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# FrameNet as a resource for paraphrase research<sup>\*</sup>

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Theoretically as well as empirically, paraphrase is a pivotal concept in many academic and nonacademic fields. And yet, its investigation has made very slow progress, due mainly to the lack of a framework that is versatile enough to deal with the nebulous nature of paraphrase in use. This paper demonstrates how the mechanisms of FrameNet can be utilized as a resource for systematic and coherent research into paraphrase. The semantic framework it provides, including detailed frame descriptions, frame-to-frame relations, and the recording of syntactic information, allows one to see in more principled ways why some set of sentences can be considered paraphrases of each other.

**Keywords:** paraphrase, FrameNet, intralingual translation, Frame Semantics, frame element, frame relation, valence, synonym, antonym

## 1. Introduction

Paraphrase — alternative ways of conveying “the same information” — is a key concept in diverse academic fields as well as in practical applications, e.g., information retrieval on the Internet, language education, lexicography, machine translation, natural language understanding/processing, and translation practice/studies. Nevertheless, systematic investigation of this important subject is surprisingly scarce.<sup>1</sup>

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<sup>\*</sup> The authors thank Charles J. Fillmore for his guidance at various stages of this project as well as two anonymous reviewers for their constructive criticism. This study was supported in part by grants from the Center for Japanese Studies at the University of California, Berkeley, and from the Japan Society for the Promotion of Science

1. Notable exceptions include Southworth 1967, D’Angelo 1979, Keck 2006, Mel’cuk and Wanner 2006, Milicevic 2007, Barreiro 2008, and Apresjan et al. 2009.

This study explores the potential of the Berkeley FrameNet database (explained in Section 2) as a source of analytical tool for this underdeveloped research area.<sup>2</sup>

FrameNet has already been explored as a tool for assessing the adequacy of English-to-Japanese translation (Hasegawa et al. forthcoming). We based that work on the assumption that if the semantic structure of an original English text is carefully analyzed in terms of the frames evoked by its constituent words and the ways in which the elements of those frames are realized, such frames and frame elements, as well as their interconnections, must somehow be preserved in the corresponding translation in Japanese. Jakobson (1959/2000: 114), seeing the commonalities of paraphrase and translation, speaks of paraphrase as *intralingual translation*, and suggests the usefulness of treating them in the same way. This conceptualization allows us to see the present paper as continuing the tradition of Hasegawa et al., this one devoted to paraphrase.

When a pair of sentences conveys acceptably similar meanings relative to a given purpose of discourse, we say that one is a paraphrase of the other, or that the two are paraphrases of each other. A stricter and context-independent sense of paraphrase could be defined as a relationship of mutual entailment that holds between two statements expressed by two sentences. However, that definition disqualifies most of what we think of as “paraphrases” in daily life. We, therefore, consider paraphrase as a gradient concept; some pairs are more strictly equivalent, while others can barely qualify as such.

Distinct from paraphrase proper is a relation of context-specific communicative equivalence. For example, if a person wishes her partner to realize that she wants to leave the party, the two sentences of (1), in context, could accomplish this purpose equally well.

- (1) a. It’s getting late.  
b. It’s getting dark.

In this paper, however, such a meaning relationship, requiring *world-based* rather than *language-based* reasoning, is excluded. Instead, we will be concerned with sentence pairings of the following types:

- (2) a. Henry had always wanted to be the best. (To be discussed in Section 4)  
b. Henry was always eager to be the best.  
c. Henry always had a hankering to be the best.
- (3) a. They are going to confine him to prison. (Section 5.1)  
b. They are going to incarcerate him.

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2. <http://framenet.icsi.berkeley.edu/>

- (4) a. He signed on with my mother as a salesman. (Section 5.2)  
b. My mother hired him as a salesman.
- (5) a. The workers then make the fabric stretch until it is the specified size. (Section 5.3)  
b. The workers then stretch the fabric until it is the specified size.
- (6) a. The price steadily rose. (Section 5.4)  
b. The price steadily became higher.
- (7) a. We discussed the issue. (Section 6.1)  
b. We had a discussion about the issue.
- (8) a. Arguing in front of them was rude of us. (Section 6.2)  
b. It was rude of us to argue in front of them.  
c. We were rude to argue in front of them.
- (9) a. The management rewarded Susan by giving her a raise. (Section 6.3)  
b. Susan was rewarded with a raise by the management.
- (10) a. The prosecution proved that he was lying. (Section 6.4)  
b. The prosecution proved him to be lying.
- (11) a. I sent my money to the treasurer. (Section 6.5)  
b. I sent the treasurer my money.
- (12) a. Jack and Jill discussed the issue. (Section 6.6)  
b. Jack discussed the issue with Jill.
- (13) a. I like to read. (Section 7.1)  
b. I like to read things.
- (14) a. She risked her life by telling FBI the story. (Section 7.2)  
b. She told FBI the story at risk to her life.
- (15) a. We continued doing it. (Section 8.1)  
b. We didn't stop doing it.

Most English speakers are likely to accept these sets of sentences as paraphrases. When we try to analyze and discuss paraphrase-related characteristics of these sets, however, we find there is a lack of systematic concepts and vocabulary. Some candidate paraphrase sets need recourse to lexical semantics, others to general or lexically-specific kinds of syntactic variation.

An online lexical database built on the principles of *Frame Semantics* (Fillmore 1982, 1985, 1994, Fillmore and Atkins 1992), FrameNet incorporates diverse types of linguistic information — more than any other online resources of a similar kind. The present study suggests ways in which the kinds of data available in FrameNet

could be used for paraphrase research: in particular, as a way to understand how and why certain sets of sentences are considered paraphrases of one another.

## 2. Frames and frame elements

A *frame* is a schematic understanding of types of events, situations, individuals, and things, including the participants, props, parts, and their relations to each other and to the larger situation. The FrameNet database defines frames (in prose, i.e., informally) and their parts, and connects frames to each other via semantic relations. Each frame is associated with a group of words which are understood against the background of that frame. In FrameNet terms, each word (in a particular sense) *evokes* a frame. For instance, the words *vend*, *sell*, *vendor*, *seller*, *auction*, and *retail* are grouped in (evoke) the `Commerce_sell` frame (frame names are in the Courier typeface), as they all have as background a commercial transaction and take the point of view of the seller of goods.

- (16) `Commerce_sell`: Basic commercial transactions involving a BUYER and a SELLER exchanging MONEY and GOODS, taking the perspective of the SELLER.

