Representing constructional metaphors

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Abstract

This paper introduces a representation and annotation scheme for argument structure constructions that are used metaphorically with verbs in different semantic domains. We aim to contribute to the study of constructional metaphors which has received little attention in theoretical and computational linguistics. The proposed representation consists of a systematic mapping between the constructional and verbal event structures in two domains. It reveals the semantic motivations that lead to constructions being metaphorically extended. We demonstrate this representation on argument structure constructions with Transfer of Possession verbs and test the viability of this scheme with an annotation exercise.

1 Introduction

Verbal semantics has received much attention in theoretical and computational linguistics. Representing the event structure evoked by verbs has been at the heart of recent theoretical and computational linguistic models (Fillmore et al., 2003; Banarescu et al., 2013; Hajič et al., 2012; Abend and Rappoport, 2013). Verb meaning is a crucial determinant of the syntactic realization of arguments and their semantic interpretation within events (Fillmore, 1985; Talmy, 1988; Levin, 1993). Conversely, argument structure constructions contribute much of the semantic structure of events (Goldberg, 1995; Croft, 2012).

Most event representations do not explicitly address metaphorical extensions across domains or metaphorical correspondences between constructional meanings. For example, the syntactic realization of arguments associated with certain verbs in the physical domain, e.g. *place* verbs (1a), *remove* verbs (2a), *cover* verbs (3a), or *uncover* verbs (4a) is also used with Transfer of Possession and Communication verbs in the social domain (the (b) and (c) sentences) (Jackendoff, 1972; Goldberg, 1995):

(1) a. Linda taped the picture <u>to the wall.</u>

 b. Jerry loaned his skateboard <u>to his brother</u>.

 c. I told a bedtime story <u>to his son</u>.

(2) a. Doug removed the smudges <u>from the table</u>.

 b. He stole money <u>from me</u>.

(3) a. Leslie covered the bed <u>with blankets</u>.

 b. The Russians supplied Syrians <u>with firearms</u>.

 c. She called me <u>with the information</u>.

(4) a. Doug cleaned the table <u>of dishes</u>.

 b. She robbed him <u>of his wallet</u>.

Transfer of Possession verbs use the same inventory of argument structure constructions as physical verbs to describe the semantic relations between participants. Communication verbs use only some of the

Constructional representation:
VOL
Linda $\xrightarrow{\text{Force}}$ +MER
Picture $\xrightarrow{\text{Path}}$ EXIST
Wall

Verbal network representation:
Phys_Entity $\xrightarrow{\text{Force}}$ MER
Moved_Entity $\xrightarrow{\text{Path}}$ MER
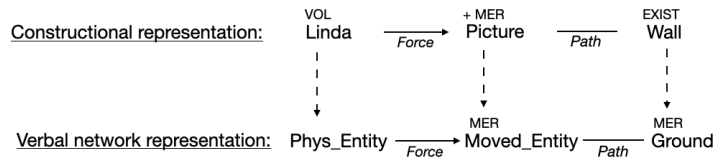Ground

Figure 1: A mapping of a Place causal chain to the Application network

physical argument structure constructions[1]. As shown above, verbs of *giving* and *telling* use the physical placing argument structure construction (1), verbs of *taking* use the physical removal construction (2), verbs of *providing* use the physical covering construction (3), and verbs of *depriving* use the physical uncovering construction (4).[2]

Metaphorical cross-domain mappings of constructional patterns are not uncommon. The use of metaphor in language is pervasive (Lakoff and Johnson, 1980; Gibbs Jr. and Steen, 1997) and a structured representation for various types of figurative language is crucial to many NLP tasks (Bolognesi et al., 2019; Hwang et al., 2017). As the examples (1-4) show, there is a need for a systematic representation that makes metaphorical correspondences between argument structure constructions explicit. In this paper, we propose a model that captures shared semantic elements that lead to argument structure constructions being extended across semantic domains. We argue that allowing for metaphorical use of argument structure constructions will prevent a proliferation of distinct constructional semantic annotations.

