ACQUISITION OF ENGLISH VERB TRANSITIVITY BY NATIVE SPEAKERS OF JAPANESE

by

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ABSTRACT

ACQUISITION OF ENGLISH VERB TRANSITIVITY

BY NATIVE SPEAKERS OF JAPANESE

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This study is concerned with the acquisition of English verb transitivity by native speakers of Japanese. Both a verb's semantic class (Levin, 1993; Pinker, 1989) and its frequency (Ambridge et al., 2008) have been proposed to influence the acquisition of verbs in L1. For example, verbs whose meaning entails change-of-location or change-of-state (e.g., *move*, *roll*, *bounce*, *melt*) typically participate in the causative alternation in English. In addition, among those verbs, it is predicted that high-frequency verbs such as *break* and *move* are acquired earlier than low-frequency ones such as *shatter* and *slide*. In SLA, a learnability problem is expected when the usage in L1 constitutes a superset of the usage in L2 (Inagaki, 2001; Montrul, 2001). Such asymmetric relationships exist between English and Japanese when there are idiosyncratic exceptions in a verb semantic class in one language but not the other. For example, inherently-directed motion verbs (e.g., *descend*, *oriru*/*orosu* "descend$_{\text{INTRANSITIVE/TRANSITIVE}}$") and verbs of disappearance (e.g., *disappear*, *kieru*/*kesu* "disappear$_{\text{INTRANSITIVE/TRANSITIVE}}$") are prohibited in the causative alternation in English, but not in Japanese. Thus, a learnability problem in the causative alternation is expected for Japanese ESL leaners. Twenty-six native English speakers and 35 Japanese ESL learners participated in this computer-based experiment. The data, analyzed with mixed-design ANOVA and mixed-effect linear models, show main and interaction effects of the verb's semantic class and the

verb's (log) frequency. Post-hoc analyses indicate that the effect of the verb's semantic class was primarily due to the idiosyncratic exceptional semantic classes, as predicted by the asymmetric relationship in SLA. A strong effect of frequency was found for the acquisition of the idiosyncratic exceptional semantic classes, indicating that frequency plays a critical role in acquiring (unlearning) grammatical constructions that exist in L1 but not in L2.

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CHAPTER 1

INTRODUCTION

This study concerns the acquisition of the transitivity of English verbs by native speakers of Japanese. Transitivity is a layman's term for a combination of grammatical phenomena that are interconnected with various grammatical constructions, many of which are known to be challenging to L2 English learners. Despite its importance, only a limited number of systematic studies have been conducted to explore the nature of the acquisition of L2 transitivity. This study is intended to bridge this gap.

The first focus of this paper is on the nature of the transitivity alternation, one of the valence shifting phenomena known as *argument structure alternation* (Levin & Rappaport Hovav, 2005; Grimshaw, 1990; Pinker, 1989; Hale & Keyser, 1993, 2002; Allen, 2009), in English and Japanese. Morphological marking for transitivity is arbitrary in the two languages but in different manners; English lacks causative morphological markers (*labile*) whereas Japanese employs both causative and anticausative morphemes (*equipollent*) (Nedjalkov, 1969; Haspelmath, 1993). Semantically, transitivity in both languages is constrained by the same broad semantic principles (Ambridge, Pine, Rowland, & Young, 2008; Gropen, Pinker, Hollander,

Goldberg, & Wilson, 1989; Gropen, Pinker, Hollander, & Goldberg, 1991; Joo, 2003; Pinker, 1989; Bley-Vroman & Yoshinaga, 1992), but English obeys much finer semantic restrictions than Japanese does (Jacobsen, 1992). The similarities and differences in how transitivity is encoded in the grammars of English and Japanese lead us to a natural question about the consequences of these properties for the acquisition of transitivity, a second focus of this study.

Relatively little research on transitivity has been conducted in Second Language Acquisition (SLA)[1] since problems of non-native-like transitivity in the learner's interlanguage grammar are not easily detectable. However, the acquisition of L2 transitivity is a crucial component of SLA because incomplete acquisition of transitivity is related to other problems, such as preposition errors in ESL. In this study, under the assumption of the *Full-Transfer Full-Access Hypothesis* (Schwartz & Sprouse, 1996) and the usage-based interpretation of the *Subset Principle* (Wexler & Manzini, 1987; White, 1987, 1991; Kapur, Lust, Harbert, & Martohardjono, 1993), the transitivity properties of certain semantic verb classes are predicted to pose learnability problems for native speakers of Japanese learning English.

The last focus of this study is the effect of frequency in the learners' input (Ambridge et al., 2008; Baayen, Kuperman, & Bertram, 2009; Braine, Brody, Fisch, Weisberger, & Blum, 1990; Brooks, Tomasello, Dodson, & Lewis, 1999; Bybee & Hopper, 2001; Bybee, 2006; R. Ellis, 2002; Forster & Chambers, 1973; Yang, 2007, 2008). It is obvious and intuitive that the amount of exposure to the target language has certain consequences on the proficiency of L2 learners. Some recent theories propose a view that (second) language acquisition is largely driven by input and

[1]Except for Juffs (1996), Montrul (2001a, 2001c), and de Souza et al. (de Souza, Fernández, & Guimaraes, 2012).

deny the role of grammatical structure in language acquisition. A strong input-driven language acquisition theory such as Brooks and Tomasello (1999a) predicts that learners' behavior will become consistent with high-frequency verbs whereas it will exhibit a lot of variability and diverge with low-frequency verbs. I will argue that this usage-based view is problematic because linguistic distributions are generally *Zipfian*, that is, low-frequency tokens account for a significant portion of the learner's input (Zipf, 1935, 1949; Yang, 2010). On the other hand, a view denying the effect of frequency is also questioned since frequency appears to have a domain-general effect in a wide range of cognitive processes (Anderson, 1993; Newell & Rosenbloom, 1980).

In this study, I propose an eclectic theory of SLA. L2 learners are constrained by crosslinguistically invariant semantic conceptual constraints, which are analogous to Pinker's broad-range rules (Pinker, 1989). The challenge for L2 learners is learning (or unlearning) narrow-range rules, which I consider to be language-specific irregularities of the broad-range rules. This distinction is experimentally testable since effects of frequency should be mostly observed in the (un)learning of narrow-range constraints, but not in the language-general universal rules.

CHAPTER 2

VERB TRANSITIVITY IN ENGLISH AND JAPANESE

2.1 INTRODUCTION

In this section, transitivity is discussed in terms of its three major factors: *unaccusativity*, *causativity*, and the *null-object* construction. Unaccusativity is an important factor of transitivity, which defines the two types of intransitive verb (Perlmutter, 1978; Jacobsen, 1992; Tsujimura, 1989, 1994). Causativity is another main feature that determines the transitivity of a verb and shows correlations with the predicate's semantics (Dowty, 1991; Levin, 1993; Levin & Rappaport Hovav, 1995; Pinker, 1989). There appears to be some correlation between unaccusativity and causativity in English. Finally, the null-object feature (Pustejovsky, 1991; Zushi, 2003) is another important factor of transitivity, especially in a null-object language like Japanese.

From the constructional perspective, transitivity can be divided into five structural frames. The first three frames ((1) - (3)) are referred to as the causative alternation in the literature (Levin, 1993; Rappaport Hovav & Levin, 1998; Haspelmath, 1993; Bowerman & Croft, 2008), and considerable research has been conducted on

this phenomenon in the study of unaccusativity. The last two constructions ((4) and (5)) exhibit a phenomenon known as the object-drop alternation. This alternation draws lesser attention in English but is crucial when we consider cross-linguistic influence from Japanese, which is known for its null-subject and null-object properties.

(1) Pure (unergative) Intransitive Frame

   a. Susan slept.

   b. The baby cried.

(2) Unaccusative Intransitive Frame

   a. The ball bounced.

   b. The window broke.

(3) Causative Transitive Frame

   a. Michael bounced the ball.

   b. Jack broke the window.

(4) Object-drop Intransitive Frame

   a. We already ate.

   b. The children are playing.

(5) Pure (non-causative) Transitive Frame

   a. The boxer hit the pads.

   b. The customer touched the screen.

These transitive constructions exhibit interesting contrasts between English and Japanese. The goal of this section is to delineate the cross-linguistic contrasts in the transitive constructions between the two languages.

2.2 UNACCUSATIVITY

2.2.1 Unaccusative Hypothesis: two types of intransitive verbs

In the *Unaccusative Hypothesis*, Perlmutter (1978) argues that intransitive verbs can be divided into two sub-classes: *unergative* and *unaccusative* based on his observations about semantic natural classes. Verbs whose meaning involves willed or volitional acts (e.g., *work, play, speak*), manner-of-speaking verbs (e.g., *whisper, shout, mumble*), sounds made by animals (e.g., *bark, neigh, whinny*), and involuntary bodily actions (e.g., *cough, sneeze* etc.) are typically unergative verbs, which always appear in the (pure) intransitive frame. In contrast, verbs with a theme or patient subject (e.g., *burn, fall, drop, sink, float, slide*), verbs of existing and happening (e.g., *exist, happen, transpire, occur*), non-voluntary emission of stimuli that impinge on the senses (e.g., *whine, sparkle, glitter, glisten*), and aspectual and durative verbs (e.g., *begin, start, stop, cease, last, remain, stay*) tend to appear as unaccusative.

The Unaccusative Hypothesis is also based on evidence from Italian and other Romance and Germanic languages. In these languages, the unergative verb in the intransitive frame systematically selects the auxiliary verb *have* (e.g., *avere* in Italian and *hebben* in Dutch) while the unaccusative verb selects the auxiliary *be* (e.g., *essere* in Italian and *zijn* in Dutch) as shown in (6).

(6) Auxiliary verb selection in Italian

a. Giovanni ha telefonato.
"John telephoned" (have)

b. Giovanni é arrivato.
"John arrived" (be)

The Unaccusative Hypothesis was further developed in the Government and Binding framework by Burzio (Burzio, 1986) who claimed that verbs that lack an external subject fail to assign accusative Case in Italian and English. Various syntactic evidence such as *ne*-cliticization in Italian (Rosen, 1984) corroborate his proposal that the sole argument of the unaccusative verb is base-generated at the argument position of the verb and moves to the VP external position via movement. In other words, a verb that does not assign an external theta-role to its subject cannot assign structural accusative Case (*Burzio's generalization*) and the movement is triggered to satisfy the Case requirement. The syntactic configurations of the two types of intransitive verb are schematically represented as below:

(7) **unergative verbs**: AGENT argument is generated at the subject position

a. John telephoned.

[John [VP telephoned]]

(8) **unaccusative verb**: the THEME or PATIENT argument is base-generated in object position and will be raised to the subject position at the Surface Structure.

a. John arrived.

[e [VP arrived John]]

Burzio's proposal is motivated by the fact that the clitic *ne* can only attach to the object of a transitive sentence or the subject of an unaccusative intransitive sentence, but not to the subject of an unergative sentence.

(9) Gianni ne trascorrerá tre a Milano.
Gianni of-them spend three in Milano
Gianni will spend three of them in Milan.

(10) *Ne telefoneranno tre domani.
of-them telephone three tomorrow.
Three of them will telephone tomorrow

(11) Ne arriveranno molti.
of-them arrive many
Many of them will arrive

In sum, the Unaccusativity Hypothesis proposes two different types of intransitive verbs; one is a pure intransitive verb with an agentive subject (unergative intransitive) and the other is a derived intransitive verb whose subject has a meaning of patient or theme (unaccusative intransitive).

2.2.2 Problems with the Unaccusative Hypothesis

There are two major problems with the Unaccusative Hypothesis. The first problem is crosslinguistic generalizability. Many diagnostics for unaccusativity, such as *ne*-cliticization, are applicable only to a subset of languages (sometimes only to one language) and there is no unaccusative diagnostic that can be employed in all languages. In addition, while language-specific unaccusative tests behave consistently with prototypical unaccusative / unergative verbs (such as *break* and *laugh*), they often exhibit different results with non-prototpyical verbs. For example, Rosen (1984) argues that, in Italian and Dutch, *snore* is classified as unergative while *blush* is unaccusative in spite of their semantic similarity. Similarly, *sneeze*, a bona fide unergative verb in many languages, is classified as unaccusative in Eastern Pomo. Kishimoto (Kishimoto, 1996) argues that *die* is unergative in Choctaw, but unaccusative in Italian and Japanese, whereas *sleep* is unergative in Italian, but unaccusative in Japanese. Of particular concern to this study, none of the proposed unaccusative diagnostics serves as a common diagnostic for unaccusativity

in both English and Japanese (see (12) and (13)). In other words, the validity of unaccusative tests is hardly cross-linguistically testable.

(12) Unaccusativity diagnostics in English (Levin & Rappaport Hovav, 1995; Kuno & Takami, 2004)

a. Causative alternation (see below)

b. *There* construction

i. There has just appeared another book by Chomsky. (unacc)

ii. *There sang a tall middle-aged woman on the stage. (unerg)

c. *One's way* construction

i. Mary danced her way through the park. (unerg)

ii. *The window opened its way into the room. (unacc)

d. Cognate object construction

i. Mary laughed a sad laugh at the meeting. (unerg)

ii. *The apples fell a smooth fall. (unacc)

e. Pseudo-passive (prepositional passive) construction

i. That bed was slept in by Napoleon. (unerg)

ii. *The sea was sunk into by a yacht. (unacc)

f. Resultative construction (Simpson, 1983)

i. John hammered the metal flat. (unacc)

ii. *I danced tired. (unerg)

(13) Unaccusativity diagnostics in Japanese

a. Numeral Quantifier (Miyagawa, 1989)

i. Gakusei-ga ofisu-ni futari kita. (unacc)
student-NOM office-LOCATION two-people come-PAST

Two students came to the office.

ii. *Kodomo-ga geragera-to futari waratta. (unerg)
children-NOM uproariously two-people laugh-PAST
Two children laughed uproariously.

b. Resultative construction (Tsujimura, 1991)

i. John-ga kuruma-o akaku nutta. (unacc; resultative)
John-NOM car-ACC red paint-PAST
John painted his car red.

ii. John-ga kanashiku waratta. (unerg; progressive)
John-NOM sadly laugh-PAST
John laughed sadly.

c. *te-iru* construction (McClure, 1990)

i. Taro-ga eigo-o benkyo-shite-iru (unerg; progressive)
Taro-NOM English-ACC study-TEIRU
Taro is studying English.

ii. Taro-ga america-jin-to kekkon-shite-iru (unacc; resultative)
Taro-NOM American-WITH marry-TEIRU
Taro is married with an American.

d. *te-aru* construction (Tsujimura, 1991)

i. Kabin-ga kowarete-aru. (unacc)
Vase-NOM break-TE-ARU
Vase was broken.

ii. *Uchi-ni tsuite-aru. (unerg)
Home-LOCATION arrive-TEARU
I arrived at home.

e. Deverbal nominal -kake (Kishimoto, 1996)

i. Shini-kake-no otoko (unacc)
die-KAKE-NOMINALIZATION man
a man (who is) about to die

ii. *Sakebi-kake-no otoko (unerg)
cry-KAKE-NOMINALIZATION man
a man (who is) about to cry

The second problem with the Unaccusativity Hypothesis is the gradability of native speakers' grammaticality judgments on unaccusative tests. Sorace (2000a, 2000b) shows that native speakers' judgments on auxiliary selection in Italian exhibit a gradience of acceptability rather than a dichotomous clear-cut judgment. Auxiliary selection is considered one of the most robust tests for verb unaccusativity in languages like Italian, Dutch, and German. In these languages, change-of-state verbs (e.g., *come, arrive, and leave*), the most prototypical unaccusative verbs, consistently select the auxiliary verb *be* and verbs of non-motional controlled process (e.g., *work, play, talk* etc.), the most prototypical unergative verbs, systematically select *have*. However, native speakers' judgments of verbs from other semantic groups such as manner-of-motion verbs (e.g., *run, walk*) and existence of state verbs (e.g., *exist, sit, lie*), display variability within each language. Sorace argues that the auxiliary selection is determined based on the verb's aspectual and semantic types, which are also influenced by secondary features such as affectedness of the argument and homogeneity of events in the predicate. If Sorace is correct that auxiliary selection is a gradient feature, then the auxiliary selection test loses its power as a diagnostic of unaccusativity.

