation, so that one event is a part of the other.

We have just seen a simple instance of such kind, the process and result pair. There is another, much better known pair which falls under the definition ONE EVENT FOR PART OF ANOTHER EVENT, the one which truly gives rise to field contiguity: CAUSATION OF PROCESS FOR PROCESS (see *to move an object* versus *an object moves*). Metonymic overlap of these situations is conventionally viewed through the prism of actionality; but if we happen to look at it from the viewpoint of creating semantic maps of lexical meanings, it turns out to be not just an actionality problem but also a purely semantic problem of lexicalization. For example, in the domain of motion in a liquid medium overlap of THE CAUSATION OF PROCESS FOR PROCESS type highlights contiguity between the fields of motion in a liquid medium and flowing (of water). The “bridge” between them is formed by the frames of (uncontrolled) drifting (with the current) and flowing of the current (for example, in a river): in many languages the verb expressing uncontrolled motion of an object with the current can also denote the motion of the current itself (cf. Japanese *nagareru*, Danish *flyde*, Lithuanian *plaukti*). Obviously, the description of motion in a liquid medium in a dictionary in a prototypical case would require a separate entry to distinguish it from the flowing of liquids, since liquids can flow not only in bodies of water but also from a tap, a bottle, a wound, or a juicy fruit. All these situations have nothing to do with the field of motion: these are two distinct yet contiguous fields.

Let us now turn to another, less trivial, instance of contiguity which is still founded in the same principle – of the part-whole relation between two situations.

In the Beserman dialect of Udmurt, the verb *kâstaškânê* conveys, first of all, the meaning ‘to stretch’. This meaning is illustrated in (6), in which somebody has a sweater stretched by putting it on. Besides, this verb also expresses the meaning ‘to crawl’, when speaking about motion of worms, snails, snakes, or other legless animals who propel themselves primarily by stretching their bodies, see (7).

- (6) Beserman Udmurt  
*Kofta kâstašk-e*  
 sweater(NOM:SG) stretch-PRS:3SG  
 ‘The sweater stretches’
- (7) Beserman Udmurt  
*nomâr / ul’itka kâstašk-e*  
 worm(NOM:SG) snail(NOM:SG) stretch-PRS:3SG  
 ‘A worm / A snail crawls’<sup>15</sup>

Such colexification is promoted by the fact that stretching of the body constitutes a part of the motion pertaining to worms, snakes, and the like. It reveals the relation of contiguity between ‘to stretch’ and ‘to crawl’: to combine stretching and crawling in one semantic space (field) would have been counterintuitive.

A good example of similar kind from the field of falling can be found at its intersection with the field of flying: such colexification is attested in Indo-Iranian languages (cf. the Old Indo-Aryan *VPAT* ‘to fly, to fall’), but obligatory standard metonymic change between ‘falling’ and ‘flying’ for downward falling of light objects from an elevated surface also occurs in many other languages outside of the Indo-Iranian group, cf. example (8) from Russian. Falling of light objects, which is slower than falling of heavy ones and which often follows not strictly vertical but partially horizontal trajectory, invites the possibility of interpreting flying as a part of the falling process, and consequently, evokes contiguity of these two fields.

- (8) Russian  
*u menya s golov-y slete-l-a (/ ??upa-l-a) šlyapa*  
 PREP I(GEN) PREP head-GEN fly.off-PST-F fall-PST-F hat(NOM)  
 ‘The hat flew off (?? fell down from) my head’

<sup>15</sup> Crawling of spiders, cockroaches, etc. is denoted differently in Beserman, namely by the generic verb of motion *mânânê* ‘to go’. Note that juxtaposition of the two kinds of crawling (‘crawling when touching the surface and moving by means of contracting and relaxing the body muscles’ versus ‘crawling by moving one’s limbs with the body close to the ground’) was highlighted in Fillmore and Atkins (2000) using English and French data.



Importantly, a field may have several fields contiguous to it – primarily due to the capacity of multiple frames of one field to simultaneously engage in “bridge” relations. In the example of the frame of downward falling from an elevated surface discussed in the previous paragraph, this frame constitutes the basis for contiguity with the field of flying. The contiguity with the frame of rotation is manifested by another frame of the semantic field of falling. In fact, the frame of loss of vertical orientation which we associate with the field of FALLING, in some languages can be covered by verbs from the field of rotation (cf. the Shughni (> Eastern Iranian) verb *gāxtow* ‘to lose vertical orientation’, ‘to turn’). Such colexification is semantically conditioned by the fact that the process of falling of vertical objects (other than downward falling from an elevated surface) implies their overturning – and the frame of overturning, as an instance of incomplete revolution around the object’s axis, belongs to the field of rotation (Kruglyakova 2010).