2 Semantic representation of the source domain: Application events

The semantic representation adopted in this paper distinguishes verbal event structure from constructional semantics (Kalm et al., 2019). We follow Goldberg (1995) in recognizing the separate contributions of argument structure constructions and verbal semantics to the specification of event structure. Our representation builds on the notion of transmission of force and its relevance to argument realization (Talmy, 1988; Croft, 1991; Croft, 2012). We identify a limited set of force-dynamic relations between event participants (cf. Croft et al., 2016). The relations can be causal (Talmy, 1988), e.g. a FORCE relation between an Agent and a Theme in *She hit the ball*, or non-causal (Croft, 1991), e.g. a spatial PATH relation between two physical entities, as in *Italy borders France*. Force-dynamic relations are used to construct verbal semantic networks and constructional causal chains. The event structure representations also include information about the type of change that each participant undergoes over the course of the event.

Application events, which subsume removal as well as placement events, describe a spatial configuration relation between two entities. Unlike Motion events (e.g. *She rolled the ball down the hill*), which describe the path of motion, Application events describe the co-location, including attachment, of two entities. Application events proceed incrementally part by part – mereologically (Dowty, 1991) – while Motion events proceed incrementally along the path of motion (Dowty's "holistic theme").

Each physical example in (1-4) is represented by a distinct causal chain which specifies which participant is construed as the incremental theme in the argument structure construction. We illustrate the causal chain for the Place construal only, due to limitations of space.

The constructional representation for Place (see Figure 1) identifies a causal FORCE relation between the initiator *Linda* and the theme *picture* which undergoes motion. The theme is in a PATH relation with the Ground *wall*. Depending on the argument structure construction, either the Ground or the Moved_Entity is construed as the incremental theme. In the placing construal, example (1a), the incremental theme is the Moved_Entity because it is syntactically realized as the direct object. The Moved_Entity is labeled +MER to indicate that the path of motion is *to* the Ground. This notation con-

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[1]Communication verbs do not occur in the *remove* (2) or *uncover* (4) construals.

[2]*Giving* and *telling* verbs also use a double object ("Transfer") argument structure construction; however, the semantics of this construction with Transfer of Possession verbs is not metaphorical. Its representation is therefore not a focus of this paper.
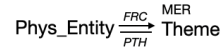
(a) Application network   (b) Constrain network

Figure 2: Verbal networks associated with Application and Constrain verbs

trasts with removal events, in which the incremental theme moves *away from* the Ground and is labeled -MER. The Ground in the placing construal is EXIST; it doesn't undergo any change in the event.

Placing and removal verbs share the same verbal event structure which is referred to as the Application network in this paper, see Figure 2a. The motivation for having a single network for these verbs is that they share the same force-dynamic relations between participants, and both construe the incremental theme as mereological. The Moved_Entity and the Ground are both labeled mereological (MER) in the verbal network. This label does not specify whether the verb describes a placing or removal event and allows for either constructional construal to map to the network. The type of change that the Phys_Entity undergoes in the verbal network is unspecified. Its specification is dependent on the volitionality of the initiator and is therefore determined contextually.

Some Application events describe a different type of event in which the figure's movement results in a co-location relation with the Agent (or a physical entity that initiates the Application event). Verbs such as *pick up* or *drop* describe this type of self-directed action, as shown in Figure 2b. The result state of such an event is a holding event expressed in English with verbs such as *hold*. Talmy (1988) refers to this type of force-dynamic relation as 'extended causation of rest' in contrast to other physical Application events. We describe this type of Application event as a Constrain event. The Constrain event structure evokes two participants: a Phys_Entity and Theme. In our analysis, we use a superordinate Force relation to describe the force-dynamic interaction between the Phys_Entity and the Theme. The argument realization of participants in Force and Constrain events is the same. Hence, there is no constructional motivation to distinguish these force-dynamic types from each other.

