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Gradable nature of semantic compatibility and coercion: A usage-based approach*

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Yoon, Soyeon. 2016. Gradable nature of semantic compatibility and coercion: A usage-based approach. *Linguistic Research* 33(1), 95-134. This study investigates the gradable nature of semantic compatibility between constructions and the lexical items that occur in them and also of the related concept of linguistic coercion, in relation to actual language use, on the basis of the usage-based model, proposed by Langacker (1987). The study shows that semantic compatibility between linguistic elements is a gradient phenomenon, and that speakers' knowledge about the degree of semantic compatibility in a given case is closely correlated with language use, specifically language processing and frequency of usage. This study also shows that coercion, which is the resolution of semantic incompatibility between a construction and a lexical item occurring in it, is also a gradient phenomenon related to usage. To do so, this study investigates linguistic knowledge of semantic compatibility between the English sentential complement construction and various verbs that occur in it, and compares this semantic compatibility with empirical data obtained from acceptability judgments of various sentences, a corpus, and an experiment on sentence processing. My findings show that the more compatible a verb is with the construction, the faster their co-occurrence is processed and the more frequently it is used. On the basis of this correlation between gradable semantic compatibility and usage, this study suggests that the study of coercion be expanded to investigate its linguistic and extra-linguistic contexts and to determine what kind of interactions lead to a better or easier resolution of incompatibility, by incorporating empirical language use data. **(Incheon National University)**

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1. Introduction

This study investigates the nature of coercion, which is defined as the resolution of semantic incompatibility between a construction and a lexical item in relation to language use. This concept reflects a usage-based approach to language, that is, one in which linguistic knowledge (grammar) is grounded in language use (Kemmer 2008; Kemmer and Barlow 2000; Langacker 1987, 1988). Recent studies in coercion have expanded the range of perspectives to consider processing (Piñango, Winnick, Ullah, and Zurif 2006; Traxler, McElree, Williams, and Pickering 2005), frequency (Gries, Hampe, and Schönefeld 2005, 2010), and contextual effects (Boas 2011). The current study investigates one important factor directly involved in coercion: semantic compatibility.

Semantic (in)compatibility between constructions and the lexical items that occur within them is not binary—"compatible" or "incompatible"—but gradable; this is taken as implicit by most cognitive linguists (Fillmore 1975; Goldberg 1995; Lakoff 1987; Langacker 1987). If we accept the gradable nature of semantic compatibility, we will expect coercion also to be gradable in nature, because it involves different degrees of semantic compatibility depending on the co-occurring linguistic elements. This gradable nature of coercion will then presumably also be reflected in differing acceptability judgments for sentences where a particular construction occurs with different levels of semantic compatibility. Further, coercion will require different degrees of processing effort depending on semantic compatibility, and the frequency of co-occurrence of given elements may differ (Gries et al. 2010; Yoon 2013).

However, the gradable nature of semantic compatibility and coercion has not been empirically studied in detail, in particular in relation to actual language use. Based on empirical data consisting of acceptability judgments, sentence processing data, and corpus data, this study claims that coercion, which has been theoretically represented as a concept that "occurs" or "does not occur" in a given case, should instead be dealt with as a gradable phenomenon in language use.

2. The relationship of coercion, semantic compatibility, and language use

2.1 Coercion and semantic compatibility

In Construction Grammar (Goldberg 1995; Michaelis 2005), a construction, which is viewed as the basic unit of linguistic organization, is defined as a conventionalized pairing of form and meaning (Goldberg 1995). In this view, a syntactic structure contributes to the meaning of the whole expression that it constitutes or in which it appears, in combination with the semantics of the lexical items that it contains. For example, the ditransitive construction (DC, [V NP1 NP2]) conveys the meaning, "transfer of possession from an agent to the recipient," as in (1) (Goldberg 1995; Pinker 1989).

(1) John *gave* Sally a book.

Note that a lexical item that is semantically compatible with a construction is one that can occur with the construction. For example, *give* can be readily used in the DC because this verb is highly semantically compatible with the DC, in that *give* conveys a prototypical meaning in which a person transfers a thing to another person, which is almost exactly the meaning of the DC.

Now, let us consider the verb *find*. Typically, *find* does not carry the meaning of transfer and does not involve a recipient in the event scene. Nevertheless, *find* can be used in the DC as well, as in (2).

(2) Mary *found* Ted the watch.

Here, (2) can be interpreted as "Mary found the watch for Ted and gave it to him," even though *find* is not perfectly compatible with the DC; in this sense, we may view *find* as "somewhat compatible" with the DC.

This resolution of incompatibility between a lexical meaning (e.g., *find*) and a constructional meaning (e.g., the DC) has been called coercion in Construction Grammar (Goldberg 1995, 2006; Michaelis 2003, 2005) and some other theoretical frameworks such as Generative Lexicon (Pustejovsky 1989).

Most studies on coercion have approached it as a theoretical concept and a phenomenon that is expected to either occur or not occur in any given case; from this beginning point, they have focused on how to formally describe coercion. For example, *a beer* is a coerced expression because the lexical item *beer* is specified [-bounded] whereas the construction [*a* N] is [+bounded] (Michaelis 2005). In other words, the construction and the lexical item are semantically incompatible. Therefore, coercion occurs: The lexical meaning [-bounded] becomes [+bounded]. Likewise, the NP *the book* should not naturally occur in the construction [*begin* X_{event}] (Pustejovsky 1995), because the construction requires a complement specified with [EVENT] while *the book* is specified with [ENTITY]. Therefore, coercion occurs: The lexical meaning [ENTITY] becomes [EVENT]. In this way, simple matching of the semantic features of a lexical item and a construction will result in an all-or-nothing conclusion: "incompatible" or "compatible"; and if incompatible, coercion will occur or not occur.

However, these approaches do not capture the continuous nature of semantic compatibility. For example, as seen in (1) and (2), *give* is perfectly compatible with the DC, while *find* is less so; and verbs even less compatible with the DC than *find* can be used in the DC, as in (3).

(3) John *cut* Jane a belt.

It is usually expected that the recipient in the DC is benefitted by receiving an entity (Pinker 1989). However, if John cuts a belt, the belt is damaged, and Jane is not likely to be benefitted. In this sense, it is very hard to use a verb in the DC if the event results in damage to an entity. However, *cut* can be used in the DC if (3) is interpreted to mean "John created a belt by cutting out a belt from a piece of leather, and gave it to Jane."

In contrast, stative verbs, such as *remain*, do not fit the DC, as shown in (4).

(4) * Sam *remained* Laura the room.

The event designated by *remain* means "not changing location" and requires only a person who remains in the location. Therefore, *remain* is the least compatible with the DC of the four verbs we have considered. Most speakers may not be able to

interpret this sentence and may judge it unacceptable.

As seen in (1)–(4), linguistic knowledge of semantic compatibility between linguistic units is not binary—compatible/incompatible. Rather, it comes in degrees, and cannot be explained by trying to determine "whether or not" the semantic features match. Instead, according to the usage-based model (Langacker 1987), semantic compatibility among units is determined based on "how much" the meanings of the linguistic units overlap. If we accept that semantic compatibility is gradable, we can also infer that some degree of incompatibility may be hard to resolve but some lesser degree of incompatibility, easy. In other words, not all coercion is considered the same. If we explain coercion with reference to language use phenomena such as processing and frequency in use, coercion is a gradable phenomenon. This relationship between semantic compatibility, coercion, and language use is explained in more detail in the next section.

2.2 Semantic compatibility and language use

In the usage-based view (Langacker 1987), the use of language is tightly linked with the linguistic system. The linguistic instances speakers hear and use are specific to context, but if they experience similar instances repeatedly, they can generalize them into a pattern or schemas by extracting commonalities, and construct linguistic knowledge thereby. Therefore, in the usage-based model, the frequency of instances of a linguistic pattern is important: If a language user experiences a pattern frequently, it is cognitively entrenched as a schema in the language system. For example, if speakers often encounter instances where *give* is used in the DC, this usage (their co-occurrence) becomes entrenched as a pattern, allowing them to construct the linguistic knowledge that the DC and *give* are compatible. Then, even though *find* is not frequently used in the DC, if speakers experience this co-occurrence often enough, *find* and the DC may be recognized as compatible too.

