Domain-transcending mappings in a system for metaphorical reasoning

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Abstract

We illustrate how the use of metaphorical views for reasoning with metaphor requires the mapping of information such as event shape, event rate and mental/emotional states from the source domain to the target domain. Such mappings are domain-independent and can be implemented by means of rules we call View Neutral Mapping Adjuncts (VNMAs). We give a list of the main VNMAs that appear to be required, and show how they can be incorporated into a pre-existing system (ATT-Meta) for metaphorical reasoning.

1 Introduction

Lakoff (1994: p.212) gives the following example of metaphor in a song lyric.

1) We're driving in the fast lane on the freeway of love.

Lakoff presents this as an example of the commonly used conceptual metaphor (or, as we prefer to call it, 'metaphorical view') LOVE AS A JOURNEY. The progress of the love relationship is viewed as a journey, the lovers as people undertaking the journey, and the love relationship as the vehicle in which they are travelling. In other words, the journey is said to map to the relationship's progress, the travellers to the lovers, and the vehicle to the relationship. A metaphorical view consists, in part, of such a set of mappings, from the "source domain" (the domain of literal interpretation of the metaphor) to the "target domain" (the domain which is being described by means of the metaphor). Lakoff does not, however, explain how the excitement of the journey is mapped over from the source domain (i.e. the domain of vehicles and journeys) to the target domain (the domain of the lovers and their relationship). Yet the mapping of this emotional state seems to be a key part of the meaning of the metaphor, both to Lakoff and to us.

In other examples (see section 3), it is similarly clear that additional aspects of the source domain must be mapped to the target domain. These include causation and ability, event shape, value-judgments, uncertainty, and so on.

In order to achieve these mappings we have designed and started to implement a set of *view neutral mapping adjuncts* (VNMAs)[1]. We regard VNMAs as standard but implicit default aspects of all view-specific metaphorical mappings. They are defaults in that they can, in principle, be overridden by particular metaphorical views or by incompatibility with the understander's knowledge of the target.

Our use of VNMAs is partly inspired by Carbonell's (1982) proposal that certain aspects of sources tend to map over to targets, irrespective of the particular metaphorical view at hand. We adopt his basic suggestion, building on it by proposing a detailed and specific set of VNMAs. We study the efficacy of these VNMAs in real-discourse examples, and show how they can be incorporated into the ATT-Meta system for metaphorical reasoning (Barnden & Lee 1999), which currently embodies some, but not much, of this view-neutral transfer of information.

[1] In Wallington *et al.*, (submitted) VNMAs are called *Conceptual Metaphor Mapping Adjuncts* (COMMAs).

2 View-Neutral Mapping Adjuncts

The VNMAs listed here are most of those needed for making sense of many examples that we have examined. They fill in specific gaps in discussions in the literature, and, as we show in (Barnden 2001a, Barnden 2001b), the set copes with a wide variety of real-discourse examples. Although others may need to be added, the ones so far identified are plausibly among the most important. The final set of VNMAs needed is an empirical matter and can only be determined over time as we gain experience with using the technique.

Note that, in what follows, we refer to target domain items to which source domain items are mapped as 'mappees'.

Causation/Ability VNMA: Causation, prevention, helping, ability, function/purpose and (dis) enablement relationships between events or other entities in the source domain map to causation, prevention, (etc.) relationships between their mappees (if they have any).

Change VNMA: If there is a change event from one state of affairs to another in the source domain, where the states of affairs themselves have mappees in the target domain, then the change event has a mappee that is a change event between the latter states of affairs.

Time-order VNMA: The time-order of events in a source domain is the same as that of their mappee events, if any.

Duration VNMA: Qualitative length of time, in the context of the source domain, that is consumed by an event maps identically to qualitative length of time, in the context of the target domain, consumed by the mappee event, if any. E.g., if something takes a long time in the context of the source domain then its mappee takes a long time in the context of the target. Also, qualitative duration comparisons map over.

Rate VNMA: Qualitative rate of progress of an event in the source domain maps identically to qualitative rate of progress of its mappee, if any. E.g., if an event progresses slowly in the context of the source domain, then its mappee progresses slowly in the context of the target domain[2].

Event-Shape VNMA: Aspectual features of events, such as whether they have a start or end, or are intermittent, map identically to any mappee events.

Mental/Emotional States VNMA: If some agents in the source domain have mappees that are also agents, then their mental and emotional states map identically, provided that the objects or propositional contents (if any) of the states can be modified by mapping relationships that apply. E.g., if John and Mary arguing is metaphorically viewed as engaging in physical combat, then the source domain proposition that *John believes he is losing in the combat* maps to the target domain proposition that *John believes he is losing the argument* assuming that combat-losing maps to argument-losing.

Value-Judgment VNMA: Levels of goodness, importance or other types of value assigned by the understander to states of affairs in the source domain map identically to levels of goodness, etc., of their mappee states of affairs, if any.