The parts of the frame (e.g., the props, participants, etc.) are called the *frame elements* (FEs) and designated by small capitals, e.g., BUYER, SELLER, etc. Words with multiple meanings (polysemous words) are treated as belonging to multiple frames: one for each sense. A word in a particular frame is called a *lexical unit* (LU).

The decision that some group of LUs belongs in one frame and not another is primarily made on semantic grounds. All the LUs in a frame should allow the same set of entailments and inferences, although they may exhibit some idiosyncratic differences. Strictly speaking, every word (sense) would evoke its own frame. FrameNet balances the need to capture detailed semantic differences against the utility of generalizing across the vocabulary.

Some considerations are simultaneously syntactic and semantic. If a word does not allow expression of a participant role (i.e., frame element) which nonetheless seems important to its background, it is not placed in the same frame with words that *do* allow expression of that role. For instance, *cost*, which evokes the `Expensiveness` frame, does not appear with a SELLER and so is not in the same frame as *buy* or as *sell*.

- (17) `Expensiveness`: A PAYER gives up (or potentially gives up) the use of an ASSET (generally money) in order to achieve an INTENDED\_EVENT. This event is often more specifically described as gaining possession of some GOODS or receiving a SERVICE. In the majority of cases, the PAYER is

described generically (INI [to be discussed in Section 7.1]), and the situation depicted answers the question of how much of an ASSET would have to be given up to receive the GOODS or bring about the INTENDED\_EVENT.

If two words profile different participants, by having different FEs in core grammatical positions (external argument or direct object), they are treated as evoking separate frames.

### 3. Features of the FrameNet database relevant to paraphrase research

The FrameNet database contains many kinds of information that, properly developed and interpreted, could be of use to those seeking to discover the phenomena that contribute to judgments of meaning similarity and paraphrase relations between sentences. In particular, FrameNet contains descriptions of frames together with lists of FEs (i.e. semantic roles), that are available for each frame: these are distinguished as “core” (uniquely essential to the meaning of the frame) and “peripheral” (conveying the same meaning no matter what frame they occur with), to which have been added a kind of adjunct-like pseudo-FE called “extra-thematic” (conveying information outside of the syntactically central frame but often situating that frame in a larger setting).

FrameNet also contains a large collection of annotated sentences, each of these showing how LUs that belong to specific frames co-occur with phrases that express the FEs proper to those frames. On the basis of such annotations, *lexical entries* have been constructed which contain tables that generalize over the combinatorial possibilities discovered for each LU. The lexical entry report for each annotated LU lists which FEs are expressible in which combinations, in what syntactic form (phrase type) and in what grammatical function (external argument, object, etc.).

The lexical entries for nouns and adjectives also contain information on the linguistically specified ways in which they combine with (support) verbs to form finite predicates, as evidenced in the corpus. Annotations also indicate ways of recovering information licensed by the omission of FE expressions in given sentences. These semantic/syntactic behaviors support a handful of paraphrase relations, both within and across individual LUs, which we take up in the following sections.

In addition to the lexical entries and the annotations, there is a set of frame-to-frame relations that make it possible to see the collection of frames, not as a flat list, but as a highly structured network. Some frames contain semantic structures that duplicate those of other frames while including additional information: in this case the relationship is one of *inheritance*. Some frames evoke a neutral and general schema of a type of event, while others accept the details of that general frame

while assigning a perspective or point of view on such an event type, highlighting the actions, experiences or affordances of some FEs over others. A typical case is the contrast between the seller's and the buyer's perspective on a more objective and neutral commercial transaction. Other such relations that are relevant to paraphrasing are the Causative\_of and Inchoative\_of relations. The former matches expressions of happenings with expressions of causing such happenings; the latter matches expressions of states with expressions of changes resulting in those states. Section 5 explores how these relations may be exploited in understanding paraphrase-relations between sentences.

#### 4. Paraphrase by intersubstitutability of synonymous expressions

Traditionally, true synonyms must have the same grammatical properties. By contrast, frame semantics recognizes that words with different grammatical properties can have analogous relations to the other elements in the sentence, e.g. *eager for*, *want*, *hankering for*, etc. Therefore, synonymous expressions of different grammatical types can be listed as LUs of a single frame. At the same time, because frame membership is based on a common background needed to interpret the LU, it is possible that LUs that belong in the same frame are not synonyms, e.g., *tall-short*.

As an example of syntactically-diverse LUs in a single frame, consider the *Desiring* frame, whose definition is as follows:

- (18) *Desiring*: An EXPERIENCER desires that an EVENT occur. The event may be represented by a salient entity involved in the EVENT.

This frame is evoked by such LUs as *craving.n*, *desire.v*, *eager.a*, *fancy.v*, and *hankering.n*. A source sentence that evokes a particular frame can in principle be paraphrased by other LUs belonging to the same frame. This is shown in (19), where the word which evokes the frame of interest is in capitals. The FEs are surrounded by brackets, with labels indicating the FE filled by that expression.

- (19) a. [Henry]<sub>EXPERIENCER</sub> had always WANTED [to be the best]<sub>EVENT</sub>.  
 b. [Henry]<sub>EXPERIENCER</sub> was always EAGER [to be the best]<sub>EVENT</sub>.  
 c. [Henry]<sub>EXPERIENCER</sub> always had a HANKERING [to be the best]<sub>EVENT</sub>.

Because FrameNet places words with different syntactic profiles in the same frame, it is possible to see paraphrases across different lexical categories and complementation patterns. The three sentences in (19) also illustrate a common means of paraphrase: substitution of a "light" verb plus predicator for a simple verb. That is, the verb *want* in (19a) is equivalent to a copula-plus-adjective (*be eager*) and support verb-plus-nominal (*have hankering*) (on support verbs, see Section 6.1).

## 5. Frame relations

### 5.1 Paraphrase by inheritance

The Inheritance relation can be illustrated by the *Inhibit\_movement* and *Imprisonment* frames:

- (20) *Inhibit\_movement*: An AGENT restricts the movement of a theme to within the vicinity of the HOLDING\_LOCATION, despite the THEME's desire, plan, or tendency towards motion; the AGENT may also use an INSTRUMENT.
- (21) *Imprisonment*: The AUTHORITIES put a PRISONER in PRISON as punishment for an OFFENSE.

The *Inhibit\_movement* frame has an individual preventing someone or something from moving away from a particular location, whereas the more specific frame of *Imprisonment* further specifies that the location is a prison, the confined item is a criminal, and the inhibition of movement is punishment.