The usage-based model also provides a prediction about processing during language use. This model assumes the use of linguistic units to involve recurrent patterns of mental or neural activation (Kemmer and Barlow 2000: xii). If a certain linguistic pattern is experienced frequently, the mental activation of this pattern is routinized, and thus it becomes faster to process (Hare, McRae, and Elman 2003; Seidenberg and MacDonald 1999). However, an infrequent or unfamiliar linguistic

instance costs more processing effort, because the neural connection is not routinized. For example, the co-occurrence of the DC and *find* will be processed relatively slowly because it is not entrenched as a pattern through repeated usage (the DC and *find* are not recognized as compatible). In short, processing effort is closely related to semantic compatibility between linguistic units and to the frequency of their co-occurrence.

This suggests that coercion too, as the resolution of semantic incompatibility, is related to processing effort and frequency. Some psycholinguistic studies claim that coercion requires more processing time (Piñango et al. 2006; Traxler et al. 2005). In addition, some neurolinguistic studies have shown that expressions involving coercion elicit increased activity in the Anterior Midline Field (Pylkkänen, Martin, McElree, and Smart 2009), and have ruled out the possibility that this effect might be due to a sensicality judgment. However, these studies assumed that semantic compatibility and coercion are binary, an assumption that we reject.

Other studies have empirically investigated the co-occurrence of a lexical item and a construction based on the usage-based model. For example, Gries et al. (2005, 2010) conducted experiments on sentence completion and processing time and compared the results with lexical-constructional co-occurrence patterns analyzed with a particular measure of relative frequency, Collostructional Analysis (Stefanowitsch and Gries 2003). They showed that the frequency of co-occurrence of a particular construction and verb in a corpus was correlated not only with the effort needed for speakers to process the co-occurrence but also with their linguistic intuition about which verbs are more or less frequently used with the construction. However, these authors did not deal with frequency, processing, or semantic compatibility as gradable, but again as binary. In short, the gradable nature of coercion has not been seriously discussed.

The current study specifically examines linguistic knowledge about various degrees of semantic compatibility between the English sentential complement construction (SCC) ([V [*that* Sentential Complement (SC)]]) and co-occurring main verb by means of sentence acceptability judgments. This semantic compatibility is compared with frequency of co-occurrence of the SCC and the verb and with processing time during language use. We predict that if speakers know that a certain lexical item is more semantically compatible with the SCC than alternatives, the pattern of the use of the verb in the construction will become entrenched through

frequent usage and will be processed more easily; and that, on the other hand, if a verb is less compatible with the SCC, their co-occurrence will be less frequent, will not become entrenched, and will be processed more slowly. Further, we assume that the gradable nature of semantic compatibility and its connection with coercion mean that coercion is also a gradient concept and also related to language use, not just linguistic knowledge. Thus, we can expand our perspective on coercion to discuss more dynamic interaction among various linguistic and extra-linguistic conditions involved in coercion in relation to empirical evidence.

The next section looks at speakers' linguistic knowledge of the semantic compatibility between a verb and the SCC. The degree of semantic compatibility will be correlated with the acceptability judgments of native speakers (Section 4), experimental results on processing effort (Section 5) and frequency patterns as found in corpus data (Section 6). The results will suggest that coercion is gradable.

3. Semantic compatibility between constructions and lexical items

Semantic compatibility was measured by comparing the prototypical meaning of the SCC with the prototypical meaning of a verb that may or may not occur in the SCC. In this section, I examine the semantics of the SCC and determine which verbs are semantically more compatible and which less, relying on the intuitions of some native speakers of English, linguistic analysis based on the binding hierarchy (Givón 1980), and the *Collins COBUILD English Dictionary for Advanced Learners* (CCED; Sinclair 2001). I did not consult frequency data from any corpora in order to avoid being strongly influenced by frequency of usage, which is dealt with as an independent factor in 6.

3.1 Semantics of the sentential complement construction

In Construction Grammar, the syntactic structure and the semantics of a construction are interrelated, in that the syntactic structure of the construction is directly linked to the semantic information in the construction. Therefore, the syntactic form of a construction directly reflects its semantics. Let us examine an example of the SCC in (5).

(5) I *know* that you *led* a rifle platoon during the Second World War. (CCED)

In (5), the possible divergence of the syntactic properties (e.g., subject, tense, aspect, mood, argument structure) in the complement from those in the main clause clearly shows that the constituent [*that* SC] is independent of the main verb [V]. This syntactic independence also reflects the semantic independence of the SC; we can see this in (5), for example, by the fact that the agent (*you*) and the temporal property (the past event) are different from those in the main clause, and the event in the SC (*you led a rifle platoon*) is not influenced by the action indicated by the main verb (*know*).

Thus, in the SCC schema, the SC denotes an event independent of the main verb action; and the semantic compatibility of the main verb with the SCC relates to the degree to which the main verb event permits the complement event to be independent.

3.2 Semantic Compatibility Criteria

To determine the degree of independence of the main verb from the SCC ([V [*that* Sentential Complement (SC)]]), I employed the criteria for determining degree of *binding* between the main verb event and the complement event, following the binding hierarchy proposed by Givón (1980).

The binding hierarchy, constructed based on cross-linguistic research, is designed to explain the relationship between the semantics of a complement-taking verb (i.e., a main verb) and the syntactic coding of the complements of that verb. “Binding” here is defined as “the extent to which the [main verb event] and lower clause events are coded and conceptualized as a single, integrated event” (Broccias and Hollmann 2007: 498). According to this definition, to the extent that the main verb event and the complement event are coded and conceptualized as integrated (bound), the complement verbs are not syntactically or semantically independent of the main verb; binding, therefore, refers to semantic and syntactic dependence. I will use the term “independent” in preference to “non-binding,” since it seems more straightforward and less metaphorical. If the binding hierarchy is applied, we can make the following statement (Givón 1980: 337): The more syntactically independent a complement clause is of a main verb, the more it will be semantically independent

of the main verb as well. Therefore, if we examine a verb's typical syntactic and semantic context, we can predict the semantic compatibility between that verb and the SCC: If the verb (can occur with a complement clause and) allows the complement clause more syntactic/semantic independence, the verb is more compatible with the SCC.

According to the binding hierarchy, formal characteristics of independent complement clauses are as follows: Subject/agent/topic case markings and tense/aspect/modality markings are independent of those on the main verb (Givón 1980: 338). Less independence (greater dependence) is syntactically realized as follows: The complement verb (CV) is a bare or *to*-infinitive verb, and the complement agent (CA) is an object of the main verb (MV). Accordingly, the semantic characteristics of independence are as follows: The agent of the main verb (MA) strongly influences on the agent of the complement (CA); the CA has more autonomy;[1] the event expressed in the complement is successfully performed (Givón 1980: 335).

Thus, by examining the typical syntactic and semantic properties of various verbs accompanied by complement clauses, we can predict the degree of semantic compatibility between these verbs and the SCC.

3.3 Degree of semantic compatibility of English verbs with the SCC

I observed various verbs and categorized them into seven groups with different degrees of semantic compatibility with the SCC. Table 1 summarizes this categorization; categories are defined below.[2]

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1 Givón (1980) originally used the term "independence" for this criterion. However, this may cause confusion with my usage of "independence" to mean "syntactic and semantic independence" (non-bindingness). Thus, I adopt the term *autonomy* (Kemmer and Verhagen 1994), which indicates the capability of the CA to act on his/her own.

2 Givón (1980) provided the following categories: verbs of "no independent event," "manipulative-implicative," "strong attempt," and "cognition-speech." I added three more categories with varying degrees of independence, verbs of "weak attempt," "intention," and "perception." With regard to independence, all three new categories lie in between strong attempt verbs and cognition-speech verbs.