A complete representation of the event structure consists of a mapping between the verbal network and the constructional causal chain. When all participants are syntactically evoked, there is a nearly complete correspondence in the mapping from the constructional semantics to the verbal network. Figure 1 shows a mapping from the Place argument structure construction associated with the example in (1a) to the Application network. In the Place construal, the label MER on the incremental theme *picture* matches the label of the corresponding participant in the network. However, the label on the Ground in the verbal network is 'overridden' by the role that the Ground *wall* is assigned in the constructional semantics.

The following sections develop a model for representing the metaphorical extensions of the Application and Constrain argument structure constructions to verbs in the social domain.

3 Metaphorical analysis

The use of metaphor in language has been extensively discussed in theoretical linguistics (Lakoff and Johnson, 1980; Lakoff, 1993; Grady, 1997; Fauconnier and Turner, 2008; Evans, 2009). Various frameworks have been put forth in recent years with the aim of explaining underlying cognitive principles that lead to the use of figurative language. However, metaphorical extensions of argument structure constructions (which we refer to as "constructional metaphors") have not received much attention.

One of the most prominent theories of metaphor is the Conceptual Metaphor Theory (CMT) (Lakoff and Johnson, 1980; Lakoff, 1993). The CMT has primarily addressed metaphors that involve stable and systematic correspondences between two conceptual domains. Metaphorical mappings are analyzed as originating in a 'source' domain and being extended to a 'target' domain. For example, the conceptual metaphor TIME IS MONEY originates in our understanding of time as a valuable commodity that can be wasted, spent, or invested. This metaphor reflects a connection between concepts in two domains: time (in the target domain) and money (in the source domain).

Our discussion of metaphorical mappings that motivate the syntactic realization of participants with Transfer of Possession verbs is guided by CMT. We consider constructional metaphors to reflect knowl-

$$\text{Agent} \xrightarrow[\text{CTRL}]{\text{PERF}} \overset{\text{MER}}{\text{Possession}}$$

(a) Dynamic Possession network

$$\text{Agent} \xrightarrow[\text{CTRL}]{\text{PERF}} \overset{\text{MER}}{\text{Possession}} \xleftarrow[\text{CTRL}]{} \overset{\text{MER}}{\text{Possessor}}$$

(b) Transfer of Possession network

Figure 3: Verbal networks associated with Possession verbs

edge structures that are regular and follow conventional patterns of metaphorical conceptualization. The physical argument structure constructions with Application events are source domain representations. They are metaphorically extended to verbs in social domains which are the target domains.

The role of metaphor in constructions has been addressed in the linguistics literature to some extent but theoretical accounts of this phenomenon are fairly limited (Jackendoff, 1972; Goldberg, 1995; de Mendoza Ibáñez and Usén, 2007). Relevant descriptions lack depth and do not provide explanations for underlying semantic motivations that lead to metaphorical extensions. For example, Goldberg (1995) argues that there is a metaphor "that involves understanding possession as the 'possessed' being located next to the 'possessor,' transferring an entity to a recipient as causing the entity to move to that recipient, and transferring ownership away from a possessor as taking that entity away from the possessor." She uses Application argument structure constructions to provide evidence for her claim. Goldberg (1995) and other scholars provide only a verbal description of the phenomenon rather than a formal representation that would make explicit the semantic motivations that lead to metaphorical extensions.

3.1 Verbal event structure of Transfer of Possession verbs

Our semantic representation of social verbs expands on the notion of transmission of force by identifying schematic force-dynamic relations between participants in the social domain. Transmission of force in social interactions has been addressed in the literature (Talmy, 1988; Croft, 2012); however, an in-depth analysis of social force-dynamic relations has not yet been proposed. To develop a representation for metaphorical constructions with possession verbs, we first describe a force-dynamic analysis of relations between participants with these verbs.

Our social event representations employ the same set of categories used in the physical domain to describe the type of change that each participant undergoes in the event. These categories are defined as domain-independent semantic features. They describe abstract qualitative changes that are not associated with any particular force-dynamic relation in any given domain. For example, the MER label describes a mereologically incremental change that the participant undergoes in an event. This type of change is not specific to any particular domain. Force-dynamic relations between participants, on the other hand, are defined as domain-specific to capture the different types of interactions that physical, social, or mental entities engage in. Force-dynamic relations define the semantic content of the network structure that is specific to the verbal domain. Using domain-independent labels to define participants' internal changes and domain-specific force-dynamic relations between participants allows us to capture common structures across domains as well as distinguish the interactions between participants that are domain dependent.

