Modeling connections between linguistic constructions and conceptual metaphors

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In cognitive studies on metaphor, the elements and relations responsible for the linguistic instantiations of conceptual metaphors are investigated on the conceptual level of cross-domain mappings. Though the cognitive approach devises strategies to model the inference patterns necessary to understand metaphorical constructions, it has not devised machinery to model the links between metaphorical linguistic constructions and conceptual metaphors. This paper, thus, aims at unveiling such links and rests on the following assumptions: (i) linguistic constructions are understood in terms of conceptual entities, (ii) concepts are grouped in conceptual domains, and (iii) conceptual domains are structured internally in terms of image-schematic structures and semantic frames. By moving from linguistic constructions to conceptual structures, this study demonstrates that language-specific and cross-linguistic generalizations underlying the links between linguistic constructions and conceptual metaphors are feasible by merging four different representation schemas: semantic fields, semantic frames, conceptual domains, and image schemas, for each of these schemas factors out the task of specifying the linguistic, conceptual, and perceptual elements, and the relations between them, which are, in turn, responsible for the linguistic instantiations of the corresponding conceptual metaphors.

1. Setting the backdrop

It is accepted in cognitively based approaches to language that linguistic constructions are conceptually grounded, and that semantic structure is organized in terms of recurrent conceptual and perceptual patterns. Accordingly, in cognitive studies on metaphor, it follows that systematic patterns of linguistic structures are, in fact, systematic sets of correspondence patterns in conceptual structure. However, the ways in which the linguistic and the conceptual structures and their dynamic nature can be systematically captured remain unanswered.

Consider the metaphorical construction Her boss exploded when she failed. In this construction, the vehicle (i.e. the term used metaphorically) exploded instantiates the conceptual domain of the physical explosions, whereas the topics (i.e. the literally used terms) boss, she, and failed instantiate the conceptual domain of human emotions and failures. In the Conceptual Metaphor Theory (CMT), the following four identities hold (Lakoff & Johnson, 1980; Lakoff, 1987, 1993). The more concrete conceptual domain is the “source domain”. The less concrete conceptual domain is the “target domain”. A specific and qualified relation between the source domain and the target domain is a “conceptual metaphor”. Finally, the linguistic instantiation of a conceptual metaphor is a “linguistic metaphor”. For example, the metaphorical construction Her boss exploded when she failed instantiates the conceptual metaphor ANGER IS A HOT FLUID IN A CONTAINER. Thus, the following pairs of correspondences apply: the physical container and the angry person’s body, the hot fluid in the container and anger, the fluid temperature and anger intensity, the cause of temperature rise and the cause of anger.

In addition to the constituent elements that comprise the basic knowledge structures that make up source domains, there are conceptual implications, “metaphorical entailments” (Lakoff, 1993; Kovecses, 2002), which are structural correspondences, i.e. mappings, from the source to the target domain. For example, when knowledge about hot fluid behavior in closed containers (e.g. the knowledge of the fact that: hot fluid in a sealed container exerts pressure on its walls, or too much pressure in the container makes it explode, etc.) is mapped metaphorically from the source domain HOT FLUID IN A CONTAINER onto the target domain ANGER. Accordingly, anger is structured in terms of heat (e.g. when anger increases beyond a certain limit, emotional intensity increases in the body to a point at which the person loses control).

In sum, a metaphorical construction is understood when the underlying conceptual metaphor is mentally processed. Though the CMT provides a schematic way to analyze metaphorical constructions, for it conceives of metaphors as types of conceptual mappings (contrary to the pragmatic approaches that conceive of metaphor as isolated linguistic occurrences), it does not make it explicit the way metaphorical constructions instantiate conceptual metaphors. For example, it does not make it explicit either the links between the emotion concept ANGER and the linguistic forms

1 A conceptual domain is understood as the “background knowledge for representing concepts” (Clausner & Croft, 1999, p. 3).

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boss, she, and fails, or the links between the conceptual relations between the physical concepts HOT FLUID and CONTAINER and the linguistic form exploded.