2.2.3 Unaccusativity in Japanese

In spite of on-going controversy about the exact nature of unaccusativity, it is an empirical fact that intransitive sentences can have either an agentive or a patient/theme subject. A similar distinction in intransitive verbs was reported in

Japanese by the Japanese linguist Haruniwa Motoori in his book *Kotoba no Kayoiji* "The pathways of words" (Motoori, 1823), which predates the Unaccusative Hypothesis by 150 years. The dichotomy is based on an intuitive interpretation of verbs - verbs signifying events caused by an agent's intentional action are called *mizukara* (by oneself) and those signifying spontaneous events are labeled as *onozukara* (naturally).

(14) Mizukara verbs

fusu "lie down", *okiru* "get up", *suwaru* "sit", *yoru* "approach", *hashiru* "run", *susumu* "advance", *wataru* "cross"

(15) Onozukara verbs

kareru "wither", *nureru* "become wet", *tokeru* "melt$_{intra}$", *yabureru* "tear$_{intra}$"

As Jacobsen (1992: 92) notes, Haruniwa's classification of verbs is based purely on the existence or absence of intentional meaning in verbs. Thus, Haruniwa's verb classification system was proposed from a purely semantic perspective. However, the classification of verbs based on *onozukara* and *mizukara* and the classification based on various unaccusativity diagnostics (13) clearly overlap. In other words, the verb classification obtained from unaccusative diagnostics in Japanese clearly shows the same semantic continuum that Haruniwa observed; unaccusative verbs tend to be interpreted as spontaneous events and, on the other end of the continuum, unergative verbs have interpretations of intentional events. To take Kishimoto (1996) as an example, a classification of Japanese verbs using the deverbal nominalization morpheme *-kake* "almost, do halfway" shows the following classification of verbs.

(16) Unaccusative/Unergative verbs (from Kishimoto (1996))

a. unaccusative

   shinu "die", *oboreru* "drawn" *umareru* "be born", *nemuru* "sleep", *chissoku-suru* "choke", *furueru* "shiver", *kuruu* "go crazy", *mahi-suru* "be paralyzed", *komu* "be crowded", *moeru* "burn$_{\text{intra}}$", *yowaru* "become weak", *katamuku* "tilt$_{\text{intra}}$", *naku* "cry", *korobu* "tumble", *kumoru* "become clouded", *naoru* "become healed"

b. unergative

   sakebu "scream", *hashiru* "run", *odoru* "dance", *okiru* "wake up", *noboru* "climb", *asobu* "play", *ugoku* "move", *nigeru* "escape", *hataraku* "work", *hanasu* "speak", *hoeru* "bark", *tatakau* "fight", *tobikomu* "jump in", *tatsu* "stand up", *dekakeru* "go out"

Kishimoto concludes that *-kake*, which involves the speaker's intention to complete the event, serves as the unaccusative diagnostic because the unaccusative dichotomy in Japanese can be characterized in terms of an agent's "volition" (Kishimoto, 1996). Thus, there appears to be a classification of intransitive verbs, akin to the one proposed in the Unaccusative Hypothesis for Italian and English, in Japanese. However, it should be noted that the syntactic diagnostics for the classification vary between the two languages and the exact nature of the key semantic element is still debated.

The gradience of the unaccusative dichotomy, especially in terms of semantic interpretation, as Sorace argues for Romance/Germanic languages, also exists in Japanese. Researchers have attempted to delineate the unaccusative dichotomy with a single semantic primitive. One such proposal was made by Kishimoto (1996), who argues that "volition" is the key semantic primitive for the unaccusative dichotomy. Another example is Tsujimura (Tsujimura, 1991, 2002a), who

proposes that unaccusativity is primarily determined by a verb's aspectual properties; that is, *telic* (delimited) verbs are classified as unaccusative whereas *atelic* verbs are unergative. Her proposal is based on aspectual theories of lexical semantics such as Dowty (1979) and Van-Valin (1990). There appears to be no conclusive evidence that decides among the proposals since judgments of semantic interpretation are often unclear. For example, verbs with a strong intentional interpretation (e.g., *work, dance, swim*) can be judged as more prototypically unergative than other less intentional verbs (such as *laugh, cry, speak*) in Japanese. I will revisit this problem in the following section.

In sum, there is a general pattern in which intransitive verbs in Japanese split into two different classes, akin to the classification of unaccusative/unergative verbs. However, the classification appears not to be dichotomous due to the gradience of native speakers' judgments. In the next section, I will discuss the unaccusative/unergative classification from the perspective of the alternation of verbs' transitivity. In discussing the patterns of transitivity alternation of verbs in English and Japanese, I will consider once again the problems with the classification of intransitive verbs.

2.3 CAUSATIVE ALTERNATION

2.3.1 Causative alternation in English

As discussed in the previous section, auxiliary-verb selection, the most straightforward unaccusative test in many Romance languages, is not available in English and Japanese since no corresponding auxiliary verb selection appears with intran-

sitive verbs in these two languages. Thus, many language specific unaccusative diagnostics have been proposed for English and Japanese. Causativity is frequently mentioned along with unaccusativity since unaccusativity exhibits some correlation with the causative alternation in English (Levin & Rappaport Hovav, 1995). As shown below, many unaccusative verbs participate in the causative alternation whereas few unergative verbs are allowed to alternate.

(17) a. The egg boiled. (unaccusative)

b. Bobbie boiled the egg.

(18) a. The ball bounced. (unaccusative)

b. Tiny bounced the ball.

(19) a. The baby cried. (unergative)

b. *The thunder cried the baby.

(20) Verbs that participate in the causative alternation (Pinker, 2007)
bounce, dangle, drift, drop, float, glide, hang, lean, move, perch, rest, revolve, rock, roll, rotate, sit, skid, slide, spin, stand, swing, turn, twist, whirl, wind, age, bend, blur, break, burn, char, chill, collapse, condense, contract, corrode, crack, crash, crease, crinkle, crumble, crush, decrease, deflate, defrost, degrade, diminish, dissolve, distend, divide, double, drain, enlarge, expand, explode, fade, fill, flood, fold, fracture, fray, freeze, fuse, grow, halt, heal, heat, ignite, improve, increase, inflate, light, melt, multi- ply, pop, reproduce, rip, rumble, rupture, scorch, shatter, shrink, shrivel, single, sink, smash, swap, soak, splay, splinter, split, sprout, steep, stretch, tear, thaw, tilt, topple, warp, wrinkle

Similar to the research on unaccusativity, a major focus of research on the causative alternation is determining exactly what semantic properties can license a

verb to be in the causative alternation class. This line of research is based on Levin (1993) who argues that verbs that participate in one syntactic alternation share the same semantic property. In other words, the verbs that undergo the same syntactic alternation share the same semantic properties, possibly some sort of semantic basic elements in language. For example, verbs participating in the *locative alternation* (e.g., *load, spray*) share two semantic properties, namely "the force of the agent who puts the substance against the surface of the other" and "the (complete) change of state of the patient". In contrast, verbs that are near synonyms of the alternating verbs, but fail to participate in the locative alternation (e.g., *pour*, *fill*) do not have those two semantic properties in their lexical conceptual structure (examples from Pinker (2007)).

(21) a. Hal is loading hay into the wagon.

b. Hal loaded the wagon with hay.

(22) a. Jared sprayed water on the roses.

b. Jared sprayed the roses with water.

(23) a. Amy poured water into the glass.

b. *Amy poured the glass with water. (no change of state component)

(24) a. *Bobby filled water into the glass. (no agentive force component)

b. Bobby filled the glass with water.

Similarly, the verbs that participate in the dative alternation (e.g., *Give a muffin to a moose. / Give a moose a muffin.*) share the properties of "change of possession", "instantaneous force," and "benefactive results" (Gropen et al., 1991). Verbs whose meanings are similar to the alternating verbs, but do not have the necessary features (e.g., *carry, lift, push*) fail to participate in the dative alternation.

For the causative alternation, "change-of-state verbs" and "change-of-position verbs" are the two major semantic classes that participate in the causative alternation in English (Pinker, 1989). However, it is subject to debate exactly what semantic element in those two verb semantic classes are semantically crucial element for the causative alternation. The difficulty arises from the fact that certain subsets of change-of-state and change-of-position verbs are expected to be causative, but do not participate in the causative alternation. One such class is verbs of appearance and disappearance (see (25)). The verbs of appearance and disappearance are semantically members of the change-of-state verbs and, like other change-of-state verbs, they pass the telicity test (i.e., compatible with the durational adverbial such as *in one hour*; see (26)) and fail the activity test (ϕ*-ing* does not entail ϕ*-ed*; see (27)).

(25) Verbs of appearance/disappearance ("Verbs of appearance, disappearance, and occurrence", "Destroy verbs", and "Verb of killing" (Levin, 1993, p. 30))
annihilate, appear, arise, assassinate, awake, blitz, butcher, come, dawn, decimate, demolish, destroy, devastate, die, disappear, dispatch, eliminate, emanate, emerge, ensue, erupt, eventuate, evolve, execute, expire, exterminate, extirpate, flow, gush, happen, immolate, issue, kill, lapse, liquidate, massacre, materialize, murder, obliterate, occur, perish, plop, ravage, raze, recur, result, rise, ruin, slaughter, slay, steal, stem, stream, supervene, surge, transpire, vanish, waste, wax, wreck

(26) The results of the exam will appear on the screen in an hour.

(27) The sign is appearing now. $\neg \rightarrow$ The sign appeared.

However, this subclass of the change-of-state verb class systematically does not participate in the causative alternation in English.

(28) a. A dove disappeared.

b. *The magician disappeared a dove.

(29) a. The patient died.

b. *The doctor died the patient.

Similarly, inherently-directed motion verbs such as *go*, *come*, *arrive*, and *descend* (see (30)) show a contrast with the manner-of-motion verb. Both the inherently-directed motion verbs and the manner-of-motion verbs denote an event of the change of position, but unlike the manner-of-motion verbs that lexically include the MANNER component, inherently-directed motion verbs have the semantic component PATH in their lexical meaning (Talmy, 2000; Stringer, 2007). The existence of the change-of-position appears to be the key element for the causative alternation since, as (31) and (32) show, motion verbs without lexically encoded change-of-location do not participate in the causative alternation (also see (33).

(30) Inherently-directed motion verbs ("Verbs of falling" (Ambridge et al., 2008); "Verbs of inherently-directed motion" (Levin, 1993, p. 263))
advance, arrive, ascend, climb, come, cross, depart, descend, enter, escape, exit, fall, flee, go, leave, meek, plunge, recede, return, rise, tumble

(31) a. The solders marched.

b. The general marched the solders.

(32) a. Stacy danced.

b. *The coach danced Stacy.

(33) Waltz verbs (= non-change-of-location motion verbs; Levin (1993))
dance, jig, pirouette, shuffle, clog, bop, tango, quickstep, samba, waltz, tapdance, boogie, polka, jitterbug, rumba, square, dance, cancan, conga, foxtrot, jive

However, inherently-directed motion verbs that clearly entails change-of-location systematically fail to participate in the causative alternation in English.

(34) a. My son came home today.

b. *Terry came my son home today.

(35) a. The ball bounced.

b. Terry bounced the ball.

Various analyses have been proposed for the causative alternation in English, but to my knowledge, no explanation has been given for why these two sub-classes do not undergo the causative alternation.

Chierchia (1989), for example, analyzes the causative alternation from the perspective of valency and proposes that unaccusatives are originally transitive verbs with "unstable valency". In other words, the causative alternation takes place as a result of the missing valence (i.e., agentive argument) that must be present in the lexical form of unaccusative verbs. This hypothesis leads to a prediction that all unaccusative verbs should have a base transitive form. In fact, Chierchia shows that the unaccusative verb *deteriorate* can be used transitively (e.g., *Over the years the roof deteriorated./The pine needles were deteriorating the roof.*). One problem with the valency account is that some unaccusative verbs lack a transitive base form (e.g., *come* in English), which Chierchia considers as an idiosyncratic exception (i.e., "frozen" unaccusative). Another problem is that the valency account does not explain why there is a tendency for verbs with stable valence and unstable valence to share similar semantic properties. As discussed above, verbs of disappearance such as *die*, *disappear*, and *vanish* are systematically frozen unaccusatives in English. The same phenomenon is observed with inherently-directed motion verbs. The unsta-

ble valency account falls short of characterizing systematic semantic patterns that are found in the distinction of unstable/frozen unaccusative verbs.

Dowty (1979) and Van-Valin (1990) show that lexicalized telicity is highly correlated with a verb's causativity. Dowty (1979) classified English predicates into four different aspectual classes using various diagnostics related to temporal and aspectual characteristics of the predicate. The diagnostics employed in Dowty (1979) are largely classified into five types; (i) stative test (e.g., (in)compatibility with the progressive form such as **I'm ϕ-ing it.*), (ii) durational test (e.g., *ϕ for an hour/spend an hour ϕ-ing*), (iii) telicity test (e.g., *ϕ in an hour/it takes an hour to ϕ*), (iv) test for incremental theme (e.g., *ϕ-ing* entails *has ϕ-ed*; complement of *finish*; ambiguity with *almost*; *ϕ-ed in an hour* entails *was ϕ-ing*), and (v) tests broadly associated with volition (e.g., compatibility with *studiously, attentively, carefully* etc.). Vendler (1967) and Dowty (1979)'s aspectual classes below are based on the first three diagnostics.