Uncertainty VNMA: The level of certainty with which situations hold in the source maps at least roughly to level of certainty with which their mappee situations, if any, hold.

Modality VNMA: Relative degree of necessity, possibility, obligation, tendency, etc., in the source domain, for actors to undertake actions or for a state of affairs to obtain, maps identically to relative degree of necessity, possibility, etc., in the mappee situations, if any.

Qualitative Degree VNMA: If the holding of a graded property or relationship in the source maps to the holding of a graded property or relationship in the target, then the qualitative absolute and relative degrees map over identically. For example, if presence of above-normal temperature maps to presence of anger, then a high temperature maps to intense anger, and the higher the temperature the more intense the anger.

Set-hood VNMA: If entities of a certain type S in the source map to entities of type T in the target, then a set of entities of type S in the source maps to a set of entities of type T in the target.

Set-Size VNMA: Qualitative size (relative or absolute) of sets in the source domain maps identically to qualitative size of mappee sets in the target domain. E.g., if a set is large in the terms of the source domain then its mappee set (if any) is large in the terms of the target domain.

Physical-Size VNMA: Qualitative physical size (relative or absolute) of physical objects in

[2] We use the term 'event' very broadly in this paper.

the source maps identically to qualitative physical sizes of mappee objects (if physical) in the target.

Logical structure VNMA: A special case of this VNMA is negation: If a property or relationship in the source has a mappee property or relationship, then non-possession of the source property/relationship maps to non-possession of the target property/relationship. Other logical structures such as conjunction and disjunction are similarly mapped.

3 Examples of VNMA use

The mental/emotional states VNMA allows the mapping of the excitement in Lakoff's example (1, above) from the source to the target domain. Since the agents in the source domain (the occupants of the car) are mapped (in fact are identical to) agents in the target domain (the lovers), the emotion of excitement maps over identically.

The effect of VNMAs is needed for the following real-discourse example, quoted in (Grady 1997):

2) The house of psychoanalysis has many mansions, but some of Freud's followers ... have not wanted to live in the main house and have built their own annexes ...

We follow Grady in taking this example to rest on the metaphorical views of ORGANIZATION AS PHYSICAL STRUCTURE, the organizations in question being various forms of psychoanalytic thought-system (or theory), and a view we call THEORY AS HOME – whereby a body of ideas, an artistic style, etc., that someone espouses can be viewed as the person's home.

Presumably ORGANIZATION AS PHYSICAL STRUCTURE maps physical containment relationships to organizational containment relationships. In the source domain it can be inferred, from the literal meaning of the utterance, that psychoanalysis (*qua* house) physically contains the main house, the annexes. Therefore, by the containment mapping relationship, psychoanalysis is being claimed in reality to contain corresponding items. Because psychoanalysis is a theory, it is inferred (defeasibly) that these items are also theories.

The annexes have been built by various psychoanalysts. A source-domain inference from this is that these sub-buildings have been caused to exist by the psychoanalysts. Since these people are also in the target domain, the causation-to-exist is transferred by the Causation/Ability and Event-Shape VNMAs to become cause-to-exist propositions in the target domain. The mapping in THEORY AS HOME combined with the Event-Shape VNMA can create the target-domain proposition that the people came to espouse the theories corresponding to the sub-buildings.

Finally, the source-domain proposition that Freud's followers have not wanted to adopt the main theory is inferred by mapping of the state of "wanting to…" by means of the mental/emotional states VNMA from the source domain proposition that some of people have not wanted to live in the main house. The negation of the state of "wanting to" is transferred by the logical structure VNMA. Note that Grady (1997) does not discuss how he would account for the evidently necessary mappings that we account for by means of VNMAs. This type of neglect is widespread in the metaphor literature.

A further real-discourse example for which VNMAs are needed is the following, quoted by Goatly (1997):

3) … general managers have cricks in their necks from talking down to the … Councils … and up to the Regions …

This manifests the metaphorical view of ORGANIZATIONAL CONTROL AS VERTICAL POSITION. The managers control the Councils and are controlled by the Regions. In the source domain, the managers get cricks in their necks because of their contortions. They therefore experience physical suffering, and hence emotional suffering. The causation and emotional suffering map to the target by the Causation/Ability VNMA and the Mental/Emotional States VNMA.

The following example illustrates the need for a Qualitative Degree VNMA. Consider the clause we have depicted in bold in the following passage, taken from Cosmopolitan (216(3), USA ed., March 1994):

4) **In the far reaches of her mind, Anne knew Kyle was having an affair**, but "to acknowledge the betrayal would mean I'd have to take a stand."

We suggest that a likely informational contribution of the bold clause to the understanding of the discourse as a whole is the following proposition:

The idea that Kyle was having an affair was something of which Anne had only a very low degree of conscious awareness (i. e. on which Anne had only a very low ability to mentally operate in a conscious way).