As the source domain provides the schematic information that shapes metaphor understanding, to interpret metaphorical constructions, it is necessary to unveil both the source domain elements and the relations that are mapped onto the target domain, which is the central problem that this paper tackles: to work out a set of explicit links that connect linguistic constructions to conceptual structures by merging four different representation schemas: conceptual domains (Lakoff & Johnson, 1999; Clausner & Croft, 1999), image-schemas (Johnson, 1987; Oakley, 2007, Peña, 1999, 2008), semantic frames (Fillmore, 1985; Fillmore & Atkins, 1992), and semantic fields (Kittay, 1987).

A selected set of metaphorical construction types with the Brazilian Portuguese verb explodir collected from corpus provides the empirical basis to investigate the linguistic constructions and the relations between them and their corresponding conceptual and perceptual elements. In this paper, these relations comprise what we will call the “metaphorical conceptual-semantic alignment” (Oliveira, 2010) between form and meaning.

More specifically, we will search the structural elements and relations that underlie the multidimensional meaning of explodir that are involved in the task of understanding the conventionalized metaphorical uses of this verb. Accordingly, we perform the bottom-up analysis: from the linguistic level of metaphorical constructions to the conceptual level of conceptual domains.2

The reminder of this paper is, then, organized as follows. Section 2 introduces the metaphorical and literal alignments between linguistic constructions and their corresponding concepts. Section 3 presents the metaphorical data to support this study. Section 4 works out the links that connect linguistic constructions to conceptual structures in terms of metaphorical propositions. Section 5 analyzes the schematic structure of the source domain of explosions, which sets the backdrop against which the target domains of emotions and statistics are understood. Section 6 describes the metaphorical mappings between the two conceptual domains of the conceptual metaphor as mappings between semantic frames, followed by our final remarks.

2. Linking linguistic and conceptual structures

In the cognitive linguistics framework, language is described as encoding different conceptualizations of experience (Croft & Cruse, 2004). It is assumed that the linguistic structure of a metaphorical construction encodes lexical-grammatical relations, whereas its conceptual structure encodes conceptual relations, which, in turn, are modeled in terms of conceptual domains (Clausner & Croft, 1999).

Because conceptual domains are claimed to be experientially grounded, the conceptual structure, which is linguistically instantiated in metaphorical constructions, is assumed to be a schematic configuration of a more generic perceptual structure, often called image schematic structure (Johnson, 1987; Lakoff, 1987). Contrary to conceptual structures, image-schematic structures are meaningful in themselves, for they emerge from recurrent patterns of experience.

For example, the spatial experience of verticality, specified in the schematic structure UP-DOWN, names the image-schema VERTICALITY, which is used to conceptualize distinct experiences, e.g. the spatial experiences of acclivity and declivity. When spatial structures are mapped metaphorically onto conceptual structures, the image-schematic structure which organizes the source domain is mapped onto the target domain, resulting in the reorganization of the latter. For example, when the experience of amount is conceptualized metaphorically as VERTICALITY, the image schematic structure UP-DOWN, which organizes the spatial source domain VERTICALITY, re-organizes it as an “up-down” experience. This reorganization, triggered by the conceptual metaphor AMOUNT IS VERTICALITY, is linguistically instantiated in the metaphorical constructions The prices rose by 30% and The number of submissions decreased. Conversely, when the experience of amount is conceptualized metaphorically as LENGTH, the image schema PATH, specified in the image-schematic structure SOURCE-PATH-GOAL, which, in turn, organizes the spatial source domain LENGTH, reorganizes the experience of amount as a “source-path-goal” experience. This reorganization, triggered by the conceptual metaphor AMOUNT IS LENGTH, is linguistically instantiated in the following metaphorical constructions She has a long period to think and I am short of money.

Thus, in the cognitive linguistics framework, because meanings are concepts, and concepts are modeled in terms of conceptual domains, conceptual domains are required to represent the meaning of the linguistic constructions. As the examples suggest, in the literal uses of language, conceptual domains are directly instantiated, whereas, in the metaphorical uses of language, one conceptual domain is linguistically instantiated in terms of the other. In the literal construction The pressure cooker exploded, the physical domain EXPLOSION is directly instantiated, whereas in the construction The boss exploded when she failed, the emotion domain ANGER is instantiated metaphorically in terms of the physical domain EXPLOSION.