Table 2.1: Dowty (1979)'s aspectual classification

TYPE	EXAMPLE	TELICITY	EVENTIVE	DURATIONAL	LEXICAL SEMANTIC REPRESENTATION
ACTIVITY	*run, sweep*	atelic	eventive	durational	[x ACT]
STATIVE	*know, think*	atelic	stative	durational	<STATE>
ACCOMPLISHMENT	*destroy, kill*	telic	eventive		[[x ACT] CAUSE [y BECOME <STATE>]]
ACHIEVEMENT	*disappear, notice*	telic	eventive		[y BECOME <STATE>]

As illustrated above, only accomplishments are dyadic (two-argument) verbs, which can potentially appear in both the causative and inchoative forms. The monodaic achievement verb does not lexically encode the agentive argument and, as a result, the majority of achievement verbs such as *recognize*, *spot*, *find*, *reach*, and *die* do not participate in the causative alternation. Vendler-Dowty's verb classification nicely captures some major characteristics of causative verbs because telic verbs are almost always change-of-state verbs and it is logically impossible for instanta-

neous verbs to appear in the inchoative construction (i.e., a construction indicating no psychologically identifiable beginning point for an instantaneous action). Manner-of-motion verbs are activity verbs, but certain activity verbs are known to behave as accomplishments with a direct object (e.g., *draw a circle*, *push a cart* etc.). An interesting fact about the manner-of-motion verbs in the causative construction is that manner-of-motion verbs requires a path prepositional phrase in the transitive use as shown in (36).

(36) Manner-of-motion verbs in the causative construction (examples from Levin & Rappaport Hovav (1995:111))

a. The solders marched to the camp.

b. The general marched the solders $^{??}$(to the camp).

a. The horse jumped.

b. The rider jumped the horse $^{?}$(over the fence).

a. The mouse ran.

b. We ran the mouse *(through the maze).

However, the telicity account essentially suffers from the same problem as the valency account in explaining the two exceptional classes: verbs of disappearance and inherently-directed motion verbs. Verbs that do not appear in the causative alternation are considered to belong to the category ACHIEVEMENT, which is contrasted with ACCOMPLISHMENT in its lack of cumulative progress toward the change of state. Many achievement verbs such as *recognize*, *spot*, *find*, and *notice* describe instantaneous events and do not participate in the causative alternation, but the distinction between cumulative progress and instantaneous action is not clear-cut for many verbs of disappearance and inherently-directed motion verbs. So, it is a

circular argument to claim these verbs are instantaneous verbs because they do not participate in the causative alternation. In other words, in terms of aspect, there is no clear distinction between the manner-of-motion/change-of-state verbs and the inherently-directed motion verbs/verbs of disappearance (e.g., *break* vs. *disappear* and *march* vs. *go*).

Another proposal has been made by Levin & Rappaport-Hovav (1995), who have carried out an extensive review of verbs of emission (e.g., *burble*, *flash*, *reek*, *bubble* etc.) and argue that a volitional externally-caused event is the semantic feature that determines a verb's participation in the causative alternation. Their analysis is based on the fact that the eventuality of most emission verbs is internally caused and the emission verbs do not appear in the causative alternation.

(37) Verbs of emission (Levin & Rappaport Hovav, 1995)

a. The jewels glittered/sparkled.

b. *The queen glittered/sparkled the jewels.

(38) a. The stream burbled/roared.

b. *The rocks burbled/roared the stream.

(39) a. The stew bubbled.

b. *The cook bubbled the stew.

The external cause must be an agent, instrument, natural force, or circumstance that directly or metaphorically implies the volitional intervention of an agent in bringing about the event. Thus, many verbs that do not participate in the causative alternation occur with an interpretation that an event takes place spontaneously.

However, this account incorrectly predicts that verbs of disappearance and inherently-directed motion verbs may alternate in the causative construction, since verbs in those two classes can bear the interpretation of volitional externally-caused event. Unergative verbs such as *cry*, *work*, and *laugh* are conceptually incompatible with externally-caused events since they arise due to spontaneous will or internal volition. However, verbs of disappearance and inherently-directed motion verbs are considerably more natural with an externally-caused interpretation than unergative verbs as in (40)-(43). The account based on externally-caused events does not provide sufficient explanation for the fact that (40a)-(43a) are grammatical whereas (40b)-(43b) are not.

(40) a. The accountant made the problem in my tax return disappear.

b. *The accountant disappeared the problem in my tax return.

(41) a. A downdraft made the aircraft descend.

b. *A downdraft descended the aircraft.

(42) a. The lion made the girl cry.

b. *The lion cried the girl.

(43) a. The teacher made the student go.

b. *The teacher went the student.

In sum, attempts to pin down a single semantic feature responsible for the causative alternation fail to provide sufficient accounts of why verbs of disappearance and inherently-directed motion verbs are not allowed in the causative alternation in spite of their semantic proximity to prototypical causative verbs.

2.3.2 Comparison between the causative alternations in English and Japanese

A challenge in investigating the L2 acquisition of causativity is that each language employs different means to indicate different levels of causativity. In this section, I will discuss causativity in Japanese from a structural view, ranging from the productive peripheral causative to the unpredictable lexical causative (Shibatani, 1976), and from a semantic view, such as direct causative, indirect causative, and sociative/associative causative. First, let me discuss the structural classification of causative in English (see (44)-(46)) to make compariosns.

(44) Peripheral/Syntactic causative

a. Julio made Jenny call the restaurant.

b. Julio let the conversation flow.

c. Julio got his brother to do the errands.

(45) adjective + derivational morpheme such as *-ify*, *-en*, *-ize*

a. Julio solidified his theory about life.

b. Julio softened the surface of the wood.

c. Second language speakers sometimes fossilize errors in L2.

(46) Lexical causative

a. Julio broke the glass figurine. / The glass figurine broke.

b. Julio wobbled his desk. / Julio's desk wobbles a lot.

Peripheral causative is also called syntactic causative since it increases valence by means of an auxiliary causative verb (e.g., *make, let, get*) in specific syntactic configurations (i.e., [*make/cause/let* X VERB]). Crosslinguistically speaking, the syntactic causative is very productive and the majority of verbs can be used in the

peripheral causative construction. Causative with derivational morpheme such as *-ify*, *-en*, and *-ize* in English is strictly restricted to the derivation from a noun or adjective such that [Y IS ADJECTIVE] ↔ [X CAUSE [Y BECOME ADJECTIVE]] by means of the derivational causative morphemes *-ize* (e.g., *crystalize, agonize, mobilize*), *-en* (e.g., *broaden, widen, enlighten*), and *-ify* (e.g., *codify, solidify, purify*). Finally, the lexical causative is a lexically-determined shift between transitive and intransitive. Unlike the syntactic causative, the lexical causative is much more constrained and not all verbs have the lexical causative. According to Haspelmath's (1993) typology of lexical causativity, the English lexical causative is almost always morphologically unmarked (i.e., *labile*) except for a few suppletive pairs such as *die/kill*, *learn/teach*, and *eat/feed*.

A corresponding classification of causativity exists in Japanese as shown in (47)-(49).

(47) Syntactic causative with causative morpheme *-(s)ase*

a. Shouta-ga Yuji-ni hon-o yom-ase-ta
Shota-NOM Yuji-DAT book-ACC read-CAUSE-PAST
Syota made/let/have Yuji read a book.

b. Gichou-wa gikai-o hirak-ase-ta.
chairman-TOP cabinet-ACC open-CAUSE-PAST
Chairman made/let/have the cabinet open.

c. Shouta-wa otouto-ni otsukai-ni ik-ase-ta
Shota-TOP brother-DAT errand-TO go-CAUSE-PAST
Shota made/let/have his brother go the errand.

(48) Noun/Adjective + *-suru* (*-naru*)

a. Shouta-ga gaarufurendo-o kanashi-ku suru.
Shota-NOM girlfriend-ACC sad-ADVERBIAL make
Shota makes his girlfriend sad. (lit. *saddened his girlfriend*)

b. Shouta-ga mokuhen-o yawaraka-ku suru.
Shota-NOM piece-of-wood-ACC soft-ADVERBIAL make
Shota softens a piece of wood.

(49) Lexical causative

a. Shouta-ga mado-o kowashita. / Mado-ga kowareta
Shota-NOM window-ACC break$_{trans}$ / window-NOM break$_{intra}$
Shota broke the window. / The window broke.

b. Shouta-ga tegami-o yaita. / Tegami-ga yaketa.
Shota-NOM letter-ACC burn$_{trans}$ / letter-NOM burn$_{intra}$
Shota burned the letter. / The letter burned.

c. Shouta-ga tsukue-o yurashita. / Tsukue-ga yureta.
Shouta-NOM desk-ACC shake$_{trans}$ / desk-NOM shake$_{intra}$
Shota shook his desk. / The desk shook.

The causative with a derivational morpheme such as *-ify*, *-en*, and *ice* in Japanese is almost equivalent to that of English such that an adjective or a noun undergoes derivation with the causative morpheme *-suru* to indicate the causative relation of [Y IS ADJECTIVE] $\leftrightarrow$ [X CAUSE [Y BEOME ADJECTIVE]]. For example, in (48), the morphological derivational causative *kanashi-ku suru* is derived from the adjective *kanashii* 'sad' and the derivation has the following consequence: [girlfriend BE kanashii] $\leftrightarrow$ [Shota CAUSE [girlfriend BEOME kanashii]]. The Japanese morphological causative appears to be more productive than its English counterpart because almost all Japanese adjectives and nouns can appear with the causative morpheme *-suru* (e.g., *tsukue-ni suru* "X makes Y to become a desk", but not **deskify*, **deskize*, **desken*).

The differences in the causative constructions in English and Japanese are more evident in the syntactic causative and the lexical causative (Jacobsen, 1992; Shibatani, 1976, 2004). The primary difference is that the distinction between the

syntactic causative and the lexical causative is blurred in Japanese due to the agglutinative nature of Japanese morphology. In Japanese, the productive causative is marked with the causative morpheme *-sase* or its allomorphe *-ase* as shown in (50).

(50) Productive causative

a. i. Shouta-ga hataraku.
Shota-NOM work
Shota works.

ii. Masao-ga Shouta-o hatarak-ase-ru.
Masao-NOM Shota-ACC work-CAUSE
Masao makes Shota work.

b. i. Shouta-ga terebi-o miru.
Shota-NOM television-ACC watch
Shota watches TV.

ii. Masao-sa Shouta-ni terebi-o mi-sase-ru.
Masao-NOM Shota-DAT television-ACC watch-CAUSE
Masao makes Shota watch TV.

c. i. Kodomo-ga aruku.
Children-NOM walk
Children walk.

ii. Masao-ga kodomo-o aruk-ase-ru.
Masao-NOM children-ACC walk-CAUSE
Masao makes children walk.

The majority of lexical causatives in Japanese are equipollent, meaning that both transitive and intransitive members of the lexical causative pair are derived from the same stem. Unlike the unmarked labile causative verb in English, one or both members of the equipollent causative pair in Japanese are morphologically marked. Equipollent is a non-directed causative pattern since the morphological

marking takes place in an inconsistent manner and cannot be classified as either causative or anticausative. The example below illustrates how the morphological marker *-e-* is employed as a causative marker in one pair and as an anticausative marker in another pair. In other words, *-e-* can mark either the causative (transitive) member or the inchoative (intransitive) member in Japanese (Jacobsen, 1992).

(51) Lexical causative marker in Japanese

a. i. John-ga mado-o ak-e-ta.
John-NOM window-ACC open$_{trans}$
John opened the window.

ii. Mado-ga aita.
window-NOM open$_{intra}$
The window opened.

b. i. John-ga tegami-o yaita.
John-NOM letter-ACC burn$_{trans}$
John burnt the letter.

ii. Tegami-ga yak-e-ta.
Letter-NOM burnt$_{intra}$
The letter burnt.

Another characteristic of the Japanese lexical causative is the variability of the morphological markers. Jacobsen (1992) compiled a small corpus of Japanese lexical causative pairs and found that 16 different morphological patterns exist among 354 lexical causative pairs in Japanese (see Table 2.2). There is a general tendency for intransitive causative (anticausative) morphology to contain the phoneme *-r-*, a remnant of the productive passive morpheme *-rare-*, and for the transitive causative morphology to contain *-s-*, a remnant of the productive causative morpheme *-sase-* (Jacobsen, 1992).

Table 2.2: Distribution of the transitive/intransitive (causative/anti-causative) morphemes: Investigation of the 354 transitive/intransitive pair verbs listed in Jacobsen (1992)

INTRA/TRANS	COUNT	INTRA/TRANS	COUNT
-ar-/-e-	71	-/-e-	55
-e-/-as-	45	-/-as-	38
-e-/-	32	-r-/-s-	30
misc	25	-re-/-s-	18
-ar-/-	8	-/-se-	7
-i-/-as-	7	-i-/-os-	6
-e-/-akas-	5	-are-/-e-	3
-or-/-e-	2	-ri-/-s-	2

The morphological affinity makes it difficult to draw a clear line between the syntactic and lexical causative in Japanese. In fact, it is an ongoing debate how to classify the non-productive lexical causative and the productive causative in Japanese (Harley, 2008). Structurally speaking, the syntactic causative is biclausal and allows an additional projection of the causative head. The unoccupied projection is considered to be linked to various scopial ambiguity and binding phenomena as listed in (52)-(54).

(52) Manner adverbial ambiguity (Shibatani, 1990)

a. Lexical causative

Tarou-wa Hanako-o te-o takaku age-te tometa (lexical)
Taro-TOP Hanako-ACC hand-ACC high raise-ing stop-PAST

Taro stopped Hanako with a hand raised high.

b. Syntactic causative

Tarou-wa Hanako-o te-o takaku age-te tomar-ase-ta
Taro-TOP Hanako-ACC hand-ACC high raise-ing stop-CAUSE-PAST

Taro made Hanako stop with Taro's/Hanako's hand raised high.