We distinguish Transfer of Possession verbs ("Transfer verbs") from Dynamic Possession verbs ("Possession verbs"). Dynamic Possession verbs (e.g. *find, obtain, lose*, etc.) describe an event structure in which the Possessor either gains or loses control over the Possession, as shown in Figure 3a.[3] Transfer verbs (e.g. *give, take*, etc.) inherit and elaborate on the event structure of Possession verbs. As shown in Figure 3b, the event structure of Transfer verbs evokes an additional participant, a Possessor. With *giving* verbs, the Possessor is a recipient who comes to gain control over the Possession. With *taking* verbs, the Possessor is the original possessor who loses control over the Possession. On an abstract force-dynamic level, *giving* and *taking* verbs share the same event structure representation.

PERFORM describes a force-dynamic relation between the Agent and Possession. PERFORM is an asymmetrical causal interaction in which the initiator uses performative illocutionary force in the sense of

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[3]We distinguish Dynamic Possession verbs from Static Possession verbs (e.g. *own, have, belong to, etc.*). Static Possession verbs do not evoke any change and use a different constructional metaphor. In this paper, we only discuss Dynamic Possession verbs.

speech act theory (Levinson, 2017), as opposed to physical force, to bring about change in the endpoint. The non-causal force-dynamic relation that characterizes the relation between Agent and Possession is CONTROL. The CONTROL relation prototypically describes a socially sanctioned relation between an Agent and an entity.[4] The Agent is construed as antecedent to the Possession in the causal chain, similar to the ordering of Figure and Ground in physical event structure representations. In the Possession and Transfer event structures, the CONTROL relation indicates that the Agent (or Possessor) either loses or gains control of the Possession.

The Possession participant is construed as an incremental theme in both verbal event structures. It is labeled MER to indicate change in possession. The type of incremental change undergone in possession events is the same as in physical Application events. Similarly to the Application network in the physical domain, we do not distinguish whether the verb describes a giving (placing) or taking (removal) event in the networks with possession verbs. Whether the incremental theme is +/-MER is not relevant to the verbal event structure representation, it is only relevant to the syntactic realization of participants.

The Possessor in the Transfer of Possession network is also identified as MER. The Possessor undergoes a mereological change by receiving or losing the Possession. Similarly to physical Application constructions, the Possessor in Transfer events may instead be construed as the incremental theme (and syntactically realized as a direct object), as shown in examples (3b) and (4b).

3.2 Metaphorical mappings

Our representation for constructional metaphors consists of a systematic mapping between constructional and verbal event structures in two domains. We show that there exists a set of correspondences between the physical (source domain) network and the social (target domain) network that motivates the metaphorical extension of the argument structure construction associated with events in the physical domain. Defining the type of change that each participant undergoes in the event as a domain-independent semantic feature allows us to identify commonalities in verbal event structures across domains. A structural overlap between the physical and social domain verbal networks does not immediately yield a metaphorical analysis but it shows that verbs in distinct domains share abstract semantic features in their representations. Common semantic features frequently motivate the use of constructional metaphors.

Figure 4 shows the semantic motivations for metaphorical mappings observed with Possession and Transfer verbs. The mappings show the source and target domain verbal networks, the correspondences between them, and the constructional causal chains that are metaphorically extended to the target domain.

A metaphorical mapping of the Constrain causal chain onto the Possession network is presented in Figure 4a. The Constrain metaphor is frequently used to describe events with Possession verbs which prototypically occur in the transitive argument structure construction. As shown in Figure 4a, the partici-

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[4] *Obtaining* or *finding* events also correlate with a physical movement of the Possession in a prototypical transfer event (Goldberg, 1995). It has been argued that the correlation of spatial motion with control over the possessed entity motivates the metaphorical extension from the physical source domain (Grady, 1997). However, we do not represent a spatial Path relation between the participant with Possession verbs as literal motion between the Possessor and the Possession is not evoked by the verbal semantics.