Table 1. Semantic compatibility with the SCC

Compatibility with SCC	Semantic Category	Typical Syntactic Construction Where V Occurs
least	no independent event (*hit*, *break*)	(6) John hit the man.
	manipulative-implicative (*make*, *have*)	(7) John made *him* **work** in the evening.
	strong attempt (*tell*, *order, advise*)	(8) I ordered *him* **to move** his car.
	weak attempt (*teach*)	(9) He taught *him* **to read**. (CCED)
	intention (*mean*, *intend*)	(10) The woman meant (*for*) *him* **to leave**.
	perception (*see*, *hear*)	(11) a. Jean saw *Ted* **sleeping** on the bench. b. Jean saw *that Ted* **was sleeping** *on the bench.*
most	cognition-speech (*think*, *know*)	(12) I *know* that *you* **led** a rifle platoon during the Second World War. (=(5))

Verbs in the first category, like *hit* in (6), do not evoke an independent event; the event of hitting someone is so tightly integrated with the event of being hit that they are conceptualized as a single event. Thus, the verbs like *hit* are not compatible with the SCC.

The examples of manipulative-implicative verbs given by Givón (1980: 369), are *make*, *have*, and *cause*. In (7), the CV *work* can be used only in the bare infinitive, and its subject is the object of the main clause *him*. Semantically, the influence of the main verb agent (MA) on the complement agent (CA) is strong, and the event of the complement intended by the MA is successfully performed. Since the complement shows minimal independence, these verbs are almost incompatible with the SCC.

For strong attempt verbs, as in (8), the SC is syntactically more independent than for manipulative-implicative verbs. The CA is expressed as the object of the MV, and the CV is expressed as a *to*-infinitive, indicative of more independence than a bare infinitive (Givón 1980: 369). Though the MA strongly attempts to manipulate the CA, the influence of the MA is weaker than with manipulative-implicative verbs, and thus the event in the complement is less likely to be successfully performed. Due to the greater independence of the complement event, strong attempt verbs are

more compatible with the SCC than manipulative-implicative verbs.

Next, the syntactic coding of weak attempt verbs like *teach* in (9) is not different from that of *order* in (9). However, semantically in (9), though the MA (*he*) does not directly cause the CA (*her*) to carry out an action (*read*), he still influences her by enabling her to read. The event in the complement is less likely to be successfully performed than in the case of *order,* because the CA may or may not read. Thus, the complement event is more independent than with strong attempt verbs.

When the intention verb *mean* is used with a human subject,[3] as in (10), the CA can be expressed as a PP (*for him*) instead of the direct object of the MV. In the example, the woman intended to make "him" leave, and may or may not have directly told him to leave or indirectly influenced conditions so that he would leave. However, regardless, since *mean* denotes an attempt occurring in the woman's mind (and perhaps only there), the man may or may not have known that he was being manipulated and may or may not have actually left. In other words, compared with weak attempt verbs like *teach* in (9), the CA is not strongly influenced by the MA, the CA has more autonomy, and the event in the complement is much less likely to be successfully performed by the CA. Therefore, *mean* is more compatible with the SCC.

Perception verbs like *see* can also be used metaphorically as cognition verbs. For example, as in (11b), the verb *see* sometimes means "to know" or "to understand," via the conceptual metaphor UNDERSTANDING IS SEEING (Lakoff and Johnson 1980). The difference between (11a) and (11b) is whether or not the meaning of visual perception is considered primary. In (11a), Jean visually perceived the bench and Ted sleeping on it and knew the situation thereby. In this case, the primary meaning of *see* is one of perception and the secondary meaning is one of cognition. On the other hand, in (11b), the fact that Jean knows that Ted was sleeping on the bench is primary and whether or not she visually perceived him is secondary (Langacker 1987: 440). In general, however, the basic meaning of the verb when no contextual information is given is considered to be one of perception, making these verbs less compatible with the SCC than verbs like *think*.

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[3] When *mean* is used with a non-human subject like *it*, *that*, or *the fact that [SC]*, it usually denotes "refer to" or "convey" rather than designating the "intention" of the subject. In this study, I focused on cases of *mean* used with a human subject.

Finally, cognition-speech verbs, such as *think*, *know*, and *say*, are not related to the agent's attempt to influence the complement event by physically or socially operating on the CA. Rather, the agent of these verbs cognitively distances him-/herself from the complement event (Langacker 1987: 447) to observe/assess it without affecting it. Thus, the complement event remains independent of the main verb. Cognition-speech verbs are highly compatible with the SCC, as seen in (12).

To judge semantic compatibility, I used syntactic and semantic independence as observed based on the binding hierarchy. Such judgments are vulnerable to criticism as subjective; thus, in order to support them, I employed WordNet::Similarity (Pedersen, Patwardhan, and Michelizzi 2004),[4] software that measures relatedness between word senses on the basis of the WordNet database (Fellbaum 1998). Since most words are polysemous, a word may have more than one concept, and WordNet organizes the concepts of nouns and verbs into hierarchies of *is-a* relations (e.g., *a wheel is a part of a car*). To measure similarity between the SCC and a particular verb, I used path length, or the number of nodes between two concepts. Assuming that the first definition of a verb is the most prototypical, I compared the first definition of the verb *think*, "judge or regard," with the first meanings of the following verbs representing all seven categories: *know*, *see*, *mean*, *teach*, *advise*, *make*,[5] and *hit*. The calculated similarities are presented in Table 2.

Table 2. WordNet::Similarity scores

Compatibility Category	Verb	Similarity
no independent event	*hit*	0.14
manipulative-implicative	*make*	0.14
strong attempt	*advise*	0.09
weak attempt	*teach*	0.11
intention	*mean*	0.17
perception	*see*	0.17
cognition-speech	*know*	0.20

Scores can range from 0 (least similar) to 1 (most similar). In Table 2, we see that *know* was the most similar to *think*, and that scores gradually decrease throughout

4 A web interface can be found at http://maraca.d.umn.edu/cgi-bin/similarity/similarity.cgi.

5 For *make*, in order to reflect the meaning of "manipulation," I used the eighth definition of *make*. For *mean*, in order to reflect the meaning of "intention," I used the seventh definition of *mean*. For all the other verbs I used the first definition.

see, *teach*, and *advise*, respectively, while mean and see have the same similarity scores. However, *make* and *hit*, which had been expected to be very low in similarity, were higher than the prediction.[6] Nevertheless, I believe that most native speakers of English will agree that *hit* and *make* are not very compatible with the SCC. Regardless, except for *make* and *hit*, semantic compatibility as predicted by binding was confirmed in general.

I predict that the degrees of semantic compatibility shown by linguistic analysis in this section are not arbitrary, but rather represent speakers' linguistic intuitions regarding semantic compatibility.

4. Acceptability judgments

People do not always speak and comprehend only perfectly compatible linguistic elements. They may resolve incompatibility sometimes, but the degree of incompatibility may vary, as the extent to which they can speak and understand the incompatible co-occurrences may vary. In this section, speakers' intuition about semantic compatibility was measured using a web-based survey of acceptability judgments of sentences in which various verbs were used in the SCC.

4.1 Participants and design

Todorova, Straub, Badecker, and Frank (2000) examined the online processing of aspectual coercion. They manipulated adverbial modifiers (durative vs. non-durative) and cardinality of the direct object (singular indefinite vs. bare plural). Besides measuring reading time, they asked participants for sensicality judgments on the sentences. In contrast to Todorova et al., I manipulated the main verbs of the SCC, which are expected to have different degrees of semantic compatibility.

For the target sentences, twenty-two verbs were selected that were presumed to belong to different semantic compatibility categories; see Table 3. Each category was given a semantic compatibility score (SemCom) determined on the basis of the independence criteria discussed in 3.1: 1 as most compatible with the SCC and 7 as least. These scores were correlated with the results of the acceptability judgments after the survey.[7]

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[6] Unfortunately, I have no explanation for the unexpectedly high similarity between *think* and *make* and *hit*.

Table 3. The twenty-two verbs selected for the survey and their semantic compatibility scores

Semantic Category	Verbs	SemCom
cognition-speech	*think, know, remember, say, learn*	1
perception	*see*, *like*, *hate*	2
intention	*mean*, *pretend*	3
weak attempt	*teach*, *instruct*	4
strong attempt	*advise*, *order*, *tell*, *want*	5
manipulative-implicative	*make*, *cause*, *help*	6
no independent event	*break*, *throw*, *hit*	7

The following sentences are examples of those used in the survey.[8]

(13) a. John *thought* that Jill went to the Japanese Restaurant three times a week.
b. Billy *hit* that Sam drank a glass of wine every evening.