(53) Antecedent of an anaphora *jibun* (Shibatani, 1990)

a. Lexical causative

Tarou-wa Hanako-o jibun-no shashin-o miseta
Taro-TOP Hanako-ACC self-GEN picture-ACC show-PAST

Taro$_i$ showed Hanako self's$_i$ picture.

b. Syntactic causative

Tarou-wa Hanako-o jibun-no shashin-o mi-sase-ta
Taro-TOP Hanako-ACC self-GEN picture-ACC show-CAUS-PAST

Taro$_i$ showed Hanako$_j$ self's$_{i/j}$ picture.

(54) Controller of *-te* adjunct (Harley, 2008)

a. Taro-wa nure-te Hanako-o hiy-as-hita (lexical transitive)
Taro-TOP wet-te Hanako-ACC cool-PAST

Taro, getting wet, cooled Hanako.

impossible: *Taro cooled Hanako, (Hanako) getting wet*

The problem is that some syntactic causative verbs (i.e., marked with *-sase-*) exhibit some behaviors as if they were lexicalized verbs. For example, Miyagawa (Miyagawa, 1989) and Zenno (Zenno, 1985) show that some of the syntactic causative verbs with *-sase* undergo semantic drift (idiomatization), which typically occurs lexical items.

(55) verb+*-sase* with idiomatic meanings (examples from Harley (2008))

a. chikara-o aw-ase
power-ACC together-CAUS

pull together

b. mimi-o sum-ase
ear-ACC clear-CAUS

listen carefully

c. hana-wo sak-ase
flower-ACC bloom-CAUS

engage in heatedly

Shibatani (1976, 2004) defines lexical causativity in terms of the degree of the agent's manipulativeness. Shibatani (1976) observes that the lexical causative is typically correlated with manipulative/direct causation whereas the syntactic causative is correlated with indirect causation. Indirect causation in the syntactic causative is structurally determined; that is, the syntactic causative in Japanese is structurally biclausal, as demonstrated with several syntactic tests proposed by Shitabani (i.e., adverbial modification, reflexive pronoun, *so-suru* replacement, and sentence pronominalization). For example, Shibatani points out that the adverbial modifier in the productive (syntactic) causative is ambiguous – it modifies either the causing event or caused event.

(56) Tarou-wa Hanako-o heya-ni damatte ireta/ire-sase-ta
Taro-TOP Hanako-ACC room-TO quietly enter-PAST/enter-CAUSE-PAST
Taro quietly made Hanako enter the room. / enter the room quietly.

(57) Tarou-wa Hanako-o kyuni tometa/tome-sase-ta
Taro-TOP Hanako-ACC suddenly stop-PAST/stop-CAUSE-PAST
Taro suddenly made Hanako stop. / made Hanako stop suddenly.

(58) Tarou-wa Hanako-o shizukani nak-ase-ta.
Taro-TOP Hanako-ACC quietly cry-CAUSE-PAST
Taro quietly made Hanako cry / made Hanako cry quietly.

(59) Tarou-wa Hanako-o ishoukenmei hatarak-ase-ta.
Taro-TOP Hanako-ACC assiduously work-CAUSE-PAST
Taro assiduously made Hanako work / made Hanako assiduously work.

The problem of the distinction between the lexical and syntactic causatives is that some syntactic causative verbs (i.e., marked with *-sase-*) exhibit some behaviors as if they were lexicalized verbs. For example, Miyagawa (Miyagawa, 1989)

and Zenno (Zenno, 1985) show that some of the syntactic causative verbs with *-sase* undergo semantic drift (idiomatization), which typically occurs lexical items.

(60) verb+*-sase* with idiomatic meanings (examples from Harley (2008))

a. chikara-o aw-ase
power-ACC together-CAUS
pull together

b. mimi-o sum-ase
ear-ACC clear-CAUS
listen carefully

c. hana-wo sak-ase
flower-ACC bloom-CAUS
engage in heatedly

Shibatani (2004) argues that the boundary between the lexical and syntactic causative is not binary, rather a continuum of two prototypical items. Shibatani proposes a causative continuum such that there are correlations among degree of grammaticalization, degree of regularity/productivity, and degree of direct causation. The degree of causation is highest in the lexical causative, which is considered the most irregular and least grammaticalized.

In sum, the classification of syntactic and lexical causative in Japanese is not as transparent as that in English. In this study, I adopt Jacobsen's definition (1992), who simply assumes that irregularity and non-productivity are the hallmarks of the lexical causative in Japanese. Thus, all causative pairs marked with any causative morpheme other than the regular causative morpheme *-sase-* and its allomorphe *-ase-* are unpredictable and thus their causativity should be lexically encoded.

2.3.3 More on the lexical causative in Japanese

As discussed above, in Haspelmath's (1993) study on the lexical markedness of causative verbs in 21 languages (Table 2.3), Japanese is identified as one of the two languages that have no directed causative markedness. This is so, because the morphological marking appears in both the transitive and intransitive members of the transitive pair, unlike other languages in which only one member of the causative verb is morphologically marked (e.g., Spanish *-se* appears only with the intransitive verb). English is the other non-directed causative language since the causative morpheme is completely absent in lexical causative verbs.

Table 2.3: Typological survey of lexical causativity of 31 verbs in 21 languages (Haspelmath, 1993) (also see (Nedjalkov, 1969))

Language	Total	**Anticaus**	**Caus**	**Equip.**	**Labile**	**Suppl.**
Russian	31	23	0	5	0	3
German	31	14.5	0	4	11.5	1
French	31	20.5	2	0	7.5	1
Hebrew	31	20.5	7.5	2	1	0
Hindi-Urdu	31	7.5	14	7.5	2	0
Turkish	30	9	17.5	2.5	0	1
English	31	2	0	1	25	3
Japanese	31	3.5	5.5	20.5	0.5	1

Anticausative: the causative variant is more basic than the inchoative variant; **Causative**: the inchoative variant is more basic than the causative variant (e.g., English causative morpheme *-ize*); **Equipollent**: both are derived from the same stem (e.g., Japanese *atsum-aru* "gather (intra)" / *atsum-eru* (trans)); **Labile**: the same verbs is used both in the inchoative and causative senses (e.g., English *break*); **Suppletive**: different verb roots are used (e.g., English *teach/learn*). When there are two synonymous expressions exist, each of them counted as 0.5.

Japanese causative is considered non-directed since the majority of causative pairs are morphologically marked in an irregular manner. As Table 2.4 shows, two-thirds of Japanese causative verbs are marked in both their transitive and in-

transitive members (equipollent) and only a few verbs follow the causative or anticausative pattern. This is a stark contrast with other languages such as Hebrew and French, whose lexical causative verbs are predominantly marked in their intransitive member. This pattern of lexical causative is also observed in Jacobsen's (1992) list of lexical causative verbs.

Table 2.4: Distribution of markedness in Japanese transitive/intransitive pairs (the 354 transitive pairs in Jacobsen (1992))

CAUSATIVE MARKER	COUNT
both_marked (equipollent)	214
trans_marked (causative)	100
intra_marked (anti-causative)	40

Some of the Japanese lexical causative verbs are marked only in one member (i.e., with a causative or anticausative morpheme), but as mentioned above, there are multiple patterns of causative and anticausative morphemes and, therefore, it is probably safe to conclude that Japanese lexical causative is non-directed.

An examination of the Jacobsen's (1992) data about causative verbs reveals another interesting fact about the Japanese lexical causative. As shown in Table 2.5, a comparison between the lexical causative in Japanese and English reveals that the majority of Japanese causative pairs lack equivalent English translations; among 354 causative verbs, only 92 pairs have equivalent causative verbs in English (e.g., *break, burn, open, close* etc.); 90 of them are suppletive (e.g., *come off/-pluck off, lurk/conceal, hurt/injure, suffer/torment*); 137 have no simple lexical intransitive verb (e.g., *come untied/untie, become smashed/smash, become wrinkled/wrinkle, become known/know*), and 35 have no simple transitive verb (e.g., *face/cause to face, approach/let approach, touch/cause to touch, realize/make realize*).[1]

[1] A complete list of Jacobsen's 354 verbs along with my own semantic classification can be found in the Appendix.

Table 2.5: Distribution of English causative verbs that are equivalent to the 354 Japanese transitive/intransitive pairs in Jacobsen (1992)

CAUSATIVE MARKER	COUNT
no simple intransitive	137
causative alternation	92
suppletive	90
no simple transitive	35

The lack of corresponding English causative verbs is discussed from a different perspective in Jacobsen (1992). For example, there is no lexical item in English that correspond to the Japanese transitive pair *hodokeru* (intransitive of *hodoku* 'untie'). Thus, English needs to rely on the peripheral causative to express the corresponding meaning in English (e.g., *become untied*). In general, Jacobsen observes that a Japanese causative pair almost always exists if there is an equivalent transitive verb in English. Therefore, Japanese has a richer lexical causative inventory primarily because a wider range of intransitive verbs is lexically represented.

In the previous section, I presented how the lexical causative in English is constrained by verb semantic class such that only "change-of-state" verbs and "manner-of-motion" verbs are allowed in the causative alternation. A natural question that follows is the nature of the relationship between the lexical causative and verb semantic class in Japanese. The observations made just above suggest that Japanese may be more loosely constrained by verb semantic class than English. In order to investigate this possibility, I classified Jacobsen's lexical causative verbs and conducted an informal study classifying lexical causative verbs in Japanese by semantic class[2] (see Table 2.6).

[2]This is an informal study as the classification of verbs based purely on my subjective judgment and no validation by a third person was conducted. However, the data clearly show patterns that capture general tendencies.

Table 2.6: Distribution of verb semantic classes in the 354 Japanese transitive/intransitive pairs in Jacobsen (1992)

VERB SEMANTIC CLASS	COUNT
change-of-state	126
manner-of-motion	44
stative	40
mental state	37
inherently-directed motion	36
change-of-location	28
verbs of appearing/disappearing	24
transaction	10
verbs that emit light sound, substance	5
touch verbs	1
verbs of laughing	1

Like the English lexical causative verbs, the majority of the lexical causative verbs in Japanese are classified as "change-of-state" or "manner-of-motion". In addition, some Japanese lexical causative verbs belong to "mental state" (e.g., *itamu* "hurt", *kurushimu* "suffer"), "change-of-location" (e.g., *doku* "get out of the way", *muku* "face"), "inherently-directed motion" (see (61); *go*, *come*, *descend* in English), and "verbs of appearing/disappearing" (e.g., *useru/ushinau* "disappear/make disappear", *arawareru/arawasu* "appear/make appear", *taeru/tayasu* "die out/let die out")[3]. For "inherently-directed motion" verbs, Tsujimura (Tsujimura, 2002b, 2006) also found that the following verbs appear with (lexical) transitive pairs[4].

(61) directed motion verbs that have (lexical) transitive pairs (from Tsujimura

[3]"Stative" indicates one of the transitive members indicates a stative interpretation rather than an event. For example, *kakeru/kaku* "be in lack/lack", *fukumu/fukumeru* "be included/include", *tsuranaru/tsuraneru* "be lined up/line up" etc.

[4]According to the Jacobsen's (1993) definition, *iku* 'go' is clearly not lexical causative because its transitive members contain the *-sase* morpheme (*ik-ase-ru*). However, the other members in the inherently-directed motion verbs are almost always lexical causatives (i.e., marked with morphemes other than *-sase*). In order to account for this exceptional verb, which happen to be a very frequent member of the inherently-directed motion verb class, I will have to assume that *ik-ase-ru* is homomorphemic of syntactic and lexical causatives. In other words, the lexical causative of *iku* is morphologically identical to that for the syntactic causative, but it is just an accidental fact that applies only to this particular verb

(2002, 2006))

a. *iku* 'go', *kuru* 'come', *tsuku* 'arrive', *kaeru* 'return', *noboru* 'climb up', *dekakeru* 'leave', *tobidasu* 'come out suddenly', *agaru* 'ascend', *sagaru* 'descend', *noru* 'get on', *oriru* 'get off', *chikazuku* 'come closer', *toozakaru* 'go away'

So, according to this informal survey of Japanese causative verbs, it can be concluded that Japanese verbs do obey semantic constraints similar to those in English since the two most frequent verb semantic classes in Japanese are identical to the two major semantic classes of the English lexical causative as well (i.e., "change-of-state" and "manner-of-motion"). Japanese appears to have a richer lexical causative inventory since it also allows other semantic classes to be lexically causative (e.g., "mental state", "change-of-location", "inherently-directed motion" etc).

2.3.4 Peripheral properties of the lexical causative verbs

Before moving on to the next topic, something must be said about certain irregularities that exist in both English and Japanese lexical causative verbs. There are some cases in which the predicate's causativity appears to change even when causativity does not play any role in the alternation. One simple example is the preposition drop phenomenon in English. In English, in certain conditions, prepositions can be omitted (Levin, 1993).

(62) a. Martha climbed up the mountain.

b. Martha climbed the mountain.

(63) a. They skated along the canals.

b. They skated the canals.

(64) a. The spaceship revolves around the earth.

b. *The spaceship revolves the earth.

(65) a. Martha slowly descended down the stairs.

b. Martha slowly descended the stairs.

Although these verbs shift between intransitive and transitive in the surface form, I will not consider them as lexical causative verbs. I assume that the preposition drop in (62)-(65) is licensed by a grammatical rule that is completely independent of lexical causativity. Although the exact nature of this rule is not in the scope of this study, it is worth noting that this type of preposition drop happens with certain motion verbs with directional phrase complements that appear as an oblique object or direct object. When the path phrase appears in the direct object position, the path phrase receives a holistic interpretation such that the path is completely traversed (Levin, 1993). Interestingly, the same type of object drop is observed in Japanese (Kuno, 1973; McClure, 2003)

(66) a. michi-o/de aruku "walk along a road, walk a route"

b. migigawa-o/de hashiru "drive *(along) the right side"

c. ie-o/kara deru "leave the house"

d. Igirisu-o/kara hanareru "leave England"

Another irregular pattern appears with unergative verbs. English unergative verbs can appear with a zero-related (cognate) direct object (Levin, 1993). As indicated in (67) and (68), the cognate object must be salient in the discourse through modification with an adjective or replacement with a hyponym nominal.

(67) a. Sarah smiled.

b. Sarah smiled a charming smile.

c. *Sarah smiled a smile.

(68) a. Sarah slept.

b. Sarah slept a beautiful sleep.

c. *Sarah slept a nap.

Although usually intransitive, unergative verbs in Japanese can also appear with a direct object of a certain kind. If an object is adversively affected by the action denoted by the unergative verb, the object can appear as the direct object. This fact is usually noted for the ability of unergative verbs in Japanese to appear in passive sentences, but the so-called *adversely-affected passive* or *indirect passive* (Shibatani, 1990) can also appear in the active voice.