All the types of contiguity and all the examples discussed above involve a change of perspective on one and the same situation, or its re-profiling (in Langacker’s terms; see Langacker 1986, Langacker 1987) – similarly to what happens in classical metonymy. We can profile either the result (‘to be drying’) or the process as a whole (‘fluttering in the wind’) – just as we choose whether to put the semantic accent on motion of the passenger or of the entire vessel, depending on the communicative task. In this case, there is no difference between resultative and argument-based metonymy. We act in exactly the same way when we choose whether in order to describe falling we want to emphasize the idea of overturning in which the upper part of an object comes down, or to accentuate falling per se, that is, motion caused by gravity until the object comes into contact with the ground. The same applies to the ‘stretching-crawling’ and ‘flying-falling’ pairs. They manifest an instance of metonymy which is less classical and less studied than resultative or argument-based metonymy. The former type could be called *processual metonymy* – when there are two processes, and one is nested within the other.

The question of whether such shifts could be considered metonymic is open to debate; nevertheless, they undoubtedly pose a challenge to the terminological metaphor of a semantic field with well-defined boundaries which entered linguistic practice almost one hundred years ago (Trier 1931) and create certain problems for the task of designing semantic maps. The difficulty is that due to these – as we see, numerous and highly diverse – cases of overlap between contiguous fields, boundaries of semantic fields become fuzzy, and the fields reveal continuity. Essentially, this means that choice of this or that fragment for investigation and subsequent visualization is always arbitrary, to some extent.

The idea that boundaries between semantic fields may be penetrable is not new: structuralists themselves pointed it out (see Ducháček 1960, among others).

Similar observations were later suggested by cognitivists (cf. Bowerman and Choi 2001), and CLICS<sup>3</sup>, in essence, also illustrates this idea – when, as we have seen above, it joins meanings from different semantic fields under one cluster owing to the possibility of their colexification. Yet, to the best of our knowledge, no research so far has looked into the nature of these overlaps, namely, which fields are contiguous with each other and in which regions the contiguity occurs, or what the range of neighbors for each field is, etc. Lexical typologists have already studied a substantial number of semantic fields and described their structure; however, all of these studies have examined fields in isolation from their neighbors. We show that the relations between the semantic field in question and its neighbors are motivated and predictable, in case one takes into consideration not only the centre of the field, but its periphery as well. Thus, for each field we establish the place it occupies among the other fragments of lexico-semantic space.

## 5 Conclusions

We discussed three theoretical problems that emerge when attempting to apply the apparatus of semantic maps to lexical data, as a technique for visualization of typological patterns which established itself in grammatical typology. The three problems are: (1) selection of data points, (2) presenting lexical metaphors on maps, and (3) contiguity of lexical fields.

In search of solutions for the first problem, we compared various approaches to identifying the universal inventory of lexical meanings and put forward our own methodology: to establish situations/frames that can be distinguished lexically in languages.

The second and the third problems are rendered in terms of frames, which offer an efficient tool for their analysis. Lexical meanings are intrinsically heterogeneous: many words are polysemous, so that some meanings of a word are direct, or literal, while others are their semantic extensions. These relations are different in nature from the “horizontal” links between direct meanings, and it is essential to capture this difference in semantic maps. To this end, we suggest that the tasks of mapping metaphors and direct meanings should be kept apart: the main semantic map should display only the direct meanings, while their derivational potential could be depicted, for example, as chainlike radial flowcharts arranged individually for each frame or group of frames.

As for the analysis of “horizontal” relations, or contiguity, of fields, there is currently little empirical evidence as to how they could be placed in terms of the theory of semantic shifts (notably, whether they qualify as metonymy), or to what

extent they are homogeneous, and what regularities govern them. Technically, the presence of such relations indicates that there are no explicit boundaries between semantic fields, and, as a consequence, selection of a lexico-semantic area to be presented on a map is largely a matter of the researcher's individual choice.<sup>16</sup>

All the outlined problems are interconnected. We believe that search for solutions, that is, examining the nuances of lexical data and modifying the models of their visualization accordingly, can substantially further our understanding of organization of lexical systems in natural human languages.

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## Abbreviations

3	third person
acc	accusative case
f	feminine gender
gen	genitive case
ill	illative case
ins	instrumental case
loc	locative case
nom	nominative case
poss	possessive
prep	preposition
prs	present tense
pst	past tense
sg	singular number

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<sup>16</sup> Apparently, it would be more reliable and accurate to define boundaries between semantic fields using statistical data, as in the CLICS<sup>3</sup> system. However, such an approach would require large amounts of lexical typological data: recall that CLICS<sup>3</sup> is based on dictionary entries; besides, it does not discriminate between direct and figurative meanings, which complicates the task of identifying boundaries between fields.

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