First, I constructed forty-four sentential complements where the tense of the main verb was fixed as past and the subject of the main clause was always a human subject in the third person. Then, I randomly matched one sentential complement with each verb in Table 3. Since the SCC requires an independent SC, verbs compatible with the SCC will be judged very natural regardless of the content of the SC. Each verb was used twice, with a different SC each time. Consequently, there were forty-four sentences in total.

As in (13a), there was no direct object NP following the main verb. If there was an NP of the verb like [V NP [*that* SC]], I regarded it as a construction distinct from the SCC. Second, verbs like *think*, *see*, and *mean* can be used as discourse markers (Fox Tree and Schrock 2002; Thompson and Mulac 1991) when they are used in present

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7 Some may question if it is appropriate to include in the experiment the verbs that do not take a subordinate clause at all (e.g., *hit, break*) or the verbs that usually occur in the construction of [V + Obj + *that* + SC] (e.g., *tell, order, advise*). However, these verbs are worth being examined because the aim of the current study is to investigate various degrees of semantic compatibility. As I expected in Section 3, the verb such as *hit* which does not require an independent event will not be compatible with the SCC. If the verb, such as *tell* and *advise,* requires a direct object, it implies that the influence of the verb action on the interlocutor is strong, and thus the verb will not be very compatible with the SCC. To see if this semantic compatibility is correlated with the acceptability judgments, I included these verbs in the experiment.

8 See Appendix 1 for a complete list of materials.

tense without the complementizer *that*, as in *I think he's wrong*. To exclude cases of discourse markers, which might confound the result of the experiment, only cases where the complementizer *that* followed the main verb were used.

The forty-four sentences were presented randomly to the participants: forty-three native speakers of English given the URL for the survey, who accessed the website at their convenience and rated the "naturalness" of the given sentences.

I deliberately avoided using the terms "grammaticality" or "acceptability" in relation to the judgments because these words may make participants judge sentences based on the principles of prescriptive grammar (Cowart 1997) and lead to a dichotomous result: grammatical/acceptable or ungrammatical/unacceptable. Moreover, this study examines the relationship between semantic knowledge and the usage; accordingly, the judgments were intended to be usage-oriented (Schütze 1996): Therefore, participants were asked to judge "how *natural* the sentence that [they] read was *for a native speaker of English to say*." The participants rated the sentences on a seven-point Likert-type scale (1 = "Perfectly natural"; 7 = "Completely unnatural"). (Henceforth, I use the terms "naturalness judgment" and "Naturalness Score" ("NatScore").)

4.2 Results and discussion

First, the NatScores for all verbs were correlated with the verb's SemCom scores through linear regression, yielding a significant correlation ($r^2 = 0.71$, $p < .001$). In Figure 1, a dark solid line marks the NatScore, which is the mean of all participants' responses for the verb across both sentences in which it was presented. A light dashed line marks the SemCom of each verb, given in Table 3.

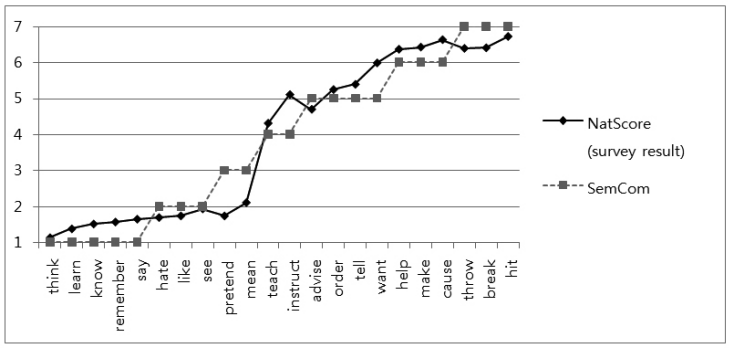

Figure 1. Naturalness score across twenty-two verbs

As seen in Figure 1, NatScore increases as verbs become more incompatible with the SCC. However, there is a big gap between NatScores 2 and 4, suggesting that speakers' intuition on semantic compatibility may not be as fine-grained as the linguistic distinction. In order to examine which verbs have significantly different compatibility, I conducted a *post-hoc* (Ryan–Einot–Gabriel–Welsch) test of ANOVA on the twenty-two verbs. The result showed that *think* (mean NatScore: 1.13), *mean* (2.09), *teach* (4.30), *tell* (5.38), and *hit* (6.72) were all statistically distinct. This indicates that there are at least five significantly different degrees of compatibility with the SCC, respectively represented by *think* as one of the most compatible verbs, *hit* as one of the least compatible, and *mean, teach,* and *tell* in the middle. In a way, this also implies that seven degrees of theoretical distinction may be too fine-grained. Only five degrees were cognitively distinctive.

In general, these results show that native speakers' compatibility judgments conform to the theoretically informed linguistic observations. It also shows that people's compatibility judgments are not clear-cut or binary; rather, there is a greater or lesser degree of compatibility depending on the verb. This result suggests that coercion may in fact be a gradable and not a binary concept, because the semantic incompatibility involved in coercion is gradable. The gradability of coercion will be supported by empirical evidence in 5 and 6.

5. Processing experiment

If a verb and the SCC are semantically compatible, speakers will process their co-occurrence easier. However, if a verb is not so compatible with the SCC, more processing effort will be expected as listeners try to resolve the incompatibility, which can be understood as amounting to a processing cost for coercion. Some experimental studies on coercion show that delayed processing is the result of coercion, not of an inference or experimental task (Piñango et al. 2006; Pylkkänen et al. 2009; Todorova et al. 2000; Traxler et al. 2005). As will be shown through the results of this experiment, processing cost increases as semantic compatibility decreases. This shows that coercion is a psychological process requiring different degrees of processing effort from case to case.

5.1 Participants and experiment design

A total of twenty-seven native speakers of English participated in the processing experiment, aged 18–24. These participants did not overlap with those in the web-based survey.

For the processing experiment, I used the same sentences containing [V [*that* SC]] that were used in the web-based survey (see Appendix B for the complete list of stimuli). I selected two different sentences with eight verbs (sixteen in all). As I noted in 4.2, the *post-hoc* test showed that verbs *think*, *mean*, *teach*, *tell*, and *hit* were significantly different from one another in terms of NatScore. Accordingly, I decreased the number of distinctive semantic compatibility categories. Note that it may have been ambiguous to some participants whether the verb *tell* was a cognition-speech verb or a manipulative-implicative verb, even though the naturalness judgment result conforms to the SemCom for a manipulative-implicative verb. In order to minimize the effect of this ambiguity, *tell* was excluded from the experiment. This decreased number of categories was also supported by the WordNet similarity scores presented in Table 2. In Table 2, the similarity score of *know* was distinctive while *see* and *mean* had the same similarity score. The scores of *teach* and *advise* were similar and those of *make* and *hit* were the same. The categories of similar or same scores may collapse.

Then, in order to make sure that the difference in RT was not idiosyncratic to the remaining four verbs only, I added the four verbs that showed the closest scores to *think, mean, teach*, and *hit,* respectively. The verb *learn* (mean NatScore: 1.37) showed the closest score to *think* (1.13), and they are grouped together; *see* (1.92) is grouped with *mean* (2.09); *advise* (4.69) with *teach* (4.30); and *cause* (6.63) with *hit* (6.72).[9] The selected verbs are summarized in Table 4. Each verb was used twice (with two different SCs).

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[9] Some might argue that testing verbs that do not involve any independent event, like *hit* in the SCC, is not desirable because these verbs are very unlikely to occur in this construction. However, this study included nevertheless, *hit* in order to test the most extreme incompatibility.

Table 4. Verbs selected for the experiment

Group	Verb	Verb Semantics
1	*think*, *learn*	cognition-speech
2	*see*, *mean*	perception, intention
3	*teach*, *advise*	weak attempt, strong attempt
4	*cause*, *hit*	manipulative-implicative, no independent event

Note that the subject of the SC (i.e., the word following *that*) was a third person in the form of a proper noun, such as *John* and *Kim*. Words of one syllable were selected for this position, because in the processing experiment I measured the RT to process this word, as will be discussed below.

In addition to the sixteen sentences with eight verbs above, I inserted thirty-two filler sentences that were not related to the target construction. All sentences were presented in a random order.