Each FE of *Imprisonment* corresponds to an FE of *Inhibit\_movement*, with additional specifications. In this type of situation, we say *Imprisonment* inherits the core FEs from its parent frame, *Inhibit\_movement*. (22) shows the correspondences between the FEs (FE-to-FE correspondences are also available in the FrameNet data, alongside frame-to-frame relationships).

- (22) *Inhibit\_movement* *Imprisonment*
- |                  |             |
|------------------|-------------|
| AGENT            | AUTHORITIES |
| THEME            | PRISONER    |
| HOLDING_LOCATION | PRISON      |
| MOTIVATION       | OFFENSE     |

A sentence which involves *Imprisonment* can be paraphrased with a sentence involving *Inhibit\_movement*, so long as the notion of a PRISON (and possibly other information pertaining to the criminal process) is included.

- (23) a. [They]<sub>AUTHORITIES</sub> are going to INCARCERATE [him]<sub>PRISONER</sub>.  
(*Imprisonment*)
- b. [They]<sub>AGENT</sub> are going to CONFINE [him]<sub>THEME</sub>  
[to prison]<sub>HOLDING\_LOCATION</sub>. (*Inhibit\_movement*)

In general, a sentence with a more specific frame is paraphrased by a sentence with a frame from which it inherits, with additional information supplied. In (23b), the additional information is provided as a prepositional adjunct that introduces the concept “prison” which is incorporated into the meaning of *incarcerate* in (23a).

In other pairs of frames, the information might be encoded with different grammatical means, such as adverbial modification (e.g., *speed~move (too) quickly*).

## 5.2 Paraphrase by perspective alternations

In the case of events or states of affairs with more than one participant, there are often sub-frames that evoke the larger situation while being descriptive of the actions, experiences, or affordances of one participant. FrameNet represents this possibility by relating those two *perspectivized* frames to a single non-perspectivized frame. For example, *Getting\_a\_job* and *Hiring* are two perspectives on the more general frame *Employment\_start*.

- (24) *Employment\_start* (general): This is a non-perspectivized frame representing the initial stage of the *Employment\_scenario*: the formation of the employment relationship between the EMPLOYER and the EMPLOYEE.
- (25) *Getting\_a\_job* (perspectivized): An EMPLOYEE obtains a POSITION with an EMPLOYER, with which there are certain TASKS associated.
- (26) *Hiring* (perspectivized): An EMPLOYER hires an EMPLOYEE, promising the EMPLOYEE a certain COMPENSATION in exchange for the performance of a job. The job may be described either in terms of a TASK or a POSITION.

While perspectivized frames may not directly share FEs with each other, FEs of one frame nevertheless usually map to similar FEs of the other; therefore, LUs from the two perspectivized frames can be used for paraphrase. In (27), *sign on* evokes *Getting\_a\_job*, while *hire* evokes *Hiring*.

- (27) a. [He]<sub>EMPLOYEE</sub> SIGNED ON [with my mother]<sub>EMPLOYER</sub> [as a salesman]<sub>POSITION</sub>.
- b. [My mother]<sub>EMPLOYER</sub> HIRED [him]<sub>EMPLOYEE</sub> [as a salesman]<sub>POSITION</sub>.

Another set of frames with perspective alternation on participants are:

- (28) *Obligation\_scenario* (general): Under some, usually implicit, CONDITION a DUTY needs to be fulfilled by a RESPONSIBLE\_PARTY. If the DUTY is not performed, there may be some undesirable social CONSEQUENCE for the RESPONSIBLE\_PARTY. This CONSEQUENCE may or may not be stated overtly.
- (29) *Being\_obligatory* (perspectivized, emphasizing the DUTY): Under some CONDITION, usually left implicit, a DUTY needs to be fulfilled by a RESPONSIBLE\_PARTY. If the DUTY is not performed, there may be some undesirable CONSEQUENCE for the RESPONSIBLE\_PARTY, which may or may not be stated overtly. Compare this frame to the *Being\_obligated* frame.

- (30) *Being\_obligated* (perspectivized, emphasizing the RESPONSIBLE\_PARTY): Under some CONDITION, usually left implicit, a RESPONSIBLE\_PARTY is required to perform some DUTY. If they do not perform the DUTY, there may be some undesirable CONSEQUENCE, which may or may not be stated overtly.

These perspectivized frames can account for the paraphrase relation in (31).

- (31) a. [The use of TM software]<sub>DUTY</sub> is OBLIGATORY [for every freelance translator working on projects for our company]<sub>RESPONSIBLE\_PARTY</sub> (*Being\_obligatory*)  
 b. [Every freelance translator working on products for our company]<sub>RESPONSIBLE\_PARTY</sub> MUST [use TM software]<sub>DUTY</sub> (*Being\_obligated*)

### 5.3 Paraphrase by isolating causation

A frame which describes a change of state of an entity is called an *inchoative* frame. The relation *Causative\_of* relates this frame to a *causative* frame, in which an agent or (inanimate) cause brings about a change in an entity. For example, the *Cause\_to\_fragment* frame can be connected, by the *Causative\_of* relation, to the *Fragmentation\_scenario* frame.

- (32) *Cause\_to\_fragment* (causative): A CAUSE or AGENT suddenly and often violently separates the WHOLE\_PATIENT into two or more smaller PIECES, resulting in the WHOLE\_PATIENT no longer existing as such.
- (33) *Fragmentation\_scenario* (inchoative): A WHOLE\_PATIENT fragments or breaks into PARTS, or alternatively a part, PART\_1, breaks off from the rest of the item, called PART\_2.

There are two ways to understand sentences as paraphrases using the *Causative\_of* relation. One is via the notion of *extra-thematic frame elements*, which are akin to the traditional notion of *adjuncts*. Extra-thematic FEs combine with many frames, either taking them into their scope and embedding them in a larger context, or elaborating the descriptions of participants or the setting (Ruppenhofer et al. 2010). They are not ordinary FEs:

“Frame-elements proper identify exactly the parts of a sentence that pick out sub-parts of the scene introduced by a target [frame-evoking LU]. In contrast, these elements explicitly introduce an independent scene. There is a very real sense in which the extra-thematic FEs are introduced by separate, constructional targets, which evoke separate frames. Since, however, the constructions that introduce extra-thematic FEs are so tightly bound together with the structures introduced by regular targets, we believe that it is appropriate to annotate them as if from the point-of-view of the target.” (p.97)

One of the extra-thematic FEs is CAUSE. Therefore, if we isolate the CAUSE (or AGENT) from a causative frame, it can be coded as the CAUSE FE of the inchoative frame associated with the Causative\_of relation, as shown in (34). Note that the CAUSE, *because of Susan*, is an extra-thematic FE, and is not the CAUSE referenced in the definition in (32).