(69) a. Shouta-wa waratta.
Shota-TOP laugh-PAST
Shota laughed.

b. Shouta-wa tomodachi-no-fuko-o waratta.
Shota-TOP friend-GEN-misfortune-ACC laugh-PAST
Shota laughed (at) his friend's misfortune.

(70) a. Shouta-wa naita.
Shota-TOP cry-PAST
Shota cried.

b. Shouta-wa musuko-no-shi-o naita.
Shota-TOP son-GEN-death-ACC cry-PAST
Shota cried (over) his son's death.

(71) a. Shouta-wa hataraita.
Shota-TOP work-PAST
Shota worked.

b. Shouta-wa fusei-o hataraita.
Shota-TOP injustice-ACC work-PAST
Shota committed injustice.

These peripheral properties of the lexical causative verb are interesting, but I will not consider them further in my study.

2.4 NULL-OBJECT FEATURE IN ENGLISH AND JAPANESE

Compared with the plentiful number of studies on null-subjects, fewer studies have been conducted on the null-object phenomenon (Hasegawa, 1984; Otani & Whitman, 1991; Port, 2010; Zushi, 2003). The reason for this imbalance is that the null-object phenomenon lacks clear parametric differences among languages and null objects are more susceptible to discourse-level constraints than null subjects are (Pérez-Leroux, Pirvulesc, & Roberge, 2008).

2.4.1 Syntactic proposals for the null-object in Japanese

There are, broadly speaking, two different proposals for the syntactic nature of null-objects in Japanese. Since selecting one specific syntactic theory has little bearing on the current study, I will just briefly discuss each proposal here.

Hasegawa (1984), following Huang's notion of the *Control Domain* (Huang, 1984, 1989), proposes that the Japanese null-object is a variable controlled by an unpronounced topic element ((73) and (74) are from Zushi (2003)).

(72) [Op$_j$ [John$_i$-ga e$_{*i/j}$ nagutta to] itta]
[Operator [John-NOM e hit-PAST that] say-PAST]

John said that he hit (him).

(73) John$_i$-ga [e$_{i/j}$ Mary-o nagutta to] itta
John-NOM [e Mary-ACC hit-PAST that] say-PAST
John said that (he) hit Mary.

(74) John$_i$-ga [Mary-ga e$_{*i/j}$ nagutta to] itta
John-NOM [Mary-NOM e hit-PAST that] say-PAST
John said that Mary hit (him).

The analysis of null-objects as variables arises from the asymmetry between null-subjects (73) and null-objects (74) – as shown in (72), the null-object is not allowed to be A-bound by a matrix subject whereas no such restriction exists with the null-subject in Japanese. In this view, the reason why English is not allowed to have null-objects is reduced to the notion of the control domain. In English, the control domain is the lowest sentence and, therefore, a null-object (variable) is not allowed since it is governed by the antecedent (violation of Condition B; e.g., **John$_i$ talked to him$_i$*). On the other hand, in Japanese (and Chinese), where the control domain is as wide as the projection of topic, the null-object is licit due to the control by an unpronounced topic operator (72).

Another analysis of the null-object in Japanese has been proposed by Otani and Whitman (1991). Following Huang (1988, 1991), Otani and Whitman argue that Japanese null-objects are similar to VP ellipsis in English (Examples are from Zushi (2003)).

(75) John threw out his letters; Mary did [VP e] too.

(76) John-wa [jibun-no teagmi]-o suteta
John-TOP self-GEN letter-ACC discard-PAST
John threw out self's letters.

(77) Mary-mo [e] suteta
Mary-ALSO discard-PAST
Mary also threw out self's letters or Mary also threw out John's letters.

Sentence (75) is ambiguous and has two different interpretations. One interpretation is that Mary threw out John's letter, in which the antecedent of the deleted pronoun *his* is John (*strict reading*). The other interpretation is that the antecedent of the the deleted pronoun is the subject of the VP-ellipsis clause, namely Mary (i.e., Mary threw out her own letter)). This interpretation is called *sloppy reading*. As shown in (77), Japanese null-object sentences generate the same ambiguity between the strict reading and the sloppy reading. With other various similarities between the Japanese null-object construction and English VP ellipsis, Otani and Whitman conclude that Japanese null-objects result from the verb raising out of VP followed by the ellipsis of VP[5].

It should be noted that both Hasegawa (1984) and Otani and Whitman (1991) assume that null-objects are not allowed in English. In these two accounts, licit null-objects in English are considered epiphenomenal and no explanation is provided for them. In the next section, I will explore null-objects in English.

2.4.2 Functional definition of null-object

One critical fact that has direct implication on the current study is that some verbs in English are, in fact, allowed to have unpronounced objects. Null objects in English are largely divided into two types: Definite Null Object (DNO) and Indefinite Null Object (INO) (Fillmore, 1986; Huang, 1984; Port, 2010). According to Fillmore (Fillmore, 1986), INO happens when the referent object is unknown or

[5]But see Hoji for his counter arguments against the VP-ellipsis analysis (Hoji, 1998).

insignificant in a sentence (e.g., *When my tongue was paralyzed I couldn't eat and drink [stuff]*) and DNO happens when the missing element is retrievable from the context (e.g., *How was the game? - we lost [the game]*). Fillmore claims that both types of null-object verb are lexically determined because synonymous expressions do not demonstrate the same degree of compatibility with null-object (e.g., *She promised/*pledged/*vowed/*guaranteed*) and only a specific sense of the verb is compatible with null-object (e.g., *He won [the race/the election/*the first prize/*the gold medal/*the blue ribbon]*).

Goldberg (2001) further develops Fillmore's definition of DNO and argues that simple transitive verbs like *kick* can be acceptable without a direct object in discourse when the action is repetitive and the prominence of the obligatory object is low.

(78) simple (pure) transitive verbs with unspecified objects (Goldberg, 2001)

a. The chef-in-training chopped and diced all afternoon.

b. Tigers only kill at night.

c. The singer always aimed to dazzle/please/disappoint/impress/charm.

d. Pat gave and gave, but Chris just took and took.

e. Their revolutionary new brooms sweep cleaner than ever.

f. The sewing instructor always cuts in a straight line.

Levin (1993) notes the lack of a coherent semantic grouping for null-object verbs in English. Quite a few English verbs are identified as null-object verbs in Levin's verb classification (Levin, 1993), but unlike other types of argument-structure alternation, these verbs do not share any semantic elements.

(79) Unspecified object (Null-object) alternation (Levin, 1993)

a. Mike ate the cake.

b. Mike ate.

(80) Null-object verbs ("Unspecified Object Alternation verbs" in (Levin, 1993, p. 33))

bake, carve, chop, clean, cook, crochet, draw, drink, dust, eat, embroider, hum, hunt, fish, iron, knead, knit, mend, milk,, mow, nurse, pack, paint, play, plow, polish, read, recite, sew, sculpt, sing, sketch, sow, study, sweep, teach, type, sketch, vacuum, wash, weave, whittle, write

In general, null-object verbs in English exhibit a great deal of variability and the distinction between null-object verbs and obligatory-object verbs is difficult to pin down. Null-object phenomena are subject to discourse-level constraints and only a limited number of English transitive verbs are allowed to appear without a direct object when no discourse-level factor exists. Japanese is often considered as a prototypical null-object language, in which almost all verbs are allowed to appear with unspecified objects. A survey shows that the status of null-objects appears to be correlated with topicality in the discourse in both languages, but the exact nature of such discourse conditions is not known yet.

2.5 SUMMARY

In this section, I presented a survey of the literature concerning the causative alternation and the null-object alternation in both English and Japanese. These two alternations exist in both languages, but the range of verbs that can participate in

the alternations differs in each language. First, Japanese verbs appear to be less restricted in the causative alternation than English verbs. Second, while Japanese is a prototypical null-object language, an equivalent null-object construction also exists in English. The null-object alternation in the both languages is subject to discourse-level factors.

CHAPTER 3

ASYMMETRIC RELATIONSHIP IN SLA

3.1 INTRODUCTION

The goal of this chapter is to discuss the concept of asymmetric learning difficulty found in the SLA literature. The main issue is that, assuming transfer from the first language, learning difficulty may not be comparable between two languages. To put it differently, there may be an asymmetric relationship in the learnability of two given languages, LX and LY, depending on direction: going from LX to LY or from LY to LX. I describe ways in which the relationship between the learner's first language and the target language can result in this asymmetry. This asymmetry was first proposed as a learnability problem in *The Subset Principle* (Berwick, 1985; Manzini & Wexler, 1987) (SP, hereafter), but various formulations of the SP have been rejected as inadequate for a formal linguistic theory (MacLaughlin, 1992, 1995; Musolino, 2006; Kapur et al., 1993) and the notion of grammars in subset-superset relationships was dispensed with altogether in linguistic research. In this paper, I will redefine the SP in SLA and argue that the notion of asymmetric learnability in SLA can still be captured without referring to grammars. I consider the

asymmetric relationship to be justified as a general cognitive theory (Pinker, 1989) that characterizes crucial aspects of SLA and cannot be ignored when attempting to account for the empirical data.

In defining the asymmetric relationship in SLA, I will also briefly discuss the initial state of L2 learners, an important factor in establishing an asymmetric relationship. Then, I will review several L2 studies including those using a bidirectional research design (Gabriele, 2009; Inagaki, 2001, 2002), in terms of the asymmetric learnability framework. Many studies show asymmetric interactions between the learner's native language and the target language; that is, the L2 learner is faced with a stronger learnability problem when the mapping between the lexicon and the syntax results in a marked grammar, and that grammar is transferred from L1 to L2. Conversely, when this mapping results in an unmarked grammar in the L1, and this grammar is transferred to the L2, then learnability is not an issue, provided there is positive evidence.

3.2 The Subset Principle

Manzini and Wexler (1987), following Berwick (1985), proposed the Subset Principle for FLA, which, in short, argues that the subset relationship in grammar is a consequence of linguistic principles (i.e., Government and Binding in their original proposal). The SP is motivated by the classic poverty of the stimulus problem, which can briefly be stated as follows:

(81) The poverty of the stimulus problem in first language acquisition

a. There are very few, if any, instances of corrective feedback in linguis-

tic input to children (Bohannon & Stanowicz, 1988; Brown & Hanlon, 1970; Hirsh-Pasek, Treiman, & Schneiderman, 1986). Even when the caregiver (directly or indirectly) attempts to provide corrective feedback, children do not pay attention to corrections to their structural errors (Brown & Hanlon, 1970). Furthermore, the amount of indirect corrective feedback falls short of what children need for changing their grammar with reasonable certainty (G. F. Marcus, 1993).

b. Without corrective feedback, children have no means to rectify their overgenerated grammar (Bowerman, 1988). This lack of external input is known as the learnability problem (Baker, 1979; Braine, 1971; Pinker, 1989), which logically necessitates some internal mechanism in the children's minds to bootstrap their language acquisition process.

The SP was a hypothesis to resolve the learnability problem by postulating that a language principle always sets a superset grammar with a marked value and leaves a subset grammar unmarked. Another assumption is that language learners always select the most conservative grammar (the smallest grammar). When these two assumptions are met, language learners can modify their hypothesized grammar to a less constrained one without negative evidence since the positive evidence alone can trigger the adoption of a new, larger grammar.

For example, Manzini and Wexler (1987) argue that the *Government Category* (GC), a parameter that defines a limit on the proper antecedent of pronouns and anaphora, follows the SP. In English, the GC is the minimal category with a subject whereas, in Japanese, the GC is the minimal category with the root tense. This results in a wider interpretation of anaphora in an embedded clause in Japanese as shown in (82) and (83) (example (83) from Hirakawa (1990)).

(82) [John$_i$ thinks that [Bill$_j$ wants [Tom$_k$ to introduce himself$_{*i/*j/k}$]]]

(83) Kenji$_i$-wa Jiro$_j$-ga Yoshio$_k$-ni jibun$_{i/j/k}$-wo shokaishite-hoshii-to
Kanji-TOP Jiro-NOM Yoshio-DAT self-ACC introduce-want-that
omotteiru
think.
Kenji thinks that Jiro wants Yoshio to introduce (him)self

Thus, in terms of the GC parameter, English is a subset of Japanese since the placement of anaphora is more constrained in English than in Japanese.

A similar subset relationship also exists between the two languages in the *Proper Antecedent Parameter* (PAP), which defines the proper antecedent for an anaphor. However, in the PAP, the subset relationship holds in the opposite direction. In Japanese, only a subject can be the antecedent of an anaphor whereas both subject and object can serve as an antecedent in English (see (84) and (85)). Therefore, in terms of the PAP, Japanese grammar is more constrained than (i.e., is a subset of) English grammar.

(84) John$_i$ told Bill$_j$ about himself$_{i/j}$.

(85) Kenji$_i$-wa Bill$_j$-ni jibun$_{i/*j}$-nitsuite hanashita.
Kenji-TOP Bill-DAT self-CONCERNING talk-PAST
Kenji told Bill about himself.

The SP predicts that both Japanese and English L1 learners initially start with the smallest grammar. For example, in case of the GC, it is predicted that all L1 language learners begin with the most constrained grammar (i.e., English grammar) and then only the Japanese L1 learners extend their grammar to the proper configuration for Japanese. This modification of grammar can occurs only with positive evidence available in the input.

However, subsequent studies have shown that this prediction is not borne out by the empirical data (MacLaughlin, 1992, 1995; Kapur et al., 1993; also, see Musolino (2006) for criticism of the Semantic Subset Principle). The L1 acquisition patterns appear not to follow the predicted path (i.e., unmarked to marked). According to the SP, it is predicted that the majority of languages select the smallest grammar since it is an unmarked (default) value, but for some parameters, it is found that a larger number of languages select the marked value rather than the unmarked one. More specifically, few languages have the minimal subject as the governing category for pronouns (= unmarked value) and many languages select marked values such as a tense or a root tense as the governing category for the pronoun.

Several SLA studies also criticized the SP and concluded that the SP does not operate in SLA (Hirakawa, 1990; Thomas, 1991; MacLaughlin, 1992; Zobl, 1988; Lakshmanan & Teranishi, 1994). Most of these studies directly applied the SP to the SLA context - the argument was made in such a way that, if the SP operates in SLA, the L2 learners should start with the most conservative (subset) L2 grammar regardless of their first language. However, the experimental data did not support this prediction (Hirakawa, 1990; Thomas, 1991; Zobl, 1988; Lakshmanan & Teranishi, 1994); rather it showed that L2 learners had selected a grammar that resembles neither the L1 value nor the L2 value in their interlanguage representation. In other words, the L2 learners adopt an intermediate form of grammar that does not exist either in L1 or L2.