We assume that there are two relevant metaphorical views: MIND IS PHYSICAL SPACE and IDEAS ARE PHYSICAL OBJECTS, containing the following relevant mappings:

When a person's mind is being viewed as a physical space, an idea's being physically located in the space corresponds to the person's being able to operate mentally on the idea, to a very low degree at least.

When an idea entertained by a person is being viewed as physical object, and the person's conscious self is viewed as a person, then the ability of the conscious self to physically operate on the idea corresponds to the real person's ability to operate in a conscious mental way on the idea.

We further assume that when a person's mind is being viewed as a physical space, the person's conscious self is viewed as a person physically located in (the main part of) that space.

Thus, if the idea is physically located in the far-reaches of the mind-space, whilst the conscious self of Anne is located in the main part of the mind-space, then the conscious self will be able to operate physically to only a very limited degree on the idea. Physical operability implies mental operability. However, we require the Qualitative Degree VNMA to map the exact degree of operability from the physical to the mental domain.

4 Incorporation into a reasoning system

ATT-Meta (Barnden & Lee 1999) is a pre-existing approach and implemented system for metaphorical reasoning. The system is rule based and carries out reasoning with uncertainty on the content of metaphorical utterances. The system currently embodies the VNMA for uncertainty. This is handled within the infrastructure of the reasoning engine. The rate and duration VNMAs have recently been embodied in a default production rule of the following form:

$$\forall e, type_1, type_2, r$$
$$\{([e: type_1]_{source} \wedge [e: type_2]_{target} \wedge [rate(e, type_1, r)]_{source}) \rightarrow [rate(e, type_2, r)]_{target}\}$$

Here, 'type' refers to the classification of an event, as, for example `eat(mary,bread)`, and event rate is relative to event type as well as the specific event. Logical forms for other VNMAs have been developed along similar lines. Furthermore, ATT-Meta already contains facilities for expressing agents' beliefs, and these will be extended to cope with mental/emotional states more generally, and also value-judgments. ATT-Meta implements the degree VNMA via explicit specification in individual rules and the negation VNMA via the inclusion of negative versions of each rule. However, both these means are cumbersome, and unlikely to form our final solution.

As a reasoning-engine, ATT-Meta employs query-directed (commonly called goal-directed) reasoning. We believe this is important for metaphorical reasoning in discourse. Thus, we assume that the text surrounding the metaphor poses a question, which the metaphor then answers. Consider again example 4 from section 3. We assume that the reader/system is given the following (simplified) query:

to-degree-exactly(Degree):can-consciously-mentally-operate-on(anne, the-idea-that(having-affair(kyle))).

where D is a variable, or in other words, to what particular degree is the affair idea consciously entertainable by Anne. A conversion rule (simplified) will then transfer this query from the mental to the physical domain:

IF to-degree-at-least(Degree): can-physically-operate-on(P, J) THEN to-degree-at-least(Degree): can-consciously-mentally-operate-on(P, J).

Reasoning about physical space will then proceed as described in section 3. And, crucially, the Qualitative Degree VNMA ensures that the value

the variable *Degree* is eventually instantiated with will carry over.

5 Comparison to other approaches

Very few metaphor researchers have discussed means for handling the mapping effects we achieve by VNMAs, even though a few of the effects are sometimes vaguely discussed (e.g. transfer of value judgments). We should note that the time-order/duration and event-shape VNMAs are strongly related to the mapping of event structure in (Lakoff 1994). Causation mapping is a primary special case of the general preservation of "higher-order" relationships in SME (Falkenhainer *et al* 1989). Since non-unary predicates map identically in SME as described in (Falkenhainer *et al* 1989), some, though not all, of the VNMAs might fall out of that identity-mapping. However, what should be described as higher-order and what as lower-order is to some extent arbitrary. Also, it is not clear how the SME approach would get the effect of the VNMAs for event-shape, modality, uncertainty, degrees and value judgments. Moreover, although the SME approach would be able to transfer mental states, it would attempt to transfer a mental state relation such as "A realizes B" in the source even when A maps to a *non*-agent in the target. Although the resulting conjectured relation in the target domain could be defeated by target knowledge, that would be less efficient than not making the transfer in the first place.

Our principle of query-directed reasoning for metaphor understanding strongly supports the use of VNMAs. The kind of information VNMAs convey will form a part of the initial query, as we demonstrated in the discussion of example 3, and VNMA rules will be treated no differently from any other rules in the process of backward-chaining used in query-directed reasoning. Contrast this with an approach, like SME, in which the systematic relations conveying the type of information for which we use VNMAs are uncovered in the source and transferred to the target.

A final reason why we use specific VNMAs is that we wish to be conservative about what is proposed. It is a larger claim than we wish to make that higher-order properties or structures *in general* are mapped over. Equally, it would be too bold, without extensive further evidence, to adopt a default such as one saying that any source-domain property or relationship that makes sense without change in the target domain is to be mapped over identically.

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