- (34) a. [Susan]<sub>AGENT</sub> BROKE [the rod]<sub>WHOLE\_PATIENT</sub> [into several pieces]<sub>PIECES'</sub>  
(Cause\_to\_fragment)  
b. [The rod]<sub>WHOLE\_PATIENT</sub> BROKE [into several pieces]<sub>PIECES'</sub> [because of Susan]<sub>CAUSE'</sub> (Fragmentation\_scenario)

The second way to understand paraphrases with Causative\_of is with the frame Causation.

- (35) Causation: A CAUSE causes an EFFECT. Alternatively, an ACTOR, a participant of a (implicit) CAUSE, may stand in for the CAUSE. Those frames that inherit the Causation frame have as their background the idea that some event is responsible for the occurrence of another event (or state).

A scene described with a causative verb (e.g., transitive *break*) can instead be described by an LU that evokes the Causation frame (e.g., *cause*, *make*, etc.) as the main verb. The subordinate verb evokes an inchoative frame, as shown in (36b). Semantic composition of Causation with the inchoative frame is equivalent to the meaning of the causative frame.

- (36) a. [Susan]<sub>AGENT</sub> CAUSED [the rod]<sub>EFFECT</sub> [to break into several pieces]<sub>EFFECT'</sub>  
(The EFFECT is syntactically realized as two constituents, a direct object and an infinitival clause.)  
b. Susan caused [the rod]<sub>WHOLE\_PATIENT</sub> to BREAK [into several pieces]<sub>PIECES'</sub>

(36a) shows the FEs of Causation: Susan, the AGENT, brings about an EFFECT, namely that the rod breaks into several pieces. (36b) shows the FEs internal to the EFFECT, which involve Fragmentation\_scenario. In combination, these two frames are equivalent to Cause\_to\_fragment.

As another example, consider the inchoative frame Expansion, evoked by *stretch*. When combined with an overt Causation verb, it forms a paraphrase of a mono-clausal sentence with the causative counterpart frame, Cause\_expansion.

- (37) Expansion: An ITEM changes its physical size. The SIZE\_CHANGE of an ITEM may be explicitly indicated or characterized in terms of INITIAL\_SIZE and/or RESULT\_SIZE.

- (38) *Cause\_expansion*: An AGENT or non-human CAUSE causes an ITEM to change its physical size. The SIZE\_CHANGE of an ITEM may be explicitly indicated or characterized in terms of INITIAL\_SIZE and/or RESULT\_SIZE.
- (39) a. [The workers]<sub>AGENT</sub> then MAKE [the fabric]<sub>EFFECT</sub> [stretch]<sub>EFFECT</sub> until it is the specified size.  
 b. [The workers]<sub>AGENT</sub> then STRETCH [the fabric]<sub>ITEM</sub> until it is the specified size.

#### 5.4 Paraphrase by isolating inchoation

FrameNet also recognizes a relationship between stative and inchoative frames by the relation, *Inchoative\_of*, which may be utilized for paraphrase in a way analogous to that for the *Causative\_of* relation. The inchoative *Change\_position\_on\_a\_scale* expression in (40a) is equivalent to the combination of *become* (evoking the *Becoming* frame) with an adjective in the static *Position\_on\_a\_scale* frame, shown in (40b). Note that while *high* is in the static frame, it must be placed in the comparative, *higher*, to approximate the meaning of *rise*. The same is true for other pairs involving scalar notions: *lengthen* vs. *become longer*, *grow* vs. *become larger*, and so on.

- (40) a. [The price]<sub>ITEM</sub> steadily ROSE.  
 b. [The price]<sub>ENTITY</sub> steadily BECAME [higher]<sub>FINAL\_STATE</sub>.
- (41) *Change\_position\_on\_a\_scale*: This frame consists of words that indicate the change of an ITEM's position on a scale (the ATTRIBUTE) from a starting point (INITIAL\_VALUE) to an end point (FINAL\_VALUE). The direction (PATH) of the movement can be indicated as well as the magnitude of the change (DIFFERENCE). The rate of change of the value (SPEED) is optionally indicated. Another scale (CORRELATE), which the values are correlated with, is indicated if it is not the default correlate (namely, absolute time).
- (42) *Becoming*: An ENTITY ends up in a FINAL\_STATE or FINAL\_CATEGORY which it was not in before.
- (43) *Position\_on\_a\_scale*: This frame contains words that describe an ITEM's static position on a scale with respect to some property VARIABLE.

A comparative adjective is not always necessary. In (44a), the frame *Becoming\_dry* is paraphrasable with a combination of *Becoming* and *Being\_dry*.

- (44) a. [My shirt]<sub>ENTITY</sub> DRIED in a few hours.  
 b. [My shirt]<sub>ENTITY</sub> BECAME [dry]<sub>FINAL\_STATE</sub> in a few hours.

- (45) *Becoming\_dry*: An ENTITY loses moisture with the outcome of being in a dry state.
- (46) *Being\_dry*: An ITEM is in a state of dryness.

## 6. Paraphrase using grammatical information available in FrameNet

### 6.1 Support constructions

FrameNet frames can contain both nouns and verbs if both are understood against the same background. Yet the syntactic means to be a predicate is limited to verbs. Some nouns, however, co-occur with semantically light verbs which allow the noun to function as a predicate. FrameNet annotates and records these pairings involving a noun and its *support verb(s)*. The sentences in (19a, c), repeated here as (47), illustrate this. The noun *hankering* takes as a support verb *have*, and in combination can form a sentence approximating that with just *want*.

- (47) a. [Henry]<sub>EXPERIENCER</sub> had always WANTED [to be the best]<sub>EVENT</sub>  
 b. [Henry]<sub>EXPERIENCER</sub> was always EAGER [to be the best]<sub>EVENT</sub>  
 c. [Henry]<sub>EXPERIENCER</sub> always had a HANKERING [to be the best]<sub>EVENT</sub>

Compare these with the usage of *discuss*. Both *discuss* and *discussion* evoke the Discussion frame.

- (48) *Discussion*: Two (or more) people (the INTERLOCUTORS, also encodable as INTERLOCUTOR\_1 and INTERLOCUTOR\_2) talk to one another. No person is construed as only a speaker or only an addressee. Rather, it is understood that both (or all) participants do some speaking and some listening — the process is understood to be symmetrical or reciprocal. This frame differs from the *Chatting* frame in that the INTERLOCUTORS have a particular TOPIC that they are attempting to decide or understand.