In this study, the connection between linguistic constructions and literal concepts3 (e.g. exploded - EXPLOSION) is termed “canonical semantic alignment” (csa), and the connection between linguistic constructions and metaphorical concepts4 (exploded - BECOME_ANGRY) “metaphorical conceptual-semantic alignment” (mcsa).

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2 The CMT, on the other hand, applies the opposite analytical strategy (“top-down” analysis), for the basic aim there is to unveil cognitive structures from linguistic evidence.

3 Literal concepts are defined as concepts that are structured directly in one domain, representing a (literal) conceptualization of an experience (Lakoff & Johnson, 1980).
Figure 1 shows: (i) the literal and metaphorical combinations of *exploded* expressed on the linguistic level (R and R1 relations), and their corresponding schematic combinations modeled on the conceptual level (R’ and R1’ relations); (ii) the csa and the mcsa between the linguistic forms and their correspondent conceptual contents (the dotted lines); and (iii) the relation between the linguistic structure (LS) and its correspondent conceptual structure (CS) (the bold dotted lines).

In order to connect linguistic and conceptual structures, we analyze the metaphorical constructions in terms of Steen’s (2002) *metaphorical propositions*, i.e. propositional structures that relate metaphorical concepts. Before going through this analysis (section 4), the next section describes the metaphorical data to which our study applies.

3. Metaphorical data

This section analyzes two classes of metaphorical constructions linguistically instantiated by the Brazilian Portuguese verb *explodir*:\(^4\) the one that instantiates both the source and the target domains in terms of linguistic expressions (Class 1), and the one that instantiates only the source domain (Class 2), because the target domain is instantiated in terms of relations (Stefanowitsch & Gries, 2006).

Table 1 shows the linguistic instantiations of these classes and their corresponding syntactic realizations.

Types 1-4 are linguistically instantiated in terms of specific lexical-grammatical patterns. In Type 1, the conceptual combination \([\text{PERSON}] + \text{[EXPLOSION]} + \text{[EMOTION]}\), which associates the concept EXPLOSION with the concepts PERSON and EMOTION, is instantiated in terms of three distinct lexical-grammatical patterns. In subtype 1.1, the concept EMOTION is instantiated in the semantic fields that express intense emotions (the semantic field of anger, which instantiates the concept ANGER, the semantic field of excitement, which instantiates the concept EXCITEMENT, etc.). In subtype 1.2, the concept EMOTION is expressed in semantic fields that express events which are strongly associated with particular kinds of emotions (e.g. in soccer games, high scores cause excitement). In Type 1.3, the concept EMOTION is instantiated in terms of the means in which particular kinds of emotion are usually expressed (e.g. sadness is expressed in terms of tears).

In Type 2, the conceptual combination \([\text{PERSON}] + \text{[EXPLOSION]}\), which associates the concept EXPLOSION metaphorically with the concept PERSON, is instantiated in terms of two distinct lexical-grammatical patterns. As will be shown in section 5, the relation between EXPLOSION and PERSON, instantiated in subtypes 2.1 and 2.2, evokes the concept ANGER and grounds this particular type of metaphor interpretation.

In Type 3, the conceptual combination \([\text{AMOUNT}/\text{VALUE} \ldots] + \text{[EXPLOSION]}\), which associates the concept EXPLOSION with the concepts AMOUNT and VALUE, is instantiated in terms of two distinct lexical-grammatical patterns. The concept VALUE is instantiated in the semantic field that expresses cost, which instantiates the concept COST, and the concept AMOUNT is instantiated in the semantic field that expresses counting. We argue that the semantic fields that instantiate the concepts that are combined metaphorically in the metaphorical constructions are constrained by the scalar properties of the relevant semantic field. For example, in the semantic field that expresses cost, because the most salient property of the concept COST is [Value], the scalar property is [Value] (subtype 3.1), whereas in the semantic field that expresses counting, because the most salient property of the concept COUNTING is [Number], the scalar property is [Number] (subtype 3.2). As we will argue in section 5, metaphor understanding is couched in these properties.

In Type 4, the indices \(^\text{WHOLE}\) and \(^\text{PART}\) indicate that the first and the second concepts stand in a part-whole relationship (e.g. in the metaphorical construction *The gamenet exploded with users*, users are part of gamenets). In the target domain of statistics, this relationship is established in the semantic fields that express some counting.