For example, Hirakawa (1990) tested the GC and the PAP with the native speakers of Japanese learning English as L2. In the GC for the anaphora, English has the smallest grammar (only local subject binds an anaphor) and Japanese has

the largest grammar (any subject). In the PAP, on the other hand, English employs the larger grammar (either subject or object can bind anaphora) than that of Japanese (only subject). (86) shows the summary of Hirakawa's study.

(86) Summarized results of Hirakawa (1990)

(a) tensed subject NP + tensed subject NP

	John	said that	Bill	hit	himself	[either way]
control (English sentence by L1 English)	1%		99%			0%
control (Japanese sentence by L1 JPN)	63%		26%			[11%]
experiment (English sentence by L1 JPN)	17%		77%			6%

(b) tensed subject NP + non-tensed subject NP

	Mary	asked	Ann	to introduce	herself	[either way]
control (English sentence by L1 English)	2%		98%			0%
control (Japanese sentence by L1 JPN)	71%		19%			10%
experiment (English sentence by L1 JPN)	36%		55%			[9%]

(c) tensed subject NP + non-tensed object NP

	Bob	talked to	Paul	about	himself	[either way]
control (English sentence by L1 English)	67%		21%			12%
control (Japanese sentence by L1 JPN)	96%		2%			2%
experiment (English sentence by L1 JPN)	74%		20%			6%

Hirakawa (1990), like other studies, rejected the SP because her subjects did not select the smallest grammar as the default value in L2 English. By virtue of the GC, the native speakers of Japanese learning English as L2 are expected to select the most conservative grammar; that is, the local subject rather than the root tensed subject as defined in their L1. However, as shown in (86a) and (86b), a significantly larger number of the Japanese native speakers chose non-local subjects (i.e., 45% of the participants in (86b)) compared to the English native speakers (i.e., 2%). If the SP operates in SLA, the local subject must be the default antecedent of the anaphora in L2 and, then, the L2 learners should not have any difficulty in selecting the correct antecedent in English. However, the native speakers of Japanese

learning English as L2 did not show such a pattern in Hirakawa's (1990) data. In sum, the SP was generally rejected as a formal linguistic principle in light of the contradictory empirical data.

3.2.1 The Subset Principle vs. The asymmetric relationship in SLA

It is important to note that these studies rejected the SP as a theory to characterize the nature of grammar. The research found that the SP was not tenable as a model of grammar since the parametric values of grammar are not hierarchically organized. However, this research did not reject the value of the SP as a general cognitive (learning) theory (Pinker, 1989). In more recent studies, an effect of the asymmetric relationship between L1 and L2 has been attested and the possibility has been suggested that different degrees of learnability occur when two languages are in a asymmetric relationship (Inagaki, 2001; S. Izumi & Lakshmanan, 1998; Montrul, 2001a; Hirakawa & Suzuki, 2010).

In order to draw a clear distinction between this proposal and the SP, I use the term *asymmetric relationship* in SLA to define this input-driven perspective of the subset-superset relationship. A significant difference between the SP and the asymmetric relationship exists in how the subset-superset relationship is established. The asymmetric relationship in SLA is defined not on the grammar itself, but the *constructions* resulting from the grammar. When the L2 grammar generates a set of constructions that stands in a subset relationship to the set of equivalent constructions generated by the grammar of the L1, negative evidence is required to demonstrate to the learner that certain constructions are not allowed in the L2. Thus, for the present study, negative evidence is necessary for the native speakers of Japanese learning English as L2 to learn the ungrammaticality of inherently-

directed motion verbs and verbs of disappearance in the transitive construction because, as shown in (87)-(88), these two verb classes are allowed to be in the transitive construction in Japanese.

(87) a. *The man vanished the coin.

b. Otoko-ga koin-o keshita
man-NOM coin-ACC vanished_TRANS

c. koin-ga kieta
coin-NOM vanished_INTRA

(88) a. *The man descended the airplane.

b. Otoko-ga hikoki-o oroshita
man-NOM airplane-ACC descended_TRANS

c. Hikoki-ga orita
airplane-NOM descended_INTRA

In the example of the GC and PAP, the native speakers of Japanese learning English as L2 are predicted to have more difficulty in switching their L1 parameter values for the GC (i.e., from a superset value (Japanese) to a subset value (English)) than in the PAP where the Japanese parameter value is a subset of the English value. This is so because if a language learner abides by a version of grammar that allows a wider range of grammatical constructions than the grammar of the target language, all input will conform to his/her version of grammar and it will not be necessary for the learners to modify their interlanguage grammar. On the other hand, if the learner holds a smaller interlanguage grammar than the target language grammar, some of the input will contradict the learner's current grammar and will force the learner to rectify their interlangauge grammar. In sum, the change from a superset to a subset is predicted to be more difficult than the other

way around since the quality of the necessary input is different. Learning a new construction requires positive evidence that is available in the L2 input. On the other hand, negative or corrective evidence is necessary to unlearn an overgeneralized usage of the grammar because no positive evidence can inform the L2 learner of the overgeneralized and ungrammatical usage of their interlanguage grammar.

To revisit Hirakawa's study, a new kind of question can be formulated in terms of the degree of learnability in the two GB principles that Hirakawa investigated.

(89) a. Is there any difference in the degree of difficulty in acquiring the native-like parameter values in the two different parameters (i.e., the GC and the PAP)?

b. If so, does it follow the predicted order? That is, is the change from a superset to a subset more difficult than the change from a subset to a superset?

Although it is difficult to draw a firm conclusion from the data available in Hirakawa's study, a bird's-eye view analysis of Hirakawa's data shows that the native speakers of Japanese learning English as L2 were more successful in resetting the PAP than the GC. As seen in (86c), 20% of the Japanese-speaking subjects selected the object as an antecedent, largely similar to 21% of the English-speaking subjects who follow the same pattern.

3.3 THE INITIAL STATE OF L2 (L1 TRANSFER)

One weakness of the asymmetric relationship in SLA is that, unlike the SP, it does not provide any specific prediction about the initial state of L2. Since the SP was falsified for its inaccurate assumption about the transfer of L1 to L2 (i.e., the empirical data suggest that the initial state of L2 learners is not the smallest and unmarked value of the grammar as the SP would predict.), it is necessary to provide a solid prediction about the L2 transfer to propose an alternative to the SP. To put it differently, if the smallest and unmarked grammar is not the L2 initial state, then exactly what is the initial state of L2 learners? In many bidirectional studies that I will discuss below, the asymmetric relationship is defined simply by comparing the learner's L1 and L2 – in other words, these studies tacitly assume that the L2 learners will fully transfer their L1 grammar to L2. While I also make the same assumption that all L1 grammar will transfer to the L2 initial state in this study, it's worth discussing various approaches that the past research has taken for the L1 transfer.

3.3.1 Various approaches to L1 Transfer in recent studies

The initial state of L2 learners became one of the central issues in SLA in the 1990's (Gass & Selinker, 1992; Odlin, 1989; Epstein, Flynn, & Martohardjono, 1996; Martohardjono & Flynn, 1995; White, 2000; Kellerman, 1995b; Vainikka & Young-Scholten, 1996) and various hypotheses have been proposed. In the literature, the initial state of L2 acquisition is called the *language transfer* or *first language influence* (Odlin, 1989), which, as the nomenclature implies, claims that L2 learners start with a mental state different from that of L1 learners due to the influence of their

native language. Although most researchers agree that L2 learners' interlanguage is affected by their L1, there is a wide range of disagreement as to how to formally define language transfer (Odlin, 1989; White, 2005).

Andersen (1983) considers language transfer as a surface phenomenon and, in the *Transfer to Somewhere Hypothesis*, he claims that language learners transfer language usage from L1 to L2 only when the learners are certain about the equivalence of expressions between L1 and L2. In other words, the language learners employ L1 grammar only when the usage of L1 is similar enough to its corresponding structure in L2. The main motivation for the Transfer to Somewhere Hypothesis is the fact that the acquisition of the L2 is faster when L1 and L2 are typologically similar (e.g., English and Spanish) than when they are not (e.g., English and Japanese). Andersen also suggests that transfer is more likely to happen when the L2 expression is frequent and semantically transparent (e.g., non idiomatic phrases).

A complementary approach is taken by Kellerman (1995a) who argues that transfer takes place at the conceptual level (cf. Jarvis, 1998; Odlin, 2005, 2008) rather than at the level of individual surface utterances. Kellerman argues that L2 learners transfer concepts from their L1 and attempt to find grammatical expressions in the L2 that fit in their conceptual framework. Thus, unlike the Transfer to Somewhere Hypothesis, Kellerman's *Transfer to Nowhere Hypothesis* predicts that transfer will take place even when the L2 does not have a grammatical element equivalent to that from the L1. One major focus of this line of research is the selection of prepositions in L2 and the role of spatial and temporal concepts in the L1 (Odlin, 2008). It is proposed that non-target like L2 interlanguage is due to the fact that L1 and L2 carve up the conceptual space in different ways.

Within the generative framework, the issue of transfer is coupled with questions about the accessibility of the innate linguistic predisposition (Universal Grammar) to L2 learners. It is still a controversy whether or not the L2 inerlanguage conforms to the linguistic specifications allowed within UG (Odlin, 2003; White, 1996, 2005) and whether or not we can discuss L1 and L2 on the same ground. Furthermore, there are two opposing views about transfer even among researchers who believe that L1 and L2 are governed by the same linguistic principles (i.e., *Full-access theory*). One position is known as the *Full-transfer theory*, which proposes that L1 transfer is unconstrained and all L1 parameter values transfer to the L2 to form the initial state of SLA (Schwartz & Sprouse, 1996; Schwartz, 1998). Some researchers have a more conservative view and claim that the L2 learners will fall back on the default values of Universal Grammar when L1 transfer does not happen (Epstein et al., 1996). The opposing view is the *Partial-transfer theory*, in which only a limited domain of the L1 is considered to transfer. For example, Vainikka and Young-Scholten (1996, 1998) proposed that only lexical items are subject to transfer and that L2 learners gradually develop functional projections in a similar way to L1 acquisition (*The Minimal Trees Hypothesis*).

Most contemporary researchers are unwilling to explicitly commit to a specific position in the transfer debate (Odlin, 2003) since the mechanism of transfer appears to be rather complex and cannot be confined to dichotomous theories. Even so, all of the experimental studies on the asymmetric relationship that I review below assume no constraint on L1 transfer; that is, they implicitly or explicitly assume the *Full Transfer/Full Access (FTFA) Hypothesis* (Schwartz & Sprouse, 1996; Schwartz, 1998) to establish the asymmetric relationship in SLA.

The assumption of "full transfer" should be made carefully since evidence

suggests that L1 transfer does not take place in certain linguistic domains. For example, Martohardjono and Flynn (1995) showed that L2 learners from various L1 backgrounds uniformly preferred the infinitival clause ((90a) and (90b)) to the finite *that*-clause ((91a) and (91b)) as a complement of a verb in English. Also, in an elicited imitation task, the L2 learners made significantly more errors in the finite that-clause sentence. This was true among all L1 groups, even for subjects whose L1 does not include the infinitival clause (such as Japanese and Chinese. See (92a) and (92b)) and whose L1 does have an identical structure to English (e.g., Spanish).

(90) a. John$_i$ promised Henry$_j$ PRO$_i$ to go to the store.

b. John$_i$ told Henry$_j$ PRO$_j$ to go to the store.

(91) a. John$_i$ promised Henry$_j$ that he$_{i/j/k}$ will go to the store.

b. John$_i$ told Henry$_j$ that he$_{i/j/k}$ will go to the store.

(92) a. John$_i$-ga Henry$_j$-ni [PRO$_{i/j}$ eraberu to] yakusoku-shita
John-NOM Henry-DAT PRO will choose COMP promise
John$_i$ promised Henry$_j$ that PRO$_{i/j}$ will choose.

b. John$_i$-ga Henry$_j$-ni [PRO$_{i/j}$ eraberu to] itta
John-NOM Henry-DAT PRO will choose COMP told
John$_i$ told Henry$_j$ that PRO$_{i/j}$ will choose.

Martohardjono and Flynn argue that L2 learners preferred and generated the correct forms of the infinitival clauses since UG allows them to resolve the reference of pronominal forms within the minimal domain. So, L2 learners fall back on the default value of UG rather than the L1 parameter values in some domain of grammar. To put it differently, the role of L1 is imperceptible in this specific parameter resetting since the learners behaved in the same manner regardless of their L1s.

In spite of the evidence suggesting that L1 transfer may not take place in some domains, for this study I employ the *Full Transfer Full Access* (FTFA) model as a working hypothesis. FTFA is an assumption that the transfer of L1 is unconstrained and therefore all L1 grammar fully transfers to L2. The assumption of Full Access to UG implies that second language acquisition is constrained by the same principles as those available in L1 grammar. These two assumptions are necessary in defining the asymmetric relationship. In this study, I assume that the asymmetric relationship can be established by comparing two languages since L2 learners' initial state is equivalent to their L1 and both L1, and L2 operate on the same linguistic principles.

3.4 Review of Japanese-English L2 acquisition studies

In this section, I examine Japanese-English interlanguage data from past experimental studies with a refined notion of the asymmetric relationship in SLA and will show that many studies exhibit asymmetric learnability in the L2 acquisition process as predicted by the asymmetric relationship.

3.4.1 Izumi and Lakshmanan (1998)

Izumi and Lakshmanan (1998) show that a learnability problem predicted by the asymmetric relationship exists in the acquisition of the passive construction in English by the native speakers of Japanese. This learnability problem was expected with the English passive construction because Japanese allows intransitive verbs to be passivized in addition to the transitive passive, which is the only available option in English. In the Japanese linguistics literature, the first type of passive is

called the indirect (adversely-affected) passive.

(93) English - direct passive only

a. John was called by Bill.

(94) Japanese - direct passive and indirect passive

a. Direct passive

Sono geki-ga Shakespeare-niyotte kak-(r)are-ta
That play-NOM Shakespeare-by write-PASSIVE-PAST

That play was written by Shakespeare

b. Indirect passive with intransitive verbs

Taro-ga se-no takai hito-ni jibun-no mae-ni
Taro-NOM height-GEN high person-by self-GEN front-in
suwa-rare-ta
sit-PASSIVE-PAST

Lit: Taro was sat by a tall person in front of self

Intended: Someone tall sat in front of Taro

c. Indirect passive with transitive verbs

Taro-ga Tom-ni computer-o tsukaw-(r)are-ta
Taro-NOM Tom-by computer-ACC use-PASSIVE-PAST

Lit: Taro was used his/a computer by Tom

Intended: Taro had his computer used by Tom

According to Izumi and Lakshmanan's syntactic analyses, the syntactic structure of the Japanese direct passive is identical to that of the English direct passive, both of which are formed by suppressing the external or agent argument of the transitive verb. On the other hand, there is no English counterpart to the Japanese indirect passive, which can be formed with both transitive and intransitive verbs. Izumi and Lakshmanan predicted that Japanese ESL learners would have a prob-

lem with the passive construction in English because they might treat the passive auxiliary verb *be* in a similar way to the Japanese passive morpheme *-(r)are*. In other words, Japanese native speakers learning English would face difficulty in recovering from the overgeneralization of the intransitive passive because the possible passive constructions in Japanese form a superset of the English passive construction (see Figure 3.1).