Among the possible support verbs recorded by FrameNet are *have* and *hold*, as in (49).

- (49) a. [They]<sub>INTERLOCUTOR\_1</sub> need to *have* a DISCUSSION [with us]<sub>INTERLOCUTOR\_2</sub> [on the matter]<sub>TOPIC</sub>  
 b. [They]<sub>INTERLOCUTOR\_1</sub> *held* DISCUSSIONS [with us]<sub>INTERLOCUTOR\_2</sub> [on the matter]<sub>TOPIC</sub>  
 c. [They]<sub>INTERLOCUTOR\_1</sub> DISCUSSED [the matter]<sub>TOPIC</sub> [with us]<sub>INTERLOCUTOR\_2</sub>

Not all support verbs are the commonly-recognized “light” verbs, such as *have*, *get*, *make*, and so on. In some cases a noun may select a highly idiosyncratic set of

support verbs with more detailed semantics, or which is strongly collocated with only that noun. *Revenge* in the *Revenge* frame is one such, allowing *exact*, *get*, *have*, *take*, and *wreak* as support verbs:

- (50) *Revenge*: This frame concerns the infliction of punishment in return for a wrong suffered. An AVENGER performs a PUNISHMENT on an OFFENDER as a consequence of an earlier action by the OFFENDER, the INJURY. The AVENGER inflicting the PUNISHMENT need not be the same as the INJURED PARTY who suffered the INJURY, but the AVENGER does have to share the judgment that the OFFENDER's action was wrong. The judgment that the OFFENDER had inflicted an INJURY is made without regard to the law.
- (51) A short while later [Joseph]<sub>AVENGER</sub> *had/got/took/exacted/wreaked* his REVENGE [on Watney's]<sub>OFFENDER</sub>.

Note that along with the change between noun and verb is sometimes a change in the syntactic expression of the FEs. Sentences with an adverb-verb combination may be paraphrased with an adjective-noun combination, along with a support verb:

- (52) a. [They]<sub>INTERLOCUTORS</sub> DISCUSSED [it]<sub>TOPIC</sub> [at length]<sub>DURATION</sub>.  
 b. [They]<sub>INTERLOCUTORS</sub> *had* a [long]<sub>DURATION</sub> DISCUSSION [about it]<sub>TOPIC</sub>.

The same pair also shows a difference in expression of complements of the verb or noun (*it* vs. *about it*). Information about the different ways in which each word allows expression of FEs is also present in FrameNet's lexical entry reports. We discuss several types of this in the following sections.

## 6.2 Valence choice by phrase type

As noted above, the lexical entry report of each LU includes information about the syntactic realization of FEs. In principle, if two valences feature the same set of FEs, then those valences may be exploited for the purpose of paraphrase. Extraposition is one such general valence alternative to verbal or clausal subjects: e.g., *doing this is easy* and *it is easy to do this*. Some frames provide additional possibilities. Take, for instance, the *Social\_interaction\_evaluation* frame, with words such as *friendly*, *rude*, and *thoughtful*.

- (53) *Social\_interaction\_evaluation*: In this frame an EVALUEE is judged by a (usually implicit) JUDGE to be of a certain character based on her or his BEHAVIOR towards other human beings; a specific AFFECTED\_PARTY may be overtly mentioned along with the DEGREE to which the EVALUEE behaves appropriately towards others. The BEHAVIOR alone may be mentioned with the understanding that these behaviors characterize a property of the

unmentioned EVALUÉE. The EVALUÉE's BEHAVIOR may be in the context of a TOPIC.

When appearing in predicate position, three valences are possible with such adjectives:

- (54) a. [Arguing in front of them]<sub>BEHAVIOR</sub> was RUDE of [us]<sub>EVALUÉE</sub>.  
 b. It was RUDE of [us]<sub>EVALUÉE</sub> [to argue in front of them]<sub>BEHAVIOR</sub>.  
 c. [We]<sub>EVALUÉE</sub> were RUDE [to argue in front of them]<sub>BEHAVIOR</sub>.

FrameNet records the differences in FE ordering between these valences as well as the internal syntax of the FEs. In (54a), the behavior which is rude is expressed with an *-ing* VP, but in (54b, c) it is by an infinitival clause. In (54a, b), the person evaluated as rude is expressed with a PP; in (54c), it is with the external argument.

### 6.3 Voice alternation

The lexical entry report for *reward* (*Rewards\_and\_punishments*) records the following valences.

- (55) *Rewards\_and\_punishments*: An AGENT (the punisher or rewarder) performs a RESPONSE\_ACTION on an EVALUÉE for a REASON, the EVALUÉE's actions or beliefs. MEANS and INSTRUMENT may also be indicated. The goal of the punishment/reward is to discourage/encourage the actions or beliefs. Words in this frame presuppose that a judgment of the EVALUÉE has occurred and that the EVALUÉE is (or becomes) aware of the judgment. This judgment was performed by a cognizer which is either the same as the AGENT, or, minimally, a representative of the same institution.
- (56) a. NP<sub>AGENT</sub> reward NP<sub>EVALUÉE</sub> PPing[by]<sub>RESPONSE\_ACTION</sub>  
 b. NP<sub>AGENT</sub> reward NP<sub>EVALUÉE</sub> (RESPONSE\_ACTION: INI)  
 c. NP<sub>EVALUÉE</sub> rewarded PP[with]<sub>RESPONSE\_ACTION</sub>

In (56a), the AGENT is an NP external argument, the EVALUÉE an NP object, and the RESPONSE\_ACTION a PP headed by *by* with a gerund object. The second pattern, (56b), is the same, but RESPONSE\_ACTION is omitted and understood indefinitely. In FrameNet terms, it is *indefinite null instantiated* (INI), on which see Section 7.1 below. The final pattern, (56c), is a passive valence. The EVALUÉE is now the external argument, and the AGENT is *constructional null instantiated* (CNI), i.e., omitted by virtue of a construction, in this case, the passive. These valences create three reasonable paraphrase candidates:

- (57) a. [The management]<sub>AGENT</sub> REWARDED [Susan]<sub>EVALUÉE</sub> [by giving her a raise]<sub>RESPONSE\_ACTION</sub>.

- b. [The management]<sub>AGENT</sub> REWARDED [Susan]<sub>EVALUÉE</sub>.  
 c. [Susan]<sub>EVALUÉE</sub> was REWARDED [with a raise]<sub>RESPONSE\_ACTION</sub>.