\(^4\) Metaphorical concepts are defined as concepts that are restructured metaphorically in terms of cross-domain mappings, which represent the conceptualization of experiences in one domain in terms of the other (Lakoff & Johnson, 1980).

\(^5\) The metaphorical tokens of the Brazilian Portuguese verb *explodir* are available at http://acdc.linguateca.pt/acesso.
## Table 1. The metaphorical construction types and their linguistic instantiations

<table>
<thead>
<tr>
<th>Conceptual domain of emotions</th>
<th>Type 1: [[PERSON]+[EXPLOSION]+[EMOTION]]</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lexical-grammatical Patterns</td>
<td>Examples</td>
<td></td>
</tr>
<tr>
<td>1.1 [(NP) V PP_de (theme)]</td>
<td>O chefe explodiu de felicidade/</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The boss exploded with happiness</td>
<td></td>
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<tr>
<td>1.2 [(NP) V PP_com (cause)]</td>
<td>O estádio explodiu com o gol/</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The stadium burst with the score</td>
<td></td>
</tr>
<tr>
<td>1.3 [(NP) V PP_em (means)]</td>
<td>Ela explodiu em lágrimas/</td>
<td></td>
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<tr>
<td></td>
<td>She burst into tears</td>
<td></td>
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<tr>
<td></td>
<td>A platéia explodiu em aplausos/</td>
<td></td>
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<tr>
<td></td>
<td>The audience burst into applause</td>
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<tr>
<td>Class 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type 2: [[PERSON]+[EXPLOSION]]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lexical-grammatical patterns</td>
<td>Examples</td>
<td></td>
</tr>
<tr>
<td>2.1 [NP V]</td>
<td>Meu chefe explodiu quando ela falhou/</td>
<td></td>
</tr>
<tr>
<td></td>
<td>My boss exploded when she failed</td>
<td></td>
</tr>
<tr>
<td>2.2 [NP V PP_com (target)]</td>
<td>Meu chefe explodiu comigo/</td>
<td></td>
</tr>
<tr>
<td></td>
<td>My boss exploded with me</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conceptual domain of statistics</th>
<th>Type 3: [[AMOUNT/VALUE…][EXPLOSION]]</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1 [NP V]</td>
<td>Os preços explodiram/</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The prices exploded</td>
<td></td>
</tr>
<tr>
<td>Class 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type 4: [[AMOUNT_WHOLE][EXPLOSION][AMOUNT_PART]]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1 [NP V PP_de (part)]</td>
<td>O jogo explodiu de usuários/</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The gamenet exploded with users</td>
<td></td>
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</tbody>
</table>

Thus, we will show that each metaphorical construction type encodes a particular set of conceptual structures that can be formally represented, given that the conceptual mappings that are responsible for the linguistic instantiations of these types are modeled.

### 4. Linking conceptual and perceptual structures

Considering the cognitive assumption that linguistic metaphor understanding depends to the analysis of the conceptual structure activated by linguistic structure (Stefanowitsch & Gries, 2006), we use the propositional analysis as a tool to connect linguistic metaphors to conceptual metaphors (Steen, 1999, 2002; Crisp, 2002). This analysis is based on the first three steps of Steen’s (1999, 2002) method of metaphor identification, which, in turn, is based on the Bovair and Kieras’s (1985) proposal.\(^6\)

Propositions are conceptual representations consisted of a predicate (P) and one or more arguments (A). Different from (literal) propositions, metaphorical propositions contain one or more metaphorically used concepts. The literal concepts are often represented by its arguments, whereas the metaphorical concepts are often represented by the predicates of the metaphorical proposition.\(^7\)

Consider the metaphorical construction *Mary exploded with happiness*, subsumed under the Subtype 1.1/Type 1, represented in the following propositional structures: (P1) EXPLOSION (MARY); (P2) WITH (P1, HAPPINESS)\(^8\), where the metaphorical concepts EXPLOSION and WITH are represented as predicates; the literal concepts MARY

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\(^6\) Steen’s first three steps for metaphor identification can be summed up as follows: (1) break-up discourse into units; (2) break-up units into propositions (the main proposition (P1) is often determined by the verb; lower-level propositions (P2, P3…) formulate the modifiers of the main argument(s) as independent propositions; (3) unveil the concepts of related to all ellipsis, substitution, and co-reference (e.g. pronouns should be replaced for the concept PERSON).