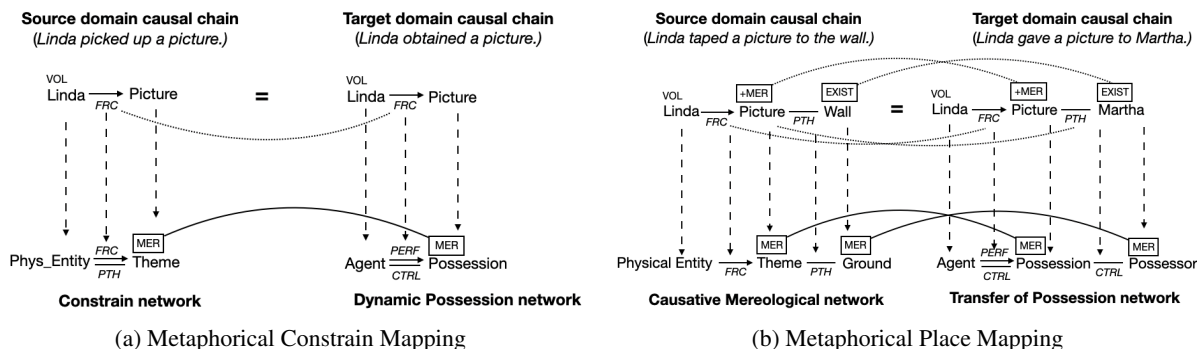(a) Metaphorical Constrain Mapping   (b) Metaphorical Place Mapping

Figure 4: Metaphorical Mapping Representations

pants in the Constrain network and the Possession network undergo the same type of internal change. The correspondences between the two semantic domains are sufficient to motivate a metaphorical mapping in which the transitive Constrain argument structure construction is extended to Possession verbs.

Figure 4b demonstrates that the Application and Transfer verbal networks also share semantic features in their representations. The participants undergo the same type of internal change over the course of these semantically distinct events. Both networks consist of an initiator which is external to the non-causal relation between participants.

As shown in Figure 4, social domain force-dynamic relations are metaphorically construed as physical relations. In particular, the social PERFORM relation maps to the source domain physical FORCE relation and the social CONTROL relation maps onto the physical PATH relation. The mapping between force-dynamic relations across domains in metaphorical construals is not random: the causal and non-causal relations in the target domain map to the causal and non-causal relations in the source domain, respectively. Additional motivations for linking relations across domains may exist. For example, the CONTROL relation is frequently associated with a physical co-location relation between the Possession and the Possessor, which further motivates the metaphorical mapping to physical PATH.

Possession verbs can also be metaphorically construed as Transfer events in metaphorical Application argument structure constructions. For example, an *obtain* verb can be used to describe a metaphorical remove event, e.g. *She obtained the book from her friend*. The verbal event structure evokes that the Agent ends up in control of the Possession; however, the constructional semantics describes a removal event in which the Possession is taken away from the original Possessor. This metaphorical construal is not unexpected given that Constrain verbs are used analogously in the physical domain in removal or placing construals (e.g. *She picked it up from the floor*). The non-causal relation between the initiator and the theme in both the Possession and Constrain networks is semantically implied but it is not syntactically expressible in English. If a CONTROL relation is overtly expressed in the constructional causal chain with Possession verbs, the participant will always be distinct from the initiator of the network and will evoke a Transfer event.

Evidence for a close correspondence between the event structures of Constrain, Application, Possession, and Transfer verbs is the use of a single verb to describe these different types of events. For example, the English verb *take* can be used as a physical Constrain verb in *He took her hand*, a verb of Removal in *He took the cup from the cupboard*, a metaphorical Dynamic Possession verb in *He took the flower*, or a Transfer verb in *They took the book from him*.