Participants came to a linguistics lab individually and were told that the task was judging the "naturalness" of the sentences. In the experiment, the participants read the sentences individually on the computer screen word by word as a self-paced reading task. After completing each sentence, they were asked to rate the naturalness of that sentence; this was meant to guide them to pay attention to the sentence content (Todorova et al. 2000) and to confirm the result of the acceptability judgments in 4. Given the web-based survey results showing that seven degrees of compatibility was an unnecessarily detailed distinction, I made the judgment simpler by changing to a five-point scale: 1 = "Perfectly natural," 5 = "Completely unnatural."

The specific RT examined was time to process the word following the complementizer *that*, underlined in (14b). Note that the word *that* itself is ambiguous: it may be a complementizer or a demonstrative. If participants read up to *that* in (14a), they may interpret *that* as a complementizer, as in (14b), which is what this experiment intends, but they may also interpret it as a demonstrative adjective, as in (14c), because demonstrative *that* may be used more frequently in most circumstances than complementizer *that* with *hit*.

(14) a. Billy hit *that*…
b. Bill hit *that* Beth saved her files in other computers as a backup.
c. Billy hit *that* ball with a bat.

On the other hand, if *that* follows *see*, it is not certain whether people will process it as a demonstrative or a complementizer, because both are grammatical and may be used quite frequently. Because RT for *that* has confounding factors other than compatibility between the verb and the construction, it may not be a good indicator of compatibility between the verb and the SCC. Instead, the participants may realize that *that* in (14b) is a complementizer rather than a demonstrative pronoun or adjective at the time when they read the word following *that*. Therefore, I measured RTs to process the word following complementizer *that*. This word was always a proper noun of one syllable (e.g., *Sam, Ted, Beth*). The prediction was that if the verb is less compatible with the SCC, participants would take more time to process the word following *that*.

Finally, I measured RT for naturalness judgments in order to obtain processing information on meta-linguistic judgments. When participants feel that a sentence lies in the middle ground between natural/compatible and unnatural/incompatible, they will spend more time judging its naturalness. On the other hand, if the sentence is obviously natural or unnatural, they will swiftly rate it "1" or "5" respectively. Therefore, peak RT is predicted for the verbs in the middle in terms of NatScore: *teach* and *advise*.

5.2 Results

I conducted a repeated-measures ANOVA with four groups, each of which contained two verbs each used twice, in different sentences (4 Groups x 2 Verbs x 2 Trials). My main concern was finding a linear trend rather than simply finding differences in NatScore or RT between groups, because this study predicts gradual change in accordance with semantic compatibility rather than significant differences between groups. I expect to find a linear trend in NatScore or RT across groups when groups were ordered by semantic compatibility with the SCC.

I first examined the results of the acceptability judgments.

Figure 2. Mean NatScore across groups (the error bar indicates standard deviation of the mean; the dotted line is a linear trend line).

As Figure 2 shows, there was a linear trend in which the groups became more incompatible with the SCC ($F(1,26) = 1642.77$, $p < .001$, partial $\eta^2 = .98$): the more compatible the verb with the SCC (e.g., *think* and *learn*, mean NatScores $M = 1.11$, 1.09, respectively), the more natural the sentence judgment. On the other hand, the more incompatible the verb with the SCC (e.g., *cause* and *hit*, mean NatScores $M =$ 4.72, 4.76), the less natural the sentence was judged. The group means were significantly different from each other, which strongly supports the linear trend (with sequential Bonferroni correction, G3 and G4: $F(1,26) = 151.67$, $p < .017$, $\eta^2 = .85$; G2 vs. G3: $F(1,26) = 42.657$, $p < .025$, $\eta^2 = .62$; G1 vs. G2: $F(1,26) = 13.05$, $p < .050$, $\eta^2 = .33$). In short, semantic compatibility as analyzed linguistically in 4 conforms to native speakers' intuition about compatibility.

Second, RT for the word following *that* was measured. Repeated-measures ANOVA showed a main effect of Group ($F(3,24) = 6.91$, $p < .05$, $\eta^2 = .46$), but no main effect of Verb or Trial. An interaction of Group and Verb ($F(3,24) = 3.03$, $p < .05$, $\eta^2 = .27$) was also found. When the two verbs in each group were compared, only *see* and *mean* showed a difference in RT (*see*: $M = 537.37$, *mean*: $M = 487.70$, $F(1,26) = 4.92$, $p < .05$, $\eta^2 = .16$). Thus, other than the *see*/*mean* group, there was no effect of verb within each group.

Overall, there was a linear trend across groups ($F(1,26) = 21.38$, $p < .001$, $\eta^2 =$ .45), as shown in Figure 3. RT was fastest for *think* ($M = 507.28$ ms) and slowest for *hit* ($M = 731.52$ ms). More specifically, as we can see in Figure 3, RTs for G1

and G2 were not very different. However, the other pairs of adjacent groups were different (with sequential Bonferroni correction, G3 and G4: $F(1,26) = 7.12$, $p < .025$, $\eta^2 = .22$ / G2 vs. G3: $F(1,26) = 4.25$, $p < .050$, $\eta^2 = .14$). This suggests that as verbs became more incompatible with the SCC, speakers process their co-occurrence more slowly.

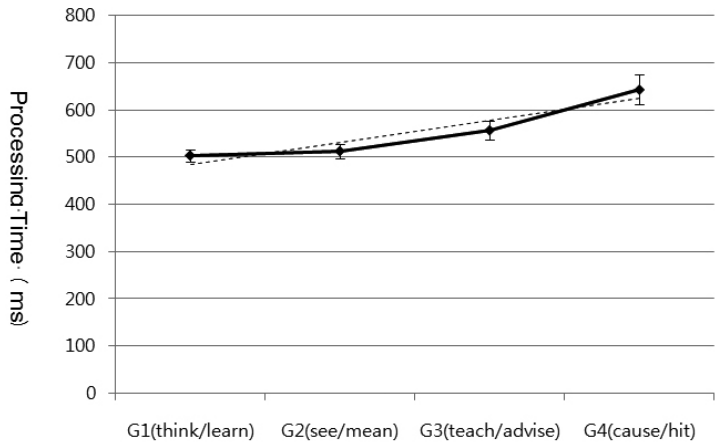

Figure 3. Mean reaction time for the word following *that*, across groups (the error bar indicates standard error of the mean; the dotted line is a linear trend line).

When participants read up to the word following *that*, they realized that *that* was a complementizer introducing an SC. When the verb was a cognition-speech verb, such as *think*, participants processed the co-occurrence of the verb and the construction easily; on the other hand, when the verb was a weak attempt verb like *teach*, they had more processing difficulty, and when the verb did not involve an independent event, such as *hit*, processing was the most difficult.

Finally, the RT for the naturalness judgment was the shortest for *think* (1657.67 ms) and the longest for *teach* (4064.85 ms). A notable result of the repeated-measures ANOVA was that there was a quadratic trend across groups ($F(1,26) = 39.20$, $p < .001$, partial $\eta^2 = .60$), leading to the peak at *teach/advise* in Figure 4. This result showed that people have trouble judging the naturalness of the co-occurrence of linguistic items that have intermediate levels of compatibility.

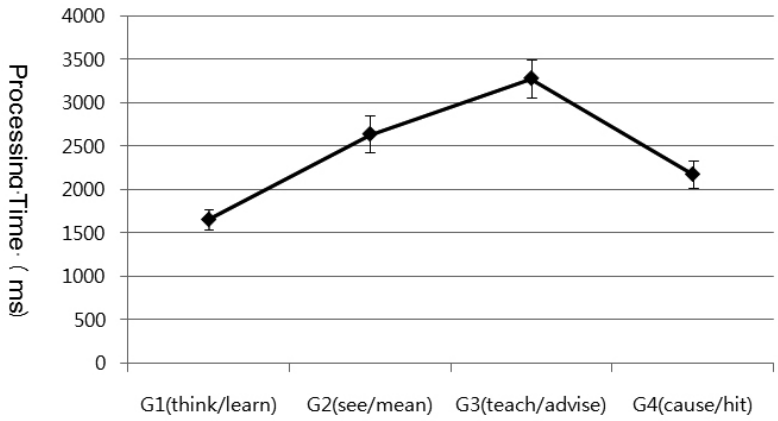

Figure 4. Mean reaction time to judge the sentences (the error bar indicates standard error of the mean).