\(^7\) In metaphorical propositions, the conceptual composition P (A) triggers a mcsa, contrary to (literal) propositions, the combinations of which trigger a csa.

\(^8\) Contrary to conventional predicate-argument structures, metaphorical predicate-argument structures include optional modifiers (adjuncts) of the linguistic constructions, which are represented as arguments of the propositions.
and HAPPINESS, in turn, are represented as arguments. The connection between the linguistic elements and their corresponding concepts are represented in Figure 2.

Because propositional structures represent solely the elements that are present explicitly in the linguistic constructions, they do not represent the inferences that are triggered by conceptual metaphors and responsible for understanding the inferences that underlie linguistic metaphors. To bridge this gap, we claim that the propositional level of metaphorical constructions should be further connected to the perceptual. The connection is achieved by linking the concepts that represent the arguments of the metaphorical propositions to their immediately preceding ontological and image-schematic concepts. On this level, the arguments and the predicates of the metaphorical propositions are linked to the elements of the target and the source domains, respectively.

In the metaphorical construction just mentioned above, the concepts MARY and HAPPINESS instantiate the arguments of the propositional structures (P1) and (P2), respectively. They, in turn, respectively, also instantiate the image-schemas CONTAINER and CONTENT in terms of the following conceptual metaphors: BODY IS CONTAINER FOR EMOTIONS, and EMOTIONS ARE LIQUIDS WITHIN A PERSON, respectively. Due to these conceptual metaphors, humans are conceptualized as containers, and emotions are conceptualized as contents.

![Figure 2. Connections between LS, CS, and PS](image)

The abstraction levels, which are responsible for the connection between the linguistic, the conceptual, and the perceptual levels of metaphor, are illustrated in Figure 2 in term of the schematization relations between the linguistic forms boss and happiness and their corresponding concepts BOSS and HAPPINESS, and between these concepts and their corresponding ontological and image-schematic concepts. Figure 2 illustrates: (i) the propositional structure of the metaphorical construction Mary exploded with happiness, (ii) the ontological concepts HUMAN and EMOTION to which the more specific concepts MARY and HAPPINESS belong, and (iii) the image-schematic concepts CONTAINER and CONTENT, to which HUMAN and EMOTION belong.

In particular, the image-schematic concepts CONTAINER and CONTENT are instantiated in all Type 1 metaphorical constructions. It should be noted, though, that in subtypes 1.2 (e.g. Mary burst into tears) and 1.3 (e.g. The stadium burst with the score) the schematization relations are also guided by conceptual metonymies, i.e. a conceptual operation that holds within the same conceptual domain and relates two entities in that domain. Metonymic and metaphorical mappings differ from each other in that the former operates in one and the latter in two domains (Lakoff & Johnson, 1980).

In the metaphorical construction Mary burst into tears, TEAR stands for SADNESS under the operation of the conceptual metonymy MEANS FOR EMOTION, according to which sadness (emotion) is experienced by means of tears. Due to this conceptual metonymy, TEAR aligns with SADNESS, not with CRYING; and TEAR is conceptualized metaphorically as CONTENT. On the other hand, in the metaphorical construction The stadium burst with the score the schematization relations are also guided by conceptual metonymies, i.e. a conceptual operation that holds within the same conceptual domain and relates two entities in that domain. According to these metonymies, persons (sport fans) are conceptualized as places (stadium), and causes (high scores) are conceptualized as effects (emotional enthusiasm). Accordingly, STADIUM and SCORE are conceptualized as PERSON and EMOTION, which, in turn, are conceptualized metaphorically as CONTAINER and CONTENT, respectively.

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9 In language-independent representation levels, more specific concepts take lower levels and more generic/schematic concepts take higher levels.