3.3 Non-physical "Possession" in Transfer events

In their prototypical sense, Possession and Transfer verbs tend to be used with participants that denote physical entities that can be physically controlled. However, corpus data indicates that these verbs also frequently occur with non-physical entities that are metaphorically conceptualized as Possessions. MetaNet (Petruck, 2018) includes metaphors such as ATTRIBUTES ARE POSSESSIONS, BELIEFS ARE POSSESSIONS, or IDEAS ARE POSSESSIONS. Non-physical entities with Possession and Transfer verbs primarily include attributes that define a person's social status or role (e.g. *They gave him an important role*). They can also denote socially agreed upon artifacts that define a person's status (e.g. *They presented him with a diploma*). Another common type of non-physical Possession is knowledge or experience, which can be metaphorically conceptualized as being 'transferred' to a person (Fillmore et al., 2003). An example such as *We now present the kaoshikii dance* describes an event in which the experience of a dance or performance is transferred to the audience.

Transfer verbs can also be used to describe communication events, e.g. *They presented him with a plan*. In this example, the speaker's ideas are metaphorically conceptualized as a Possession that is being transferred to an addressee. This conceptualization of the event motivates the use of the Transfer verb and the metaphorical Provide argument structure construction. Although a communication event may be entailed contextually, it is not specified by verbal or constructional semantics in this example. The means of presentation is not explicitly stated with a Transfer verb. The constructional and verbal semantics only convey that the Recipient now has a knowledge of the *plan*. Our semantic representation and annotation

does not aim to disambiguate whether the event describes communication, social role assignment, or some other event in the social domain when Possession or Transfer verb is used. The representation only depicts the mapping of the constructional semantics to verbal semantics.

4   Annotation exercise

To see how well our representation could be developed into an annotation scheme, we asked three linguistics graduate students who are familiar with our research to annotate a random sample of 123 examples from the RED and BOLT corpora[5]. The annotators did not participate in the development of the annotation scheme. Only one of the annotators had previous experience annotating linguistic corpora.

The annotation sample was restricted to verbs that describe Possession and Transfer events and physical Application and *send* verbs which can be used to describe physical events as well as social possession events. We used the VerbNet verb classification (Kipper et al., 2007) to extract examples with verbs from VerbNet's possession classes. We later added *send* examples and additional physical examples with Application verbs to have a more balanced number of physical and metaphorical examples in the dataset. The sample excluded idiomatic examples with possession verbs (e.g. *I'm pretty calm about things and like to **take** things as they come*), examples in which the verb was followed by the preposition *without* (e.g. *I had to **leave** without a refund*) and other examples with *leave* that describe metaphorical Motion, not Possession (e.g. *[...]only 15 months until we can **leave** nationwide and move over to a proper btl mortgage*). A carefully pre-sorted annotation sample was needed to ensure that annotators encountered only examples that were addressed in the guidelines. The primary goal of the exercise was to test how well annotators can correctly identify metaphorical events given that the constructions used with metaphorical and non-metaphorical events are the same and are annotated the same way. High inter-annotator agreement for the semantic domain (annotated as EVENT DOMAIN in the exercise) would support our proposed simplified representation for constructional semantics which relies on accurate semantic domain identification.

EVENT DOMAIN	FD1 labels	FD2 labels
Social:Possession	Autonomous	Control
Physical:Force	Instrument	Deprive
Physical:Mereology	Physical	Force
Physical:Motion	Self-volitional	Motion
	Volitional	Place
		Provide
		Remove

Table 1: Annotation labels

The annotation scheme used in the exercise is an extension of our existing annotation scheme devised for examples in VerbNet classes with verbs in the physical domain (Croft et al., 2016). Each example was annotated for EVENT DOMAIN and the constructional semantics by using FD1 and FD2 labels. EVENT DOMAIN was not previously used in our annotation scheme. It was introduced in the current scheme to distinguish metaphorical uses of argument structure constructions from non-metaphorical ones. The full inventory of annotation labels is listed in Table 1.