5.3 Discussion

The NatScores once more confirmed the results of the web-based survey: There are degrees of semantic compatibility, and not all incompatible co-occurrences will be resolved in the same way. This was further confirmed empirically through the results of the experiment. The RTs for the word following *that* showed that more incompatible co-occurrences require more time to resolve, as predicted by the usage-based model.

One possible reason why a verb incompatible with the SCC requires more processing effort is the coercion effect, as some other studies (e.g., Piñango et al. 2006) have previously shown. For example, as was seen in 3.2, *see* can be used to express the "cognition meaning," a metaphorical interpretation of the "perception meaning." Thus, we can say that when *see* is used in the SCC, it is coerced into a cognition meaning, as in (11b), rather than a perception meaning. In addition, when used in the SCC, *teach*, which is typically used to mean "giving instructions," conveys information in the form of a factual proposition, as shown in (15).

(15) She taught *that George Washington was the first president of the US.*

In (15), the verb *teach* is something like a cognition-speech verb in that the MA does not affect the complement event but merely reports it. In this case, a weak attempt verb, *teach*, is coerced to mean "giving information about a fact" rather than "giving an instruction to do some action(s)."

With regard to some very incompatible verbs like *make* and *break* that were not tested in the experiment, several native speakers of English reported in the web-based survey that they could interpret *John made that Mary did it* into the meaning "John pretended that Mary did it," and *John broke that Mary did it* into the meaning "John broke the news that Mary did it." This shows that people do not simply judge a sentence to be natural or unnatural immediately when they encounter a co-occurrence of incompatible linguistic items. Rather, they try to reconcile the semantic incompatibility and make sense out of the sentences, that is, they engage in coercion.[10]

The current study further shows that coercion is not just a binary theoretical concept that "occurs" or "does not occur," but instead a gradient phenomenon directly related to processing. As stated in 2.1, the concept of coercion is a case of schema extension in Cognitive Grammar (Langacker 1987), on which the usage-based model is based. Speakers may have experienced numerous instances in which, when a cognition-speech verb and the SCC are used together, the schemas of the verb and the SCC are recognized as semantically compatible in the speakers' linguistic knowledge. Therefore, if the sentence *John thought that Jill went to the Japanese restaurant* is given, participants will have no problem categorizing it into the schemas of the cognition-speech verb and the SCC and comprehending it fast. However, in contrast, *teach* may not occur very frequently in the SCC, and *hit*, even less. The schemas of *teach* and *hit* are recognized as less compatible with the SCC than that of *think*, and thus, if *teach* or *hit* is used in the SCC, people need to extend the schema of *teach* or *hit* and the schema of the SCC in order to categorize this instance so that they can comprehend it; and extending the schemas in this way will cost more processing effort.

Finally, the RTs for the naturalness judgments provided evidence that the

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[10] The coerced interpretation may vary across individuals depending on their experience or background. It is true that some participants rated the naturalness of *hit* as 2 while others rated it as 5. The RT for the next word to that varied from 336 mesc to 1910 msec. The varying degrees of judgment scores and RTs should be discussed in relation to the coerced interpretation in future studies.

participants took more effort to judge naturalness when they encountered sentences of intermediate compatibility. Speakers managed to comprehend sentences where *teach* occurred with the SCC despite the lack of clear compatibility. However, doing so required more processing cost, because the incompatibility had to be resolved. Due to the cost for coercion, the speakers could not readily judge it simply natural, and gave intermediate scores to these sentences. The time to give a naturalness score became longer because the speakers had to determine the scores between "natural due to the resolution of the incompatibility" and "unnatural due to the processing cost."

On the other hand, if a clearly incompatible verb like *hit* is used with the SCC, people may try to coerce the co-occurrence in order to comprehend it. This is why the RT for the word following *that* was long in the case of *hit*. However, despite this attempt at coercion, people cannot reconcile the incompatibility in this case. Thus, when they have to make a meta-linguistic judgment after reading the sentence, the judgment process is quick because the sentence is quite obviously unnatural (that is, the verb and the SCC are incompatible). Therefore, the RT for naturalness judgments is directly related to compatibility, in that judgment is most difficult when semantic compatibility is intermediate.

In conclusion, the correlation of semantic compatibility, processing effort, and naturalness judgment scores found in this study supports the hypothesis rooted in the usage-based model: coercion is not a dichotomous theoretical concept evoked when semantically incompatible elements co-occur, but a gradable psychological concept that is closely related to actual language use.

This section has examined the processing aspect of language use, while the next section examines the frequency aspect.

6. Frequency

In this section, using corpus data, I examine which verbs are more frequently and less frequently used with the SCC. In corpora of written discourse, expressions are more likely to follow prescriptive grammar, meaning that incompatible items are not likely to occur together. In this sense, corpora of spoken discourse will be preferred for purposes like those of this study, because less compatible items may be more likely to have been used together. However, if a corpus contains casual

conversation only, instances of the complementizer may be rare. In this sense, a corpus of formal spoken discourse will be preferred if available. I chose to use the Corpus of Spoken Professional American English (CSPAE), which provides language that is in some ways intermediate between normal written and spoken English. This corpus contains two million words transcribed in formal settings such as academic discussions (faculty council meetings and committee meetings) and White House press conferences (question and answer sessions). The software used for the corpus search was *MonoConc Pro* (Barlow 1996; 2004).

6.1 Method

In order to search for instances where a verb is used in the SCC, I used a regular expression, presented as (16).

(16) [A-Za-z]*<w VV[A-Z]*> that<w CST>

The regular expression in (16) searches all instances where a complementizer or relativizer *that* directly follows a lexical verb of any tense and aspect. Next, I manually checked and deleted instances that were not cases of the SCC. The SC that this study deals with (in the SCC) is semantically and syntactically independent of the main verb; however, the fact that the syntactic form of the SC is restricted to the subjunctive mood, as in (17) means that the complement is not syntactically or semantically independent of the main verb. Therefore, I excluded these instances of the subjunctive mood as well.

(17) In that meeting the President *directed that* several steps *be taken*, …
(CSPAE_WH96AT)

Below, (18) summarizes the search results in terms of the SCC.

(18) Corpus description
a. total number of words in the CSPAE: 2,030,000
b. number of instances of the SCC found by (16) (token frequency): 3553

c. number of verbs used with the SCC found by (16) (type frequency): 152

In order to examine which of the 152 verbs occur more frequently with the SCC and which verbs less frequently, I analyzed the frequency patterns of the verbs using the methodology called Collostructional Analysis (Stefanowitsch and Gries 2003; Gries et al. 2010), specifically, using *Coll.analysis 3.5*, provided by Gries (2014). The methodology attempts to show which lexical items are more strongly attracted by (that is, more frequently used with) a construction relative to other lexical items and at the same time, which lexical items are more attracted by a particular construction than by other constructions. Then, using Fisher's exact test, we can calculate "collostruction strength," or how strongly a verb is associated with the construction (i.e., how frequently it is used in the construction). The results show whether the verb is attracted or repelled by the construction and how strongly. For more details on Collostructional Analysis, see Stefanowitsch and Gries (2003).

6.2 Results and discussion

I first examined how frequently the verbs, which were used in the processing time experiment, occur in the SCC in the corpus. The results are presented in Table 5. The column *Collo_Rank* indicates the ranks of the verbs when ordered by collostruction strength.

Table 5. The collostruction rank and relation with the SCC for the eight experimental verbs

Verb	Semantic Category	Collo_Rank	Relation
think	Cognition-speech	4	attraction
learn	Cognition-speech	94	attraction
see	Perception	103	attraction
mean-H[11]	Intention	117	repulsion
teach	Weak attempt	---	
advise	Strong attempt	144	repulsion
cause	Manipulative-implicative	---	
hit	No independent event	---	

[11] I divided instances of *mean* into two depending on whether the subject was human or non-human. "*Mean*-H" in Table 5 indicates *mean* with a human subject; there were also 146 instances of *mean*

As Table 5 shows, the verbs that are more compatible with the SCC (*think*, *learn*, and *see*) were attracted by (frequently used in) the SCC, while verbs less compatible with the SCC were repelled by (not frequently used in) the SCC (*mean* and *advise*) or did not occur in the SCC at all (*teach*, *cause*, and *hit*).