Although a “long passive” is also possible (*Susan was rewarded with a raise by the management*), because FrameNet’s lexical entries are generated automatically based on corpus data, that precise pattern is not listed. Despite this corpus-based limitation, the FrameNet lexical element reports are surely a rich source of paraphrase information.

#### 6.4 Paraphrase by complement type alternations

Words which appear in phrases or clauses that indicate propositions or events often allow expression of such FEs as a finite or non-finite clause. FrameNet records this fact as the same FE with two (or more) possible realizations, as with *prove*, in the *Reasoning* frame.

- (58) *Reasoning*: An ARGUER presents a CONTENT, along with SUPPORT, to an ADDRESSEE. The CONTENT may refer elliptically to a course of action or it may refer to a proposition that the ADDRESSEE is to believe. Some lexical units (e.g. *prove*) indicate the speaker’s belief about the CONTENT.
- (59) a. [The prosecution]<sub>ARGUER</sub> PROVED [that he was lying]<sub>CONTENT</sub>.  
 b. [The prosecution]<sub>ARGUER</sub> PROVED [him to be lying]<sub>CONTENT</sub>.

#### 6.5 Paraphrase by ditransitive alternations

Many verbs participate in the ditransitive alternation, with a Goal-like FE expressed either as a PP or an NP. The distinction is lexical — members of the same frame may either allow or not allow the alternation. *Send*, in *Sending*, does:

- (60) *Sending*: A SENDER plans the PATH (along with SOURCE and GOAL) of a THEME and places it in circumstances such that it travels along this PATH under the power of some entity other than the SENDER. This frame also has a RECIPIENT distinct from the GOAL.
- (61) a. [I]<sub>SENDER</sub> SENT [my money]<sub>THEME</sub> [to the treasurer]<sub>RECIPIENT</sub>.  
 b. [I]<sub>SENDER</sub> SENT [the treasurer]<sub>RECIPIENT</sub> [my money]<sub>THEME</sub>.

By contrast, *route*, which is also in the *Sending* frame, only allows *route the document to the next person in the process*, and not *\*route the next person the document*. Similarly, in the *Giving* frame, *give* permits the ditransitive alternation, but *donate* does not.

## 6.6 Paraphrase by reciprocal alternation

Sometimes the arguments of a predicate can be expressed in different ways without implying a genuine semantic difference. Examples are found in the set of frames that exhibit “reciprocity,” where two or more entities can be introduced as a single (plural) NP, or one of them can be realized as a nuclear syntactic element (subject or object) and the other as an oblique element, typically with a prepositions. The *Discussion* frame in (48), repeated here as (62), is one of these.

- (62) *Discussion*: Two (or more) people (the *INTERLOCUTORS*, also encodable as *INTERLOCUTOR\_1* and *INTERLOCUTOR\_2*) talk to one another. No person is construed as only a speaker or only an addressee. Rather, it is understood that both (or all) participants do some speaking and some listening — the process is understood to be symmetrical or reciprocal. This frame differs from the *Chatting* frame in that the *INTERLOCUTORS* have a particular *TOPIC* that they are attempting to decide or understand.

- (63) a. [Jack and Jill]<sub>INTERLOCUTORS</sub> DISCUSSED [the issue]<sub>TOPIC</sub>.  
 b. [Jack]<sub>INTERLOCUTOR\_1</sub> DISCUSSED [the issue]<sub>TOPIC</sub> [with Jill]<sub>INTERLOCUTOR\_2</sub>.

In (63a), the *INTERLOCUTORS* frame element is evoked, but it can be just as easily represented with the interlocutors in separate constituents, as in (63b).

There do exist, however, some grammatical differences between the two valence possibilities that limit this method. Many modifier clauses and phrases will make reference to the external entity of the main clause, and if such modifiers are present then there is no simple paraphrase between the plural or conjoined NP and the distributed NPs. In (63c), the *PURPOSE* FE indicates Jack’s purpose specifically. Paraphrase with *Jack and Jill* as the *INTERLOCUTORS* would require drastic changes to (or omission of) the purpose clause.

- (63) c. [Jack]<sub>INTERLOCUTOR\_1</sub> DISCUSSED [the issue]<sub>TOPIC</sub> [with Jill]<sub>INTERLOCUTOR\_2</sub>  
 [in order to convince her he was knowledgeable]<sub>PURPOSE</sub>.

Another example of this type of paraphrase involves the *Competition* frame:

- (64) *Competition*: This frame is concerned with the idea that people (*PARTICIPANT\_1*, *PARTICIPANT\_2*, or *PARTICIPANTS*) participate in an organized rule governed activity (the *COMPETITION*) in order to achieve some advantageous outcome (often the *PRIZE*). *RANK* and *SCORE* are different criteria by which the degree of achievement of the advantageous outcome is judged.
- (65) a. [Leslie]<sub>PARTICIPANT\_1</sub> COMPETED [against Joe]<sub>PARTICIPANT\_2</sub> [at tennis]<sub>COMPETITION</sub>.  
 b. [Leslie and Joe]<sub>PARTICIPANTS</sub> COMPETED [at tennis]<sub>COMPETITION</sub>.

## 7. Constructions

### 7.1 Paraphrase by licensed omission

FrameNet records, in the same valence tables mentioned above, the possibility that one or more arguments of a verb, adjective, or noun, are omitted — *null instantiated*, in FrameNet terms. In some cases the omitted argument must be known in the context (*definite null instantiation*) and in other cases it need not be (*indefinite null instantiation*). The latter case is often accompanied by a semantic narrowing of possible arguments. Thus, while any manner of food or meal can be the object of *eat*, the simple clause *They were eating* must be interpreted as *they were eating a meal*. Further examples of indefinite null instantiation are given below.

- (66) a. I like to read.  
b. I like to read things.
- (67) a. Do you know anyone who smokes?  
b. Do you know anyone who smokes cigarettes?
- (68) a. They are quite similar.  
b. They are quite similar in appearance.

In many contexts, these sentences are inter-substitutable, although there are some cases where, even though grammatically an omitted argument is interpreted indefinitely, the context makes it clear what it is. In these cases, the sentence with an overt indefinite object (like *things*) would be an inappropriate paraphrase.

Definite null instantiation (DNI) is similarly useful in relating two sentences to one another. Examples of DNI are shown below.

- (69) a. We won.  
b. We won the game.
- (70) a. They arrived early.  
b. They arrived at their destination early.
- (71) a. My job is similar.  
b. My job is similar to yours.