EVENT DOMAIN specifies the domain and the subdomain of the example. The target domain is frequently implicit in the verb, as is the case with *find* in (5). *Find* is a Possession verb and the EVENT DOMAIN of the example is annotated Social:Possession. However, verbal semantics alone cannot always accurately determine the target domain. For instance, the verb *take* can be used to describe a physical mereological event (6), annotated as Physical:Mereological, or a Possession event (7), annotated as Social:Possession.

(5)   They seemed more interested in helping me **find** the right car.

(6)   One can **take** white eggs out with a pipette or eyedropper.

(7)   He at least **took** the neighbor's bicycle.

The `FD1` label identifies whether the initiator of the event is internal or external to the core event. It also specifies whether the initiator acts volitionally or not.[6] The `FD2` label describes the 'core' event, i.e. the event that the incremental theme is engaged in. For instance, example (6) was annotated `Volitional Remove`. The constructional semantics describes a causal chain in which the subject *one* is an external (`Volitional`) initiator that causes the `Remove` event in which the direct object *white eggs* is removed from a container, a null-instantiated participant.

The annotators were presented with written annotation guidelines[7]. Due to time constraints, we did not verbally go over the guidelines nor did we do a trial annotation prior to this annotation exercise. The types of disagreements detected in the test annotation indicate that improved annotation guidelines could lead to higher inter-annotator agreement scores in the future. To assess inter-annotator agreement, we used Cohen's Kappa on each of the annotated units. The reported values are averages of the Cohen's Kappa scores for each annotator. The `EVENT DOMAIN` annotation was the most accurate (0.73). Lower `FD1` (0.47) and `FD2` (0.57) agreement scores resulted from recurring errors that could be prevented with improved annotation guidelines, as discussed below.

5   Error analysis

About 40% of errors in the `EVENT DOMAIN` annotation resulted from incorrectly identifying whether an event was `Physical` or `Social` with *take* and *grab* verbs. This was particularly problematic when these verbs occurred with a theme that referred to a physical object. In such contexts, both verbs evoke temporary control over the object as well as a physical force event. There were two main types of these errors. In one case, the error with *take* and *grab* verbs resulted from incorrectly recognizing whether the physical event or the social control relation was more salient to the interpretation of the event. For instance, in *I quickly **grabbed** sentence strips out of the closet*, the verb describes a physical removal event; however, the event also evokes that the Agent has control over the object by being spatially co-located with it. The annotation of this example as `Physical:Mereology` reflects that the physical event is more salient in the interpretation when compared to the control relation between the Agent and the moved entity, which is only a precondition for the physical event to take place. In other cases, *take* occurred in a context in which the verb described a use-type relation, e.g. *If you **take** a flash light and shine it through the eggs [...]*. Alerting the annotators to the fact that *take* could be used to describe a `FORCE` relation in physical manipulation events in the annotation guidelines should result in fewer errors of this type. Additionally, including a more detailed description of how to annotate physical verbs that evoke both domains at the same time should lead to higher inter-annotator agreement.

Another common type of error (about 15%) in the `EVENT DOMAIN` resulted from choosing the wrong subdomain label when an event took place in the physical domain. Many *take* verbs were incorrectly annotated as `Physical:Mereology` when they occurred in Constrain events, e.g. *I was told to **take** my coffee to go*.

`FD1` and `FD2` labels were more challenging to annotate given the larger inventory of annotation labels associated with these categories. To correctly annotate the `FD2` label, the annotators had to correctly determine the core event and, in many cases, take into account null instantiated participants. Additionally, the choice of `FD2` impacted the annotation of `FD1`. Approximately 37% of all `FD1` errors were due to an incorrect choice of an `FD2` label. About 43% of `FD1` errors resulted from annotators incorrectly distinguishing internal initiators from external initiators.

Many of the `FD1` errors had to do with distinguishing external and internal initiators. For example, various examples with `Force` FD2, e.g. *I just **grab** the blender and pop in some other stuff*, were

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[6]`FD1` labels distinguish different types of initiators. Autonomous is used when the initiator is internal to the event, similarly to Self-volitional. However, unlike Self-volitional, the Autonomous initiator does not act volitionally. Physical is used analogously to Volitional and describes an external initiator that doesn't act volitionally. Instrument is used when an Agent uses an intermediary object, i.e. an instrument, to carry out an action. Instruments are common with physical Application and *send* verbs but infrequent in metaphorical construals with Application verbs.