Overall, among the 152 verbs occurring in the SCC, most were cognition-speech verbs. Due to space limitations,[12] in Table 6, I present only the twenty verbs that were most strongly attracted by (more frequently associated with) the SCC), along with the number of instances of each in the SCC, the total number of instances of the verb found in the corpus regardless of the co-occurring construction, and the collostruction strength.

Table 6. The twenty verbs most strongly attracted by the SCC

Verb	# of Instances in SCC	# of Instances in Corpus	Coll. Strength
say	1088	8526	2516.463
suggest	196	748	692.488
believe	153	549	559.4835
think	321	3868	443.0755
indicate	127	548	413.2342
assume	75	222	305.3505
hope	80	269	302.5878
ensure	66	160	300.1229
know	255	3473	299.813
feel	86	549	211.4348
agree	75	600	152.7075
argue	44	203	136.155
note	35	115	133.7978
recognize	38	179	115.9089
acknowledge	23	80	84.93307
decide	46	500	69.01157
understand	54	727	62.75321
imply	17	70	56.53897
guarantee	18	82	56.05996
assure	17	84	50.11165

In Table 6, the verbs most frequently used with the SCC are cognition verbs such as *believe*, *think*, *assume*, *hope*, *know*, *recognize*, *understand*, and so on. The

used in the SCC with a non-human subject.

12 For the complete results of the collostructional analysis, see Appendix C.

agents of cognition verbs assess an entity or event outside, but do not affect the world outside. Thus, the semantics of these verbs are compatible with the semantics of the SCC, in that the event in the SC is independent of the main verb event.

Another type of verb are speech verbs, or verbs of expressing ideas, such as *say*, *suggest*, *argue*, *imply* and so on, as in (19).

(19) a. President Bush *said* that this was a threat to our security interests. (CSPAE_WH94T)
b. I think we're still in dialogue, so I don't want to *suggest* that it's completed. (CSPAE_WH94T)

In (19a), the president expresses his opinion, and in (19b), *suggest* means mentioning or implying the following proposition that the dialogue is completed. In both these cases, the verb in the main clause does not affect the proposition in the SC. The verbs in (19) are semantically compatible with the SCC in that the content of the SC is independent of the main verb action.

However, some speech verbs, such as *suggest* and *argue*, were found being used to involve the intention of the main verb agent (MA) or to make the main verb action influence the event in the SC. For example, it is possible that the MA tries to affect the world outside by suggesting, arguing, or indicating some idea. In these cases, the SC carries an auxiliary like *should* or *ought to*, as in (20).

(20) I would *suggest* that you should at least move back in the direction of the 80 percent statement and get closer, at least, to a 50/50 scoring. (CSPAE_COMM8A_1)

In (20), the semantic property of the SC is restricted to the deontic modality. When these auxiliaries are used in the SC, the main verb is interpreted as a weak attempt verb rather than a cognitive-speech verb. Actually, in the corpus data, when weak attempt verbs (e.g., *recommend* and *request*) and strong attempt verbs (e.g., *require* and *advise*) were used in the SCC, the modality of the complement was deontic, and expressed with auxiliaries such as *should* or *ought to*. This seems to indicate that less compatible verbs can occur in the SCC only in relatively restricted tenses, aspects, and moods.

Let us now turn to the verbs that are the most strongly repelled by (the least frequently associated with) the SCC.

Table 7. The twenty verbs most strongly repelled by the SCC

Verb	# of Instances in SCC	# of Instances in Corpus	Coll. Strength
require	5	437	2.200148
figure	2	231	2.10914
rule	1	147	1.887329
buy	1	121	1.190601
report	12	745	0.836979
comment	3	228	0.732145
speculate	1	92	0.528464
maintain	2	149	0.442725
care	1	76	0.24386
advise	1	75	0.228716
forget	1	74	0.213932
convey	1	73	0.199519
establish	4	234	0.158468
wish	1	65	0.098884
repeat	1	63	0.078265
disagree	1	59	0.043315
remind	2	111	0.040772
undertake	1	57	0.029274
arrange	1	55	0.017742
articulate	1	49	0.000187

Even among verbs not frequently associated with the SCC, there are cognition-speech verbs such *as report*, *comment*, *speculate*, *forget*, *repeat*, etc. The difference between these verbs and the prototypical cognition-speech verbs, such as *think* and *say*, is that the former can often be associated with other constructions, e.g., the transitive construction. These verbs often take an abstract entity such as a *procedure*, *idea*, or *plan* as a direct noun object. Because of their strong association with other constructions, these verbs seem to be relatively less frequently associated with the SCC; nevertheless, they can be used in the SCC when the direct object (e.g., *idea*, *plan*) is omitted and the details of the idea or the plan are expressed in the SC.

In Table 7, we can see the verbs that do not involve an independent event; all of these are incompatible with the SCC. For example, *buy* and *convey* typically do

not involve an independent event. They usually express the meaning of "transfer" (Goldberg, 1995; Pinker, 1989), as in *John bought a book from Mary* and *They convey fish to direct to Billingsgate*. However, we can use them in the SCC as in (21), where *buy* and *convey* are respectively coerced to mean "receiving an idea" and "reporting an idea"; here, what is metaphorically accepted or conveyed is the idea described by the SC.

(21) a. Our colleagues in other disciplines just don't *buy* that we have all that much of a leadership there. (CSPAE_COMM8A_1)
b. So how does one *convey* that this is not contradictory information? (CSPAE_ COMR6A_1)

Although not presented in Table 7 to save space, *push*, which usually does not involve an independent event, was repelled by but still occurred in the SCC, as in (22).

(22) … are you *pushing* that we really should consider more context? (CSPAE_COMR6B_1)

Usually, *push* is used in the transitive construction. However, in (22), the idea expressed by the SC is metaphorically conceptualized as an entity that is pushed (forward), and *push* is coerced to mean "claiming the fact or the idea."

Examining coercion in relation to actual usage highlights several aspects of coercion that have not been studied in detail. First, coercion as a concept is not isolated from usage. For example, the expression *a beer* may be used very frequently,[13] and the co-occurrence of [-bounded] noun and [+bounded] construction may be entrenched. Given this, when we compare *a beer* with *a tree*, will *a beer* require extra processing effort whenever people speak this phrase? If so, the next question is this: Will processing of *a beer* be a case of coercion? To answer this, we need to examine coercion in terms of processing and frequency.

Second, if we look at the instances in the corpus, we can see that coercion is a dynamic interaction between the verb meaning and the constructional meaning. As a

[13] As of February 10, 2015, the number of instance of *a beer* (36,000,000) found through an informal Google search was much larger than that of *a bottle/glass/can/mug of beer* (1,420,000).

principle of coercion, an "Override Principle" (Michaelis, 2005) has been proposed, in which the lexical meaning conforms to the constructional meaning when the semantic incompatibility is resolved. In other words, meaning is coerced unidirectionally. However, as was shown in (20), when less compatible verbs, such as weak attempt and strong attempt verbs, occur in the SCC, the condition of the SC is more restricted to a deontic modality. This means that the lexical meaning sometimes conditions the properties of the construction. In other words, coercion is not a process in which lexical meaning unidirectionally conforms to the constructional meaning; rather, it is a dynamic interaction among linguistic (and probably extra-linguistic) context. Recent studies on coercion (Boas 2011) attempt to investigate linguistic and extra-linguistic conditions that affect acceptability judgments on coerced expressions. If we examine these conditions by looking at empirical data (specifically, corpus data and experiments where different conditions are manipulated), we will be able to better understand the coercion effect.

7. Conclusion

The gradable nature of semantic compatibility and coercion has not previously been empirically studied. Coercion has usually been examined in isolation from actual language use, with a focus on elaborating the linguistic features involved in this phenomenon (e.g., [+/-], [ENTITY/EVENT], etc). Consequently, it has been implicitly assumed that coercion is a binary, "all or nothing" concept, following the conception of semantic compatibility too as a matter of "matching" or "not matching."