The a-sentence of each pair above preserves roughly all the information contained in the sentence with an overt FE. With *win* and *arrive*, the definition of the frames involved (*Finish\_competition* and *Arriving*, respectively) makes it possible to create a relatively underspecified yet still definite FE: what is won is a game (or contest, competition, etc.), and where someone arrives is their destination. *Similar* is different in that nearly any two items can be compared, so there is no general

way to expand a sentence like (71a). Nevertheless, as another type of valence alternation, null instantiation provides a fruitful way to study paraphrase possibilities.

## 7.2 Extra-thematic adjunction

Some frame-bearing LUs give information about the content of a state of affairs (*content predicates*); others locate a state of affairs within some larger interpretive schema (*interpretation predicates*). As opposed to content predicates, which describe or denote events, interpretation predicates describe or evaluate the larger situation surrounding the action. *Create, dance, eat, laugh, read, walk*, for example, are all content predicates; *condescend, dare, disdain, insult, manage, risk* are pure interpretation predicates.

When the main verb is of one type, and a grammatically subordinated element is of the other type, the semantic interpretation of the clause may require not the “subordination” of the one to the other, but *an integration of the two* (Hasegawa et al. 2006). This idea of frame integration can be exemplified by sentences (72); each reports the same action and locates it as part of the *Revenge* frame evoked by *retaliate*.

- (72) a. We RETALIATED<sub>INTERPRETATION</sub> by BOMBING<sub>CONTENT</sub> their village.  
 b. We BOMBED<sub>CONTENT</sub> their village IN RETALIATION<sub>INTERPRETATION</sub>.

- (73) *Revenge*: This frame concerns the infliction of punishment in return for a wrong suffered. An *AVENGER* performs a *PUNISHMENT* on a *OFFENDER* as a consequence of an earlier action by the *OFFENDER*, the *INJURY*. The *AVENGER* inflicting the *PUNISHMENT* need not be the same as the *INJURED PARTY* who suffered the *INJURY*, but the *AVENGER* does have to share the judgment that the *OFFENDER*'s action was wrong. The judgment that the *OFFENDER* had inflicted an *INJURY* is made without regard to the law.

But these two sentences differ in which verbal appears as the main predicate to evoke the pivotal frame, for *bomb* evokes the *Attack* frame.

- (74) *Attack*: An *ASSAILANT* physically attacks a *VICTIM* (which is usually but not always sentient), causing or intending to cause the *VICTIM* physical damage. A *WEAPON* used by the *ASSAILANT* may also be mentioned, in addition to the usual *PLACE, TIME, PURPOSE, REASON*, etc.

- (75) a. [We]<sub>AVENGER</sub> RETALIATED [by bombing their village]<sub>PUNISHMENT</sub>  
 b. [We]<sub>ASSAILANT</sub> BOMBED [their village]<sub>VICTIM</sub> [in retaliation]<sub>PURPOSE</sub>

We call this predicate alternation *head-switching*. Let us consider another example, the English verb *risk*, which evokes the *Run\_risk* frame:

- (76) *Run\_risk*: A *PROTAGONIST* is described as being exposed to a potentially dangerous situation that may end in a *BAD\_OUTCOME* for him- or herself. An *ASSET* which is in danger of loss may stand in for the *BAD\_OUTCOME*. There is no implication that the *PROTAGONIST* intentionally exposes themselves to the risky situation. The *PROTAGONIST* may be attempting to achieve some *PURPOSE*, which involves being in a dangerous situation. The *ACTION* that creates the risk may also be expressed.

Like *retaliate*, *risk* has only an interpretive function, expressing the likelihood of some mishap affecting the protagonist in some situation (Fillmore and Atkins 1992, 1994). When we hear, for example, that someone risked his health, we cannot know from that information alone what he actually did, but we do know that whatever he did is considered by the speaker harmful to his well-being.

*Risk* permits head-switching:

- (77) a. She RISKED<sub>INTERPRETATION</sub> her life by TELLING<sub>CONTENT</sub> FBI the story.  
 b. She TOLD<sub>CONTENT</sub> FBI the story AT RISK<sub>INTERPRETATION</sub> to her life.
- (78) a. [She]<sub>PROTAGONIST</sub> RISKED [her life]<sub>ASSET</sub> [by telling the FBI the story]<sub>ACTION</sub>.  
 b. [She]<sub>SPEAKER</sub> TOLD [the FBI]<sub>ADDRESSEE</sub> [the story]<sub>MESSAGE</sub> at risk to her life.

As an interpretation predicate, *risk* evokes the frame that provides FEs adequate for interpreting (78a): *She* instantiates the *PROTAGONIST*, *her life* the *ASSET*, and *by telling the FBI the story* the *ACTION*.

The main predicate of (78b), *tell*, on the other hand, evokes the *TELLING* frame, which contains verbs that communicate the act of a *SPEAKER* to address a *MESSAGE* to an *ADDRESSEE*. In (78b), *she* instantiates the role of the *SPEAKER*; however, the *TELLING* frame lacks an appropriate FE for *at risk to her life* to fill. Therefore, we need to invoke also the larger interpretation frame of *Run\_risk* with which the given situation is interpreted, as illustrated in (78c).

- (78) c. [She]<sub>Protagonist</sub> [told the FBI the story]<sub>Action</sub> at RISK [to her life]<sub>Asset</sub>.

Being interpretive, the *Run\_risk* frame is inherently integrative of content and interpretation predicates. The proposition expressed by the content predicate constitutes in *Run\_risk* the situation that is interpreted as being risky.

## 8. Negatively-defined antonym

While the current version of FrameNet provides adequate tools for accounting for various types of paraphrase, as exemplified above, it still needs to enrich its

resources for other types of paraphrase. In this section we explore the paraphrases that are related in terms of *negatively-defined antonyms*, as exemplified by (79).

- (79) a. We continued doing it.  
b. We didn't stop doing it.

The term *antonym* is commonly used to express various opposing relationships among LUs, although antonymy in real situations is frequently expressed not only lexically, but also by phrasal units. Therefore, a special resource is needed for the truly conventional pairings.

Some subtypes of antonymy have been proposed in structuralist semantics. Non-gradable oppositions like *male* vs. *female* are called "symmetric" (or "complementarity antonymy"), which is distinguished from "asymmetric antonymy" in a narrow sense, illustrated by *big* vs. *small*. "Relational antonymy," which is based on different perspectives on the same relationship (e.g., *parent* vs. *child*), also receives separate treatment as "converseness." We recognize that two kinds of negatively related antonyms are particularly relevant to paraphrasing.