10 In literal constructions (e.g., She pretended to wipe the tears from her face), tears do not necessarily imply sadness, the reason of which TEAR aligns ontologically with CRYING rather than with SADNESS.
Contrary to Type 1, the metaphorical constructions subsumed under Type 2 (e.g. *The boss exploded when she failed; She exploded with me*) instantiate the image-schematic concept CONTAINER alone, as the experienced emotion (of anger) is not lexically instantiated in this type.

In the domain of statistics (subsuming Types 3 and 4), the image-schematic concept SCALE is instantiated metaphorically. Consider the metaphorical construction *The prices exploded*, where PRICE, which instantiates the argument of the metaphorical proposition P [EXPLOSION (PRICE)], instantiates the image-schematic concept SCALE in terms of the conceptual metaphor AMOUNT IS VERTICALITY, according to which amounts (including values and sizes) are conceptualized metaphorically as scales. In particular, this image-schema is instantiated metaphorically where EXPLOSION is combined with concepts that express some kind of amount or value. As discussed in section 2, this instantiation is modeled in terms of the scalar properties Number and Value, respectively.

Finally, in the metaphorical construction *The gamenet exploded with users* (from Type 4), GAMENET and USER, which instantiate the arguments of the metaphorical propositions P1 [EXPLOSION (GAMENET)] and P2 [WHITH (P1, USER)], instantiate the image-schematic concept SCALE in terms of the same conceptual metaphor AMOUNT IS VERTICALITY. In particular, this instantiation is modeled in terms of the scalar property Number, which in turn, stands in the part-whole relation between the arguments (GAMENET-USERS) of the propositional structure.

As those examples suggest, linguistic structures are connected to conceptual structures by representing metaphorical constructions on the propositional level. As we will show in the next section, the perceptual structure of the target domain, which is understood metaphorically in terms of the source domain, is unveiled by linking the arguments of the metaphorical construction to their corresponding ontological and image-schematic concepts.

5. The conceptual structure of the source domain of explosion

In this section, we show how the arguments of the propositional structures abstracted from Types 1-4 activate the conceptual structures from which the metaphorical uses of *explodir* are understood.

In particular, corpus data analyses allowed us to make the following generalization with respect to the lexical-grammatical relations between the vehicle exploded and its topics: the non-physical event of explosion expressed in the metaphorical intransitive constructions are more dependent on the relational nature of the process of explosion than on the physical nature of the things exploded. At a schematic level, it follows that the background knowledge associated with the concept EXPLOSION can be modeled after the modeling of the image-schematic relations that ground the process of explosion.

In particular, we argue that the resulting structure of EXPLOSION emerges from the connection between three image-schematic structures: UP-DOWN, which uses the image schemas SCALE, RESTRAINT_REMOVAL, and which uses the image schemas FORCE and CONTAINER, and IN-OUT, which uses the image-schemas CONTAINER and CONTENT.\(^\text{11}\)

In particular, the metaphorical instantiation of the concept EXPLOSION construes this connection in three distinct ways: (i) the UP-DOWN image-schematic structure is combined with the RESTRAINT_REMOVAL image-schema; (ii) the RESTRAINT_REMOVAL image-schema is combined with the spatial configuration of the CONTAINER image-schema, and (iii) the spatial configuration of the CONTAINER image-schema is combined with the IN-OUT image-schematic structure.

In (i), the removal of the limits of a scale can be associated with the event of exceeding that limit, for the removal of limits does not imply that the property of measuring is discarded. In (ii), the removal of the boundaries of a container can be associated with the event of disrupting, for the removal of boundaries implies the disruption of the container. In (iii), the disruption of containers can be associated with the release of its contents for disruptions imply contents release. The three-way connections (i)-(iii) are represented by the following relational structures: EXCEED\_X, DISRUPT\_Y, and RELEASE\_Z, where X, Y, and Z stand for the concepts that are conceptualized as scales, containers, and contents, respectively.

The experiential grounding of the source domain of explosion that is mapped metaphorically onto the target domains of emotion and statistics is made explicit in terms of the relational structures just described in the preceding paragraphs. We argue that the metaphorical elaborations of each structure are responsible to understand a specific metaphorical construction type.

Figures 3 and 4 show that the propositional structures abstracted from Types 1 and 2 activate the conceptual structures RELEASE\_Z and DISRUPT\_Y, respectively; and that the propositional structures abstracted from Types 3 and 4 activate the conceptual structure EXCEED\_X.