On the basis of the assumption made by the usage-based model that linguistic knowledge is closely related to usage, this study looks at the gradability of semantic compatibility and coercion as manifested in acceptability judgments, processing effort, and frequency of usage: As the acceptability judgments showed, semantic compatibility is a gradable concept; different degrees of semantic (in)compatibility require different degrees of processing effort to resolve; this gradable nature is also reflected in different degrees of frequency of usage. With these connections between gradable semantic compatibility and usage, we can expand the study of coercion in the future in order to investigate linguistic and extra-linguistic contexts in which

gradable coercion appears and to determine the contextual properties that lead to better or easier resolution of incompatibility, by incorporating empirical language use data.

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Appendix A

Acceptability Judgments Materials[14]

1. Barbara knew that the editor published very cheap magazines.
2. Beth knew that Ted visited his parents in New York in the summer.
3. John remembered that Margaret only read best sellers of the year.
4. Tom remembered that Ann wrote in her journal almost every day.
5. Thomas said that Kelly sold women's accessories at the new store.
6. Danny said that John paid about seven dollars for water per month.
7. Jenny liked that John gave her a ride to the office every day.
8. Susan liked that Mary often went to classical music concerts.
9. Rosie hated that Katie brought the heavy laptop to the office.
10. Ann hated that the girl often sang the songs from the 1980's.
11. Kim pretended that John took a shower three times a day in July.
12. John pretended that his brother ran a nice barbecue restaurant.
13. Tom instructed that Johnny often swam in his private pool all summer.
14. Bob instructed that the heavy man broke restaurant chairs all the time.
15. Susan ordered that Jim went to school by bike on Thursday and Friday.
16. Susan ordered that the professor dealt with World War II in his book.
17. Mary told that Kelly read two local newspapers in the morning.
18. Ann told that the couple celebrated their wedding every year.
19. Jill wanted that Jim frequently donated large sums to charity.
20. Katie wanted that Robert played soccer with his friends as exercise.
21. Billy made that Andrew went to the small park to jog on Saturday.
22. Katie made that the young actor threw a big party at his garden.
23. Cindy helped that Uncle Bob gave Tim delicious candies for Christmas.
24. Lucy helped that the old woman invited her neighbors to her house.
25. Robert broke that Cindy took care of her neighbor's child during the day.
26. Larry broke that Jane majored in economics at UCLA.
27. Katie threw that Sally called her mother in Wisconsin on Friday.
28. Cathy threw that Beth listened to the radio show at 6: 30.

[14] The sixteen sentences that are the same as the processing experiments are omitted. See Appendix B for these sentences.

Appendix B

Processing Experiment Materials

1. John thought that Jill went to the Japanese Restaurant three times a week.
2. Barbara thought that Jim gave private piano lessons to children.
3. Katherine learned that Ted bought frozen food at the new grocery store.
4. Barbara learned that John carried his blue blanket all over the place.
5. Katherine saw that Ann's grandmother drank Starbucks coffee recently.
6. Barbara saw that Jill often prayed for the poor people around her.
7. Sally meant that John typed on the computer much faster than Nora.
8. Billy meant that Jane watched the TV show every Tuesday.
9. Billy taught that Mike invented very unique products.
10. Katherine taught that Jill sometimes played the violin as a hobby.
11. Bill advised that Ken worked in a small town as a police officer.
12. Lucy advised that James trained animals from Africa at the zoo.
13. Jill caused that Beth delivered fresh milk to every other house.
14. Billy caused that Ted woke up at eleven thirty in the morning.
15. Billy hit that Sam drank a glass of wine every evening.
16. Bill hit that Beth saved her files in other computers as a backup.

Appendix C

The Results of Collostructional Analysis[15]

verbs	# of instances in SCC	# of instances in corpus	coll.strength	relation
imagine	21	142	49.03812	attraction
show	38	471	48.92354	attraction
confirm	20	130	48.1936	attraction
expect	42	591	45.93584	attraction
emphasize	19	124	45.63393	attraction
notice	14	69	41.33123	attraction
mention	36	492	40.91838	attraction
realize	13	59	40.5735	attraction
prove	8	42	22.58841	attraction
deny	9	56	22.41677	attraction
contend	4	7	21.59552	attraction
conclude	11	94	20.95823	attraction
demonstrate	12	123	19.10183	attraction
sense	4	11	16.90267	attraction
state	15	206	16.89249	attraction
certify	5	21	16.40533	attraction
vouch	2	2	15.51437	attraction
recall	8	72	14.50898	attraction
discover	6	40	14.15215	attraction
presume	4	17	13.02362	attraction
allege	3	8	12.89623	attraction
remark	3	8	12.89623	attraction
prefer	7	69	11.598	attraction
hint	3	10	11.3475	attraction
claim	5	35	11.33444	attraction
stress	6	55	10.68791	attraction
insist	5	39	10.33869	attraction
specify	7	77	10.31725	attraction
pretend	3	12	10.15228	attraction
reaffirm	6	58	10.13937	attraction
confess	2	4	10.05276	attraction
admit	4	27	9.33936	attraction
assert	4	27	9.33936	attraction
observe	5	44	9.261883	attraction

[15] Twenty verbs that are the most strongly attracted and twenty verbs that are the most strongly repelled are omitted. For these verbs, see Table 6 and Table 7.

announce	17	361	9.190766	attraction
proclaim	2	5	8.909602	attraction
conjecture	1	1	7.756911	attraction
find	34	993	7.589596	attraction
remember	11	210	7.358806	attraction
predict	5	56	7.220683	attraction
dispute	3	24	6.064646	attraction
insure	2	10	5.840586	attraction
determine	10	217	5.150578	attraction
decree	1	2	5.026115	attraction
reiterate	4	52	4.831948	attraction
urge	5	77	4.784745	attraction
anticipate	6	107	4.536336	attraction
command	1	3	4.021413	attraction
negate	1	3	4.021413	attraction
venture	1	4	3.383611	attraction
pledge	2	21	3.099599	attraction
hear	34	1231	2.668159	attraction
editorialize	1	6	2.559146	attraction
risk	1	7	2.266047	attraction
suspect	1	7	2.266047	attraction
reply	1	8	2.021148	attraction
ascertain	1	9	1.812288	attraction
dictate	1	10	1.631402	attraction
visualize	1	10	1.631402	attraction
concern	2	38	1.348081	attraction
grant	2	39	1.283173	attraction
concur	1	13	1.207526	attraction
perceive	1	16	0.902507	attraction
verify	1	16	0.902507	attraction
recommend	7	233	0.886405	attraction
complain	1	17	0.819223	attraction
bet	1	18	0.743305	attraction
signal	1	18	0.743305	attraction
communicate	6	205	0.662256	attraction
request	3	90	0.601266	attraction
envision	2	59	0.42735	attraction
learn	10	402	0.328266	attraction
initiate	1	26	0.324595	attraction
explain	7	275	0.288363	attraction
guess	2	65	0.284333	attraction
underscore	1	33	0.132025	attraction

charge	1	35	0.096181	attraction
mind	1	35	0.096181	attraction
accept	5	217	0.057437	attraction
volunteer	1	39	0.043979	attraction
see	77	3683	0.009065	attraction
promise	1	44	0.008778	attraction
testify	1	45	0.005124	attraction
aggregate	1	48	5.20E-05	attraction
ask	3	1964	60.75967	repulsion
tell	1	1472	52.91456	repulsion
like	1	1316	46.56504	repulsion
read	3	1156	29.88061	repulsion
discuss	2	956	26.81223	repulsion
move	3	1046	25.85679	repulsion
provide	3	956	22.61591	repulsion
keep	1	648	19.90263	repulsion
call	2	711	17.71115	repulsion
address	2	680	16.58919	repulsion
mean-H	5	966	16.41132	repulsion
write	2	648	15.44004	repulsion
answer	1	515	14.7849	repulsion
consider	1	429	11.54648	repulsion
express	1	276	6.022241	repulsion
encourage	1	273	5.918557	repulsion
respond	3	410	4.809962	repulsion
release	1	237	4.695122	repulsion
push	1	221	4.16563	repulsion
define	1	216	4.002269	repulsion
pursue	1	205	3.64676	repulsion
share	1	205	3.64676	repulsion
intend	1	204	3.61472	repulsion
commit	1	182	2.923046	repulsion
add	9	720	2.779644	repulsion
describe	3	322	2.581987	repulsion
reflect	3	315	2.421551	repulsion
compare	1	165	2.408526	repulsion

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