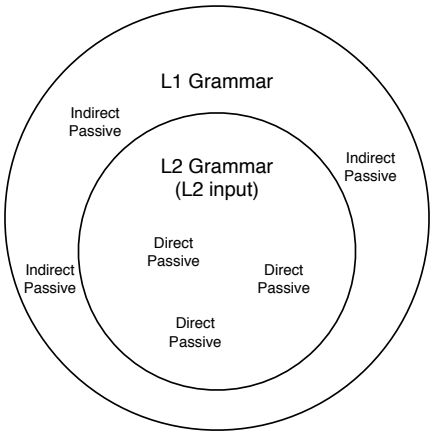


Figure 3.1: The learnability problem predicted by Izumi and Lakkshmanan (1989)

The experiment was conducted with 15 Japanese ESL students using three different tasks (i.e., translation, picture-cued production, and grammaticality judgment) at three different points in time (i.e., pre-treatment, immediate post-treatment, 2nd post-treatment after 8 weeks). Some subjects received explicit instruction about the English passive construction in their ESL class (experimental group) whereas the other subjects did not. The results showed that none of the subjects in the experimental condition made any errors in judging grammaticality of the passive constructions where as the participants in the control group inaccurately accepted the intransitive passive in English at a statistically significant level (some examples of the errors are presented in (95)). Based on the results, Izumi and Lakshmanan concluded (i) the Japanese native speakers learning English overex-

tended their L1 grammar and incorrectly accepted the ungrammatical intransitive passive constructions in L2 and (ii) the necessity of negative evidence for the Japanese native speakers to arrive at the correct English passive constructions.

(95) Examples of L2 mistakes (from Izumi and Lakshmanan (1989))

a. **Mr. Tanaka was stolen stereo*. (Translation task; description of the picture: *Mr. Tanaka was upset because his stereo set was stolen*)

b. *I was ate my kaki to my friend. (Translation task; *The last piece of cake, which I wanted to eat, was eaten by my friend.*)

c. *Taro was cryed by his girlfriend yesterday (Translation task; *Taro did not know what to do when his girlfriend cried.*)

d. *Taro was sit down front of [blank].... (Translation task; *A tall man sat in front of Taro in the movie theater. So, Taro could not see the movie very well.*)

e. *On the way to come here, I was rained. (Translation task; *On the way here, it started raining and I got wet.*)

In sum, Izumi and Lakshmanan's study presents a clear case of the learnability problem for Japanese native speakers learning English. In their study, as expected, the Japanese-English interlanguage manifests a clear influence of the native language and learnability by the asymmetric relationship on the acquisition of the passive structure in English.

3.4.2 Hirakawa (2001)

In contrast, Hirakawa (2001) failed to find the expected learnability problem in the classification of unaccusative/unergative verbs in L2 in her experiment with English-speaking learners of Japanese.

According to Hirakawa, a large body of evidence suggests that L2 learners have problems with unaccusative verbs in English as their surface representations are identical to those of unergative verbs. Since there is a strong correlation between the surface subject and the agentive thematic role across languages, L2 learners often misinterpret the thematic role of the surface subject of L2 unaccusative verbs as the agentive role. In her study, Hirakawa tested 25 adult English-speaking learners of Japanese and 20 Japanese-native speakers (as a control group). She used the adverbial modifier *takusan* "a lot" and the aspectual morpheme *-teiru* as diagnostics for verb accusativity and investigated L2 learners' interpretations of L2 verbs. The adverbial modifier *takusan* can modify both NP and VP in Japanese, but it can modify only the internal argument of a verb. Thus, when it is used with an unaccusative verb, it modifies the surface subject (e.g., *hito-ga takusan tsuita* "a lot of people arrived / *people arrive a lot (of times)") and, with unergative verbs, it modifies only the VP predicate (e.g., *hito-ga takusan asonda* "people played a lot / *a lot of people played"). Hirakawa also employed the aspectual morpheme *-teiru* as a diagnostic of a verb's unaccusativity, which generates the resultative interpretation with unaccusative verbs (e.g., *ochiteiru* "(It) has fallen. / *(It) is falling") and the progressive interpretation with unergative verbs (e.g., *waratteiru* "(he) is smiling / *(he) has smiled"). Using those diagnoses, Hirakawa investigated whether L2 Japanese learners successfully learned the distinction between the unaccusative and unergative verbs.

The results show that the native speakers of Japanese learning English as L2 learners were generally correct in their interpretation of the L2 verbs (see Table 3.1). Statistically significant interaction effects were found between unaccusative and unergative, primarily caused by the advanced learners who failed to distinguish

unaccusative from unergative verbs. While the cause of the advanced learners' low performance was unknown, Hirakawa concluded that, in general, her subjects successfully distinguished unaccusative verbs and unergative verbs in the target language.

Table 3.1: Results (note: these are approximate scores estimated from Figures 1 - 3 in Hirakawa (2001); 6-point Likert-scale (0 as "incorrect" and 5 as "correct"))

	INTER	ADVANCED	NATIVE
takusan with **transitive** V (false description)	1.0	1.2	0.5
takusan with **transitive** V (true description)	4.2	4.5	4.6
takusan with **unergative** V (false description)	1.2	2.8	0.9
takusan with **unergative** V (true description)	3.8	3.7	4.0
takusan with **unaccusative** V (true description)	4.5	4.0	4.5
-teiru with **transitive** V (true description)	4.9	5.0	4.9
-teiru with **unergative** V (true description)	5.0	5.0	5.0
-teiru with **unaccusative** V (false description)	1.3	1.0	0.1

In spite of the successful acquisition of unaccusative verbs by the subjects in Hirakawa's study, it is not clear whether this study serves as counter-evidence against the prediction under the asymmetric L1-L2 relationship. Similar distinctions between unaccusative and unergative exist in both Japanese and English and, if the initial state of L2 acquisition is the L1, no learnability problem is expected to the extent that those distinctions overlap each other. The only cross-linguistic difference between Japanese and English in her experimental design is the resultative interpretation of the aspectual marker *-teiru* with unaccusative verbs, which is not available in English. This specific aspectual difference was tested by Gabriele (2009), which will be discussed later in this section.

3.4.3 Inagaki (2001,2002)

Inagaki (2001, 2002), investigated the English constructions [Manner-of-motion verb + goalPP] (which is not grammatical in Japanese) and [Directed-motion verb + goalPP] (grammatical in both English and Japanese). Thus, in this construction, the Japanese constructions are a subset of their counterparts in English.

(96) [manner-of-motion verbs + GOALPP] (from Inagaki (2001))

a. John walked to school.

b. John ran into the house.

c. ?* John-ga gakkou-ni aruita
John-NOM school-at walked
John walked to school.

d. ?* John-ga ie-no naka-ni hashitta
John-NOM house-of inside-at ran/entered
John ran into the house.

Inagaki's study is notable for its bidirectional experimental design, which examined the acquisition process of both Japanese native speakers learning English and English native speakers learning Japanese. Bidirectional research provides reliable evidence for the influence of the asymmetric relationship if the expected asymmetry is found.

According to the asymmetric relationship, Japanese native speakers learning English should not have difficulty recognizing the grammaticality of English [manner-of-motion verb + goalPP] constructions. On the other hand, English native speakers learning Japanese will have a problem detecting that [manner-of-motion verbs + goalPP] is not grammatical in Japanese. Inagaki tested a total of 64 the native

speakers of English learning Japanese learners and the native speakers of Japanese learning English with a picture-cued grammaticality judgment task.

Table 3.2: Overview of the experimental stimuli of Inagaki (2001)

English		**Japanese**
[MannerV + PP]	=	?*[PP + MannerV]
[DirectedV + PP + *-ing*]	=	[PP + *te* + Directed V]
[DirectedV + PP + by *-ing*]	=	[PP + *te* + Directed V]
[DirectedV + PP + by *-ing*]	=	[*te* + PP + Directed V]
[MannerV + DirectedV + PP]	=	[*te* + PP + Directed V]

(97) a. English [MannerV + PP]: *John walked into the house*

b. English [DirectedV + PP + *-ing*]: *John went into the house walking*

c. English [DirectedV + PP + by *-ing*]: *John went into the house by walking*

d. English [MannerV + DirectedV + PP]: *John walked and went into the house*

e. Japanese [PP + MannerV]: ?**John-wa ie-no naka-ni aruita*

f. Japanese [PP + *te* + Directed V]: *John-wa ie-ni aruite itta*

g. Japanese [*te* + PP + Directed V]: *John-wa aruite ie-ni itta*

The results (in Table 3.3) showed that Japanese native speakers accepted almost all English sentence types. In the Japanese-sentence experiment, English native speakers also accepted all sentence types, failing to detect the ungrammaticality of [PP + Manner-of-motion Verb] in Japanese.

In both data sets, statistically significant interaction effects between L1 and sentence type were found. The asymmetric learnability is supported since a significant difference in [PP + Manner Verb] between English L1 and Japanese L1 groups was found. In sum, the asymmetry found in Inagaki's bidirectional study is exactly what the asymmetric relationship expects; that is, the second language

Table 3.3: Summary of the results in Inagaki (2001); 5-point Likert scale from -2 (unacceptable) to 2 (acceptable)

	ENGLISH SENTENCE TYPE			
GROUP	MANNV+PP	DIRV+PP+-ING	DIRV+PP+BY+-ING	MANV AND DIRV+PP
Japanese	1.24 (0.54)	-0.22 (1.18)	1.13 (0.78)	0.97 (1.01)
English	1.92 (0.16)	0.36 (0.55)	-0.51 (0.99)	0.40 (1.10)

	JAPANESE SENTENCE TYPE		
GROUP	PP + MANV	PP + TE + DIRV	TE + PP + DIRV
English	0.78 (1.00)	1.32 (0.57)	0.68 (0.97)
Japanese	-0.80 (0.82)	1.47 (0.51)	1.47 (0.51)

learners have difficulty with structures when the L1 accepts a wider range of grammatical constructions than the L2 does.

3.4.4 Bley-Vroman and Yoshinaga (1992) and Inagaki (1997)

Although Bley-Vroman and Yoshinaga (B&Y, hereafter) (1992) did not specifically investigate the asymmetric relationship between Japanese and English, a follow-up to their study by Inagaki (1997) using the same experimental design provides some insights into the asymmetric relationship between Japanese and English. Both B&Y (1992) and Inagaki (1997) looked at the acquisition of the dative alternation by Japanese native speakers learning English as L2.

(98) a. Mary gave/tossed/told/*shouted/*pushed Harry NP.

b. Mary gave/tossed/told/shouted/pushed NP to Harry.

B&Y (1992) were primarily concerned with two constraints on the dative alternation in English. The possession constraint rules out a non-potential possessor (such as PLACE) as the first NP in the double-object dative (98a). The best known example of this constraint is ”John sent the boarder/*border a package” and this constraint appears to be a universal one (”broad-range rules” according to Pinker

(1989)) on the dative alternation. Verbal semantic constraints are, according to B&Y (1992), English specific rules that require dativizable verbs to have certain semantic elements in their lexical structure. More specifically, B&Y (1992) looked at the sensitivity of the native speakers of Japanese learning English as L2 to the distinction between (i) ballistic motion (e.g., *toss, throw, kick*) and continuous causation of motion (e.g., *push, shove, pull*) and (ii) between manner-neutral information transfer (e.g., *tell*) and physical manner of speaking (e.g., *whisper, shout*). The results show that the native speakers of Japanese learning English as L2 failed to generalize the verbal semantic constraints with novel verbs and B&Y (1992) concluded that L2 learners can acquire only the broad-range language universal rules, but not language specific verbal semantic rules. This conclusion is on par with the asymmetric prediction - Japanese native speakers had difficulty in acquiring the narrow-range verbal semantic constraints that do not exist in their L1.

However, Inagaki (1997) reexamined B&Y's study and argued that Japanese does have verbal semantic constraints. B&Y (1992) argue that only the double-object dative exists in Japanese since both the recipient argument and the theme argument are subcategorized in the dative-alternation verbs. This assumption is based on the fact that only the subcategorized argument can be the subject of a passivized sentence. In (99), PLACE-*ni* cannot be passivized because *-ni* in PLACE-*ni* is not the dative case marker and, thus, PLACE is not subcategorized by the verb (like the possession constraint rule in English).

(99) a. Mary-ga John-ni/PLACE-ni Hon-wo nageta.
Mary-NOM John-DAT/PLACE-ni book-ACC throw-PAST
John threw a book to Mary.

b. John-ga hon-o nage-rare-ta.
John-NOM book-ACC throw-PASSIVE-PAST

John was thrown a book.

c. *PLACE-ga hon-o nage-rare-ta.
PLACE-NOM book-ACC throw-PASSIVE-PAST
PLACE was thrown a book.

d. Hon-ga John-ni nage-rare-ta.
book-NOM John-by throw-PASSIVE-PAST
The book was thrown to John.

Ingaki (1997) argues that B&Y's conclusion is not warranted since a careful examination of several verb types reveals that Japanese also show some sensitivity to the verbal semantic constraints (see (100) from Inagaki (1997)).

(100) a. *John-ga Mary-ni hako-o shi-ta/hakon-da/hii-ta/age-ta.
John-NOM Mary-DAT box-ACC push/carry/pull/lift-PAST
John pushed/carried/pulled/lifted a box to Mary.

b. John-ga Mary-ni booru-o nage-ta/ket-ta
John-NOM Mary-DAT ball-ACC throw/kick-PAST
John threw/kicked a ball to Mary.

Inagaki argues that, contra to B&Y (1992), both Japanese and English obey verbal semantic constraints. The two languages differ, however, with respect to the compatibility between the verbal semantic classes and the dative construction as shown in (101).