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\(^{11}\) Mirroring the SCALE image-schema structure, the FORCE image-schema includes a source, a direction, and a destination. The main distinction between them is the following: the former includes an up-down orientation, whereas the latter includes a path. The CONTAINER image-schema includes an interior, an exterior, and a boundary (Peña, 1999; 2008).
Figure 3. The links between the arguments (P1, Y and Z) of Type 1 metaphorical propositions and their corresponding perceptual concepts

Figure 4. The links between the arguments (P1 and Y) of Type 2 metaphorical propositions and their corresponding perceptual concepts

Figure 5 shows that the conceptual structure EXCEED_X is used metaphorically in the target domain of statistics to indicate the over-expression of amount or value. On the other hand, the conceptual structures RELEASE_Z and DISRUPT_Y are used metaphorically in the target domain of emotion to express a sudden emotional reaction (excitement, sadness, etc.) and an anger reaction, respectively. These metaphorical uses are schematized by the following conceptual metaphors: EMOTION IS AN OBJECT TARGETED AT SOMEONE (or SOMETHING), ANGER IS A HOT FLUID IN A CONTAINER, and AMOUNT IS VERTICALITY, respectively.

Figure 5. The links between the arguments (P1 and X) of Type 3/4 metaphorical propositions and their corresponding perceptual concepts

In the next section, we model the relational structures that organize the source domain of explosion in terms of semantic frames (Fillmore, 1985), i.e., a conceptual structure that describes a particular scene/domain (a situation, object or event) and its participants (Ruppenhofer, Ellsworth, Petruck & Johnson, 2006).

This discussion is couched in the following assumptions: (i) linguistic constructions are understood in terms of conceptual entities (Evans & Green, 2006), (ii) concepts are grouped in conceptual domains (Clausner & Croft, 1999; Croft, 2009), and (iii) conceptual domains are structured internally in terms of image-schematic structures and semantic frames (Johnson, 1987; Lakoff, 1993) and semantic frames (Sullivan, 2007; Bouverete & Sweetser, 2009).

6. Representing metaphorical mappings between conceptual domains as mappings between semantic frames

Following the main stream of cognitive studies on metaphor (e.g., Sullivan, 2007; Bouveret & Sweetser, 2009), this section depicts the modeling of the metaphorical conceptual mappings between domains as mappings between semantic frames. To model these mappings, first, we describe the events of exceeding, disrupting, and releasing (discussed in
section 5) in terms of semantic frames, and the connection between these events in terms of connections between frame elements (FE). The semantic frame that describes the exceeding event and that matches the relational structure EXCEED_X is change_of_position_on_scale, which is defined as ‘a changing of an item (Item) position (Attribute) on a scale from an initial point to an end point (Final State)’. As Figure 6 shows, the FE Final State of this frame represents the conceptual inference <exceed_limit>, upon which the metaphorical elaborations of the concept EXPLOSION in the target domain of statistics are based.

The semantic frame that describes the disrupting event and that matches the relational structure DISRUPT_Y is cause_to_fragment, which is defined as ‘a scene in which an event (Cause) leads to the separation of an entity (Whole_Patient) into pieces, resulting (Result) in the fragmentation of the original entity’. As Figure 6 also shows, the FE Result of this frame represents the conceptual inference <disrupted_container>, which grounds the metaphorical elaborations of the concept EXPLOSION in the target domain of emotions within Type 2.

Finally, the semantic frame that describes the releasing event and that matches the relational structure RELEASE_Z is emitting, which is defined as ‘a scene in which an agent (Emitter) discharges its content (Emission) for some reason (Reason)’. As Figure 6 shows, the FE Emission of this frame, which semantically elaborates the conceptual structure RELEASE_Z represents the conceptual implication <releasing_content>, which grounds the metaphorical elaborations of the concept EXPLOSION in the target domain of emotions within Type 1.

Figure 6 schematizes the relational structures EXCEED_X, DISRUPT_Y, and RELEASE_Z and the connections between these structures in terms of connections between FEs (the dotted arrows). We claim that each relational structure is elaborated metaphorically by a particular conceptual combination, which, in turn, is instantiated by specific lexical-grammatical patterns.