[7]A revised version of the annotation guidelines can be accessed online at https://github.com/fd-semantics-unm/coling-metaphors. Revisions to the guidelines were made after the annotation exercise to address common errors, see Section 5.

annotated `Volitional FD1` despite the semantic incompatibility of `Force` and the presence of an external initiator in transitive argument structure constructions.[8]

As noted above, annotators sometimes chose a wrong `FD2` label which then led to an incorrect `FD1` annotation. About 14% of `FD2` errors resulted from annotators incorrectly including a null instantiated participant in the annotation. For example, some annotators annotated the example *What year did Mussolini **seize** power in Italy?* as `Volitional Remove`, assuming that an original possessor was part of the constructional semantics. However, in this context, *take* does not describe a removal event, it describes an obtaining event, i.e. Mussolini gaining power. The correct annotation label for `FD1` and `FD2` was therefore `Self-volitional Force`. Approximately 25% of `FD2` errors resulted from a null instantiated participant not being included in the annotation when it should have been. For example, in *we are **collecting** a premium up front and their total cost is known up front*, the original possessor from whom the premium is collected should be part of the constructional semantics leading to the annotation `Volitional Remove`. If an annotator did not recognize that a null instantiated participant was semantically evoked, the `FD2` label would have been incorrectly annotated as `Force`. The guidelines should clarify when a null instantiated participant ought to be included in the annotation and provide more examples to supplement the explanations.

About 16% of `FD2` errors included a wrong incremental theme construal. Annotators frequently annotated a `Remove FD2` example (e.g. *[they] actually care about the customers safety rather than **taking** their money*) as `Deprive FD2`. This error resulted from incorrectly identifying the original Possessor as the incremental theme, rather than the Possession. This type of error was also common with `Place` and `Provide` construals. The decision which of the participants is the incremental theme should be guided by which participant is expressed as the direct object in the construction.

Another 17% of `FD2` errors resulted from interpreting a motion event as mereological. Some annotators incorrectly identified examples with *send* verbs as mereological, rather than motion events. Although it was clearly stated in the annotation guidelines that the `FD2` label in examples such as *He might have **sent** it to me today* is `Motion`, having more time to go over the guidelines with the annotators would have probably resulted in fewer errors. The guidelines should also include a more detailed description of various application examples and the syntactic realization of the incremental theme.

6 Conclusion

The use of constructional metaphors in the social domain is pervasive. Communication verbs use the same inventory of Application argument structure constructions as Transfer of Possession verbs. Other common constructional metaphors in the social domain include Motion metaphors with verbs that describe entering or leaving a social role, status, or an institution. For example, *firing* and *resigning* verbs occur in Motion argument structure constructions (e.g. *He resigned from the military*). Locative metaphors are common with verbs of social membership and employment (e.g. *He is employed at IBM*). Recognition of the many metaphorical argument structure constructions in social events will allow us to simplify the annotation of the semantic contribution of argument structure constructions to event structures for social events. It will also allow us to capture an important dimension of meaning that will be useful for building computational models that reason over social events, a goal of future work.

The annotation exercise indicates that annotators can reliably identify a literal use of argument structure constructions from their metaphorical use. This finding supports our hypothesis that a simplified representation of constructional metaphors that relies on a correct identification of the semantic domain of the example can be used to determine the event structure of a particular example.

Acknowledgements

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[8]The dataset included only examples in which `Force` had an internal initiator since we focused on Constrain events. `Place` and `Remove` events, on the other hand, always evoked an external initiator when metaphorically used with Transfer of Possession verbs. In the physical domain, `Place` and `Remove` may occur with an external or internal initiator. The annotators were not informed about the correlation of internal and external initiators with `FD2` labels in this dataset.

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