### 8.1 Symmetric antonymy

Symmetric antonymy (mutually exclusive, complementary) asserts either one is equivalent to negating the other, and negating either one is equivalent to asserting the other, for example:

- |      |                           |                          |
|------|---------------------------|--------------------------|
| (80) | <i>accept</i>             | <i>decline</i>           |
|      | <i>admit VPing/that+S</i> | <i>deny VPing/that+S</i> |
|      | <i>alive</i>              | <i>dead</i>              |
|      | <i>comply with</i>        | <i>violate</i>           |
|      | <i>continue VPing</i>     | <i>stop Vping</i>        |
|      | <i>present</i>            | <i>absent</i>            |
|      | <i>remember to VP</i>     | <i>forget to VP</i>      |
|      | <i>simple</i>             | <i>complicated</i>       |

- (81) a. I forgot to do it.  
b. I didn't remember to do it.

- (82) a. I remembered to do it.  
b. I didn't forget to do it.

Symmetric antonyms permit paraphrase in combination with negation, as shown in (81–82). If it is true that someone forgets to do something, then it is also true that the person does not remember to do it. Likewise, if the person remembers to do it, it is also true that s/he does not forget to do it.

A more complex pair is *agree/disagree*. Suppose that X makes a proposal to Y. If Y agrees to it, then Y does not disagree to it. If Y disagrees to it, then B does not agree to it. However, it is not the case that symmetric antonyms are always paraphrasable via negation in all contexts. That is, in some cases, it is possible for someone to “neither agree nor disagree” to a proposal. Symmetric antonymy will be in force only when one of the two options is relevant. If Y ignores the request, or asks to be allowed some time to think about it, then the situation where *agree* and *disagree* are antonymic (i.e., contrastive actions) has not yet been triggered. This is not unique to *agree/disagree*. The antonyms *dead/alive* are relevant for entities that have or had life: a rock is neither dead nor alive. The pair *straight/crooked* is appropriate only for linear objects. Yet, given such an object, it is either straight or crooked. For some antonym pairs, our general world knowledge is enough to license the contrast (e.g., *forget/remember*), while for others (*agree/disagree*) more context may be required to judge whether the two are paraphrasable via negation.

Currently, FrameNet does not specifically record information about antonymy. In many instances, symmetric antonyms are grouped together as evoking the same frame, e.g., both *dead* and *alive* evoke the same `Dead_or_alive` frame. FrameNet occasionally tags certain LUs with “semantic types,” indicating miscellaneous information about the word. The semantic types “positive” and “negative” could in principle be used to separate antonyms that are LUs of the same frame, although the utility of this mechanism is rather limited. For instance, it is not clear that the positive/negative distinction is always the most appropriate way to describe the antonymy. There is also no way to specifically group multiple pairs of words together, as would be necessary if there are several antonym pairs in the same frame.

## 8.2 Asymmetric antonymy

Asymmetric antonymy (polar/gradable) asserts one entails negating the other, but negating one does not entail the other, for example:

- (83) *abundant*    *scarce*  
*cheap*            *expensive*  
*early*            *late*  
*easy*             *difficult*  
*good*             *bad*  
*intelligent*    *stupid*  
*love*             *hate*  
*proud of*        *ashamed of*

- (84) a. I'm not proud of what you did.  
       b. ≠ I'm ashamed of what you did.

- (85) a. I'm not ashamed of what you did.  
 b. ≠ I'm proud of what you did.

Asymmetric antonyms do not permit paraphrase in the same manner as symmetric antonyms. Most gradable adjectives (*tall, short, big, small*, etc.) are of this type. None of the pairs listed in (83) above allow paraphrases in both directions: If X is rich, it is true that X is not poor, but because we cannot infer "X is rich" from "X is not poor," these two sentences are poor paraphrases, to say the most.

The current version of FrameNet is organized inconsistently with respect to antonymy. Some antonym pairs are included in a single frame (e.g., *easy* and *difficult* in the `Difficulty` frame), whereas members of other pairs belong to different frames (e.g., *stop* in `Activity_stop` and *continue* in `Activity_ongoing`). Treating antonyms more consistently, and refining the application of semantic types might result in some improvement on FrameNet as a resource for paraphrase research.

We propose the following structural modifications to the FrameNet database: (i) all antonymous frames should be linked to a more general frame that covers the background information they share, and (ii) where a frame contains antonymous LUs, it should be split into two subordinate frames, with a new antonymic frame-to-frame relation between each subordinate frame and a general frame. Where appropriate, the more specific antonyms (*agree* and *disagree*, *stop* and *continue*) are moved to the subordinate frames.

Although we do not treat converses (e.g., *parent* vs. *child*) in detail in this paper, the FrameNet lexicon is set up to capture this type of relationship in some limited cases. Converse antonyms do lend themselves to paraphrase, especially with relational nouns: *X is Y's student, Y is X's teacher*; *X is Y's parent, Y is X's child*. Noun pairs like these are sometimes in the same frame (both *parent* and *child* evoke `Kinship`). Converse verbs, such as *give* and *receive* are generally treated in separate but related frames in FrameNet (`Giving` and `Receiving`, both perspectives on `Transfer`).

## 9. Conclusions

Theoretically as well as empirically, paraphrase is a pivotal concept in many academic and nonacademic fields. And yet, its investigation has made very slow progress, due mainly to the lack of a framework that is versatile enough to deal with the nebulous nature of paraphrase in use. This paper has demonstrated how the mechanisms of FrameNet can be utilized as a resource for systematic and coherent research into paraphrase. The semantic framework it provides, including detailed frame descriptions, frame-to-frame relations, and the recording of syntactic

information, allows one to see in more principled ways why some set of sentences can be considered paraphrases of each other.

In the course of our research, we have identified more than 40 types of paraphrase, and resources available in the current version of FrameNet are adequate to account for many of them. Five types of paraphrase have been discussed with illustrative examples: Paraphrase (i) by intersubstitutability of synonymous expressions, (ii) by related frames (inheritance, perspective\_on, causative\_of, inchoative\_of), (iii) by support verbs, (iv) by valence alternations (extraposition, active/passive, alternative complementation types, ditransitives, reciprocals), (v) by licensed omission of recoverable arguments, (vi) “head switching” through extrathematic adjunction.

During our investigation, we have recognized diverse types of paraphrase for which FrameNet lacks sufficient resources. In this paper, we focused on one type that employs negatively-defined antonyms. There are two kinds of negatively related antonyms: symmetric and asymmetric antonymy. The former can be used in paraphrase, but the latter cannot be. We proposed a structural change to the FrameNet frame hierarchy to better reflect these types of semantic relations between words and frames. By these modifications, FrameNet can become a more viable tool for paraphrase research.

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