In Type 1, the FE Emission of the frame emitting, which semantically elaborates the conceptual structure RELEASE_Z, carries over the conceptual inference <releasing_content> from the source domain of explosion to the target domain of emotion, triggering the unpredictable inference <expressing_emotion> in this domain. Due to this mapping, the manifestation of emotions is seen as the release of contents. Thus, the metaphorical constructions which instantiate the conceptual composition [[CONTAINER]+[EXPLOSION]+[CONTENT]] are interpreted from this metaphorical mapping.

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12 FrameNet semantic frames were used to illustrate our work. The FrameNet database is available at http://framenet.icsi.berkeley.edu/.

13 In particular, it is the metaphorical elaboration of the conceptual structure [[CONTAINER]+[EXPLOSION]+[CONTENT]] that activates the conceptual metaphor EMOTION IS AN OBJEKT TARGETED AT SOMEONE/SOMETING.
target domain of emotion. In particular, because humans are conceptualized metaphorically as containers, and anger is conceptualized metaphorically as a pressurized container, the metaphorical mapping of the conceptual inference $<$disrupted_container$>$ onto the target domain of emotions triggers the unexpected inference $<$angry_person$>$ in this domain.\(^{14}\) Due to these mappings, angry persons are seen as disrupted containers. Accordingly, the metaphorical constructions which instantiate the conceptual combination $[[\text{CONTAINER}]+[\text{EXPLOSION}]]$ are interpreted from this metaphorical entailment.

Finally, in Types 3 and 4, the FE Final State of the frame change_position_on_scale, which semantically elaborates the conceptual structure EXCEED, carries over the conceptual inference $<$exceed_limit$>$ from the source domain of explosion to the target domain of statistics. In particular, because amounts are conceptualized metaphorically as verticality, the metaphorical mapping of the conceptual inference $<$exceed_limit$>$ onto the target domain of statistics triggers the unexpected inference $<$exceed_amount/value$>$ in this domain.\(^{15}\) The metaphorical constructions which instantiate the conceptual combination $[[\text{SCALE}]+[\text{EXPLOSION}]]$ are interpreted (see Types 3 and 4) in terms of this metaphorical entailment.

### 7. Final remarks

As shown in this paper, in Class 1 (see Table 1), in the domain of emotion, the metaphorical instantiation of the concept EXPLOSION aligns (mcsa) the ontology of the concept EXPLOSION with the ontology of the concept RELEASE; on the other hand, in Class 2 (see Table 1), the ontology of the same concept is aligned metaphorically (mcsa) with the ontology of ANGER. On the linguistic level, these mcsas are responsible for the inclusion of the vehicles which instantiate the concept EXPLOSION into the sets that lexicalize the releasing of an emotion (e.g., “releasing verbs”, such as show, display, manifest, release, express), and the emotional reaction of anger (Types 1 and 2, respectively), respectively.

In both classes 1 and 2, in the domain of statistics, the metaphorical instantiation of the concept EXPLOSION aligns (mcsa) the ontology of the concept EXPLOSION with the ontology of the concept EXCEEDING. On the linguistic level, this mcsa is responsible for the inclusion of the vehicles that instantiate the concept EXPLOSION into the set that lexicalizes “statistics overflows” (e.g. “rising verbs”, such as increase, rocket, skyrocket, raise, soar).

Throughout the analyzes of the mcsas in terms of conceptual domains, image-schemas, semantic fields, semantic frames, and the connection that is established between them, we could model the entities and relations from the linguistic structure, the conceptual structure, and the perceptual structure, that are responsible for the linguistic instantiations of conceptual metaphors, thus converting “(mental) conceptual instructions” into “(linguistic) semantic instructions”.

### References


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\(^{14}\) In particular, it is the metaphorical elaboration of the conceptual structure [[CONTAINER]+[EXPLOSION]] that activates the conceptual metaphor ANGER IS A HOT FLUID IN A CONTAINER.

\(^{15}\) In particular, it is the metaphorical elaboration of the conceptual structure [[SCALE]+[EXPLOSION]] that activates the metaphorical mapping MORE IS UP, derived from the conceptual metaphor AMOUNT IS VERTICALITY.