(101) Grammaticality of verb semantic classes in the double-object dative construction

a. Throw verbs (e.g., *throw, kick*): grammatical in both languages

b. Push verbs (e.g., *push, carry*): ungrammatical in both languages

c. Tell verbs (e.g., *tell, teach*): grammatical in both languages

d. Whisper verbs (e.g., *whisper, shout*): grammatical in Japanese but not in English

Table 3.4: Means of grammaticality rating of the verbs in the double-object dative construction by Japanese native speakers learning English (Except from Inagaki (1997) Table 4)

	Verb Class	Novel verb	Real verb	Mean
Native speakers	**Throw class**	1.77 (1.19)	1.41 (1.38)	1.59 (1.29)
	Push class	0.91 (1.80)	-0.72 (2.16)	0.09 (2.14)
	Tell class	2.03 (1.16)	2.78 (0.38)	2.41 (0.93)
	Whisper class	0.19 (1.86)	-0.53 (1.87)	-0.17 (1.88)
	Verb Class	Novel verb	Real verb	Mean
Japanese speakers	**Throw class**	0.11 (1.71)	-1.77 (1.18)	-0.94 (1.68)
	Push class	-0.19 (1.49)	-2.09 (1.11)	-1.14 (1.62)
	Tell class	0.91 (1.60)	2.19 (1.34)	1.55 (1.60)
	Whisper class	-0.55 (1.74)	-0.73 (1.86)	-0.64 (1.79)

The results of Inagaki (1997) do not show the pattern expected by the asymmetric relationship. Japanese speakers successfully distinguished the difference between Tell verb class and Whisper verb class, but failed to distinguish Throw verb class from Push verb class. Inagaki (1997) suggested that the frequency of exposure might have contributed to the unexpected results.

3.4.5 Montrul (2001a, 2001b)

Montrul (2001c, 2001b) investigated the acquisition of causative verbs in English, Spanish, and Turkish[1]. Like Inagaki (2001, 2002), the study was conducted bi-directionally and native speakers of the three languages were tested on causative sentences in the different L2s. The three languages employ different morphological markers for causative verbs. As shown in (102) and (103), English causative verbs

[1]Montrul (2001b) also recruited Japanese native speakers, but I will not include them in my discussions here as the number of subjects is far fewer than the subjects of the other languages (only 9 Japanese subjects)

are predominantly labile, Spanish employs the anti-causative morpheme *-se*, and Turkish uses both the causative morpheme *-Dir* and the anti-causative morpheme *-li*.

(102) Turkish

a. the causative suffix *-DIr* (and its allomorphs)

i. Gemi bat-miş.
ship sink-past
The ship sank

ii. Düsman gemi-yi bat-ır-mış
enemy ship-ACC sink-CAUS-past
The enemy sank the ship/mae the ship sink

b. the anticausative morpheme *-Il* (polyfunctional and homophoneous with the passive morpheme)

i. Hırsız pencere-yi kır-dı
thief window-ACC break-past
The thief broke the window

ii. Pencere kır-ıl-dı
window break-pass-past
The window broke

c. psych verb

i. Arslan aucı-yı kork-*ut*-muş
lion hunter-ACC fear-CAUSE-past
The lion frightened the hunter

ii. Aucı kork-muş
hunter frighten-past
The hunter got frightened

(103) Spanish

a. change-of-state verb: the anticuasative (reflexive clitic) *se* (polyfunctional in impersonal passive)

   i. El ladrón rompió la ventana

      The thief broke the window

   ii. La vantana <u>se</u> rompió

      The window broke

b. psych verb: can be paraphrased with *hacer* 'make'

   i. El león asustó al cazador.

   ii. El cazador <u>se</u> asustó

   iii. *El cazador asustó

   iv. El león *hizo* asustar(se) al cazador
   the lion made frightened the hunter

Native speakers of each language were tested on the acceptability of different forms of causative sentences (i.e., causative, inchoative, and peripheral causatives) with a picture-judgment task. The major findings were that (i) Spanish native speakers preferred the peripheral causative (e.g., *The window got broke*.) significantly more than the other language groups, (ii) Turkish speakers did not show any influence of the causative and anti-causative verbs in Turkish (L1) on the acceptability of verbs in L2, and (iii) English speakers accepted intransitive verbs with the anti-causative morpheme in Spanish, but did not have problems with the causative and anti-causative verbs in Turkish. Montrul (Montrul, 2001c, 2001b) concludes that the L2 learners transfer their surface morphological markers, which causes non-native-like judgments on the causative constructions. This conclusion is akin to the asymmetric relation in that the transfer of causative or anti-causative morphemes is the primary problem for L2 learners rather than the acquisition of

new causative or anti-causative morphemes that do not exist in L1 (but cf. Eckman's (Eckman, 1977, 2008) Markedness Differential Hypothesis)

3.4.6 Gabriele (2005,2009)

Finally, Gabriele (2005, 2009) looked at the acquisition of aspectual markers English *-ing* and Japanese *-teiru* in her bidirectional L2 study. Following McClure's analysis of the aspectual markers in English and Japanese (McClure, 1995), Gabriele expected a gap in the interpretation of the [achievement verb + aspectual marker] construction in the two languages. In English, an achievement verb marked with *-ing* is interpreted as progressive, as is an accomplishment verb. However, in Japanese, the accomplishment verbs in the *-teiru* construction is construed as progressive, while an achievement verb with *-teiru* generates a resultative interpretation.

(104) The interpretation of accomplishment and achievement verbs with the aspectual marker

  a. English *-ing*

    i. **accomplishment**: "*painting a portrait*" → progressive

    ii. **achievement**: "*arriving*" → progressive

  b. Japanese *-teiru*

    i. **accomplishment**: "*e o kai teiru*" → progressive

    ii. **achievement**: "*tsui teiru*" → resultative

Gabriele argues that learning the new L2 grammar is not problematic in L2 acquisition. The real difficulty of SLA is to unlearn the L1 grammar. Thus, in

the case of the acquisition of the aspectual morpheme, the L2 learners (of both English and Japanese) should have difficulty with achievement verbs since the interpretation of those verbs with the aspectual marker is different from that of their L1.

The data showed significant main effects of context (i.e., complete (resultative interpretation) or incomplete (progressive interpretation)) and interaction effects between context and proficiency levels. In both language groups, there were main effects of the proficiency level in the accomplishment verbs whereas no main effects of the proficiency level were found with achievement verbs. Thus, both English and Japanese learners, regardless of their proficiency levels, successfully identified the correct context for the [achievement verb + aspectual morpheme] construction. The performance with the achievement verbs, however, was worse, especially for the lower proficiency groups. Thus, although she did not make a direct connection between this asymmetric difficulty and learnability due to the asymmetric relationship, Gabriele concludes that unlearning is more difficult than learning a new construction is supported.

3.5 SUMMARY

To summarize, with a few exceptions, most acquisition studies of L2 English and Japanese show asymmetric differences predicted by the learnability of the asymmetric relationship. Studies conducted in the bidirectional framework provide especially strong evidence for the influence of the asymmetric relationship.

CHAPTER 4

FREQUENCY EFFECTS IN SECOND LANGUAGE ACQUISITION

4.1 INTRODUCTION

An increasing number of researchers have investigated the role of input in language acquisition. Focusing on the effects of input frequency, studies of L1 acquisition have examined, among other phenomena, the latency of lexical retrieval (Forster & Chambers, 1973), the transitivity of verbs (Brooks & Zizak, 2002; Brooks, 2004; Ambridge et al., 2008), and the passive construction (Brooks & Tomasello, 1999b). Computational studies of language acquisition have looked at contextual features for the dative alternation (Bresnan, Cueni, Nikitina, & Baayen, 2007), the acquisition of semantic verb classes (Lapata & Brew, 2004), verbs' selectional restrictions on direct objects (Resnik, 1996), and irregular past morphemes (Rumelhart & McClelland, 1986). Although these studies implicitly assume that input, as opposed to hard-wired linguistic knowledge, is the primary cause for language learning, there is a wide range of assumptions as to what types of frequency are necessary for language learners to successfully acquire language. To consider this question, I present a short discussion exploring two different frequency effects:

entrenchment and *preemption*. The survey shows that the frequentist's account of language acquisition is problematic with low-frequency and unseen tokens, which Zipf's law predicts to be prevalent in linguistic distributions.

4.2 Frequency effects on language acquisition

A large body of literature suggests that there is an effect of frequency on L1 acquisition. Studies on the acquisition of verbs by young children show that early Age-of-Acquisition (AoA) words such as *come, hit, take* and *disappear* are more frequent than their semantically equivalent late-AoA words *arrive, strike, remove* and *vanish*. Research on the lexicon has attested to the frequency effect and suggests that the lexicon stores not only lexical features but also information related to frequency. In lexical decision experiments, high-frequency words are accessed faster than low-frequency words (Forster & Chambers, 1973) even after controlling for the length and phonological complexity of words. For example, among *clock*, *doctor*, *hut*, and *urn*, the first two high-frequency words are processed faster than the latter low-frequency words. This simple frequency effect appears in both auditory and visual tasks (Bradley & Forster, 1987).

The effect of lexical frequency is also attested in high-level language processes such as sentence processing. Foss (1969) has shown that a sentence with a low-frequency synonym is processed more slowly than an equivalent sentence with a high-frequency synonym. Frequency is also at work in prepositional phrase attachment. In addition to the global and heuristic preference to attach a prepositional phrase to the lower phrase in English (i.e., *Minimal Attachment*), associative frequency between the verb and the prepositional phrase also influences the res-

olution of the PP attachment ambiguity. At the extreme end of the frequency effects on the PP attachment resolution, Hindle and Rooth (1993) demonstrated that measures of association among verb, preposition, and noun derived from a large corpus alone can be used to predict the human judgment of PP attachment with high accuracy.

The effect of simple frequency is evident also in the historical diachronic change of language. For example, Lieberman et al. (Liberman, Michel, Jackson, Tang, & Nowak, 2007) conducted corpus analyses of diachronic development of irregular verbs from Old English to Modern English. While the number of irregular forms decreased over the history of English, the regularization of irregular verbs did not occur randomly. The high-frequency irregular verbs typically survived and still exist in Modern English (e.g., *be, have, come, do, find, get, give, go, know, say, see, take* etc.). In contrast, the low-frequency irregular verbs were more likely to be regularized due to the selection process and to disappear in the developmental process of the English language (e.g., *stroke, suck, swallow, wash, weigh, yell, yield, bark, bellow* are regularized, but *wake, weave, weep, wind, bid, dive, heave* are not.). Pagel et al. (Pagel, Atkinson, & Meade, 2007), in a synchronic cross-linguistic study, supported the hypothesis that low-frequency irregular verbs have a higher regularization rate than high-frequency ones. Their analyses of contemporary English, Spanish, Russian, and Greek show a negative correlation between verb frequency and the rate of verb meaning replacement (i.e., mismatch of meanings among the four languages). This suggests that the meanings of low-frequency verbs tend to be replaced with new meanings while high-frequency verbs are less subject to such a change.

Bybee (Bybee & Hopper, 2001; Bybee, 2003, 2008) argues that frequency ef-

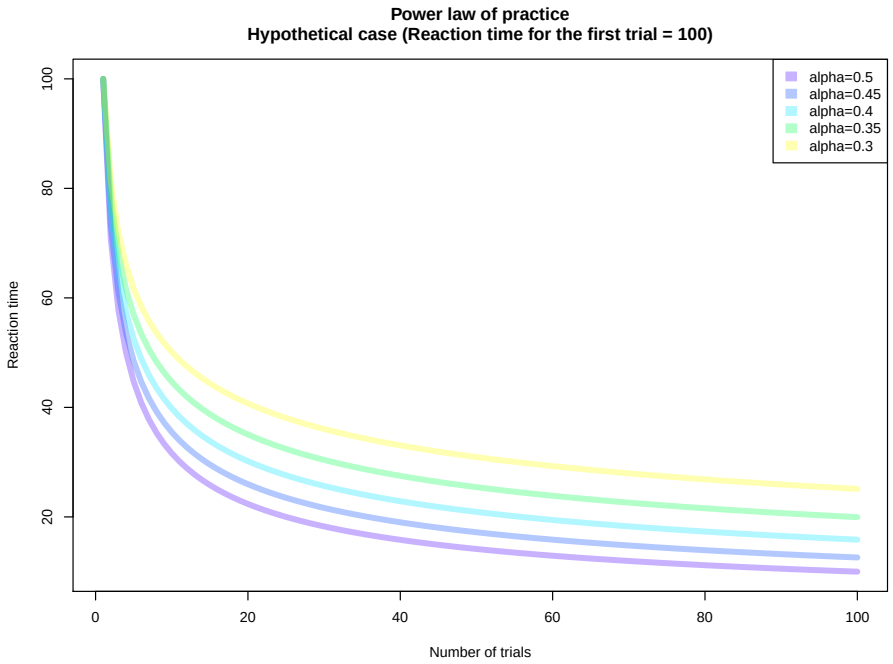
fects on diachronic change reflect the fact that grammar is formulated by the cognitive organization of learners' experience. In her strongly usage-based account, Bybee argues that high-frequency tokens found in a construction (e.g., *quedarse inmóvil* "become immobile" in [verb + adjective] construction in Spanish) undergoes a process called grammaticalization, in which the high-frequency type serves as the prototype for the meaning and attracts other tokens that are semantically similar to the prototype (e.g., *quedarse parado* "become stationary"). Bybee (2006) showed that native speakers of Spanish preferred a low-frequency phrase (e.g., *quedarse parado*) that has a high-frequency prototype (i.e., *quedarse inmóvil*) more than a low-frequency phrase that lacks a high-frequency phrasal synonym (e.g., *quedarse orgullosisimo* "become proud").

4.3 The Power Law of Practice and the Zipfian distribution

Among cognitive psychologists, the effect of frequency within experimental settings is known as the *Power Law of Practice*, which says that the frequency effect on performance of a particular task will diminish as the subject repeatedly performs task (Newell & Rosenbloom, 1980). The Power Law of Practice is an empirical model of human learning capacity that has been repeatedly attested in studies on memory.

(105) $T_n = T_1 \times n^{-\alpha}$

(where $\alpha \approx 0.4$, T_n = the time to perform a task after n trials, T_1 = the time to perform a task on the first trial, and n = the number of trials)



As (105) shows, the Power Law of Practice shows that the effect of practice on performance decreases and will reach asymptote as the frequency increases. Newell and Rosenbloom (1980) found that α usually averages about 0.4 in various memory experiments, and they proposed that chunking of information must happen in order to achieve a higher level of learning.

The Power Law of Practice highlights two simple, yet often ignored facts about the frequency effect. First, it shows that the frequency effect should not be measured on an interval scale. While frequency is a discrete, countable measure, a fixed interval between two counts does not have equal psychological significance. In memory experiments, the frequency effect of a single additional exposure is large when the frequency is small (e.g., comparing the exposure to a token twice and three times) while it is almost negligible when the frequency is large (e.g., comparing 100 exposures to 101 exposures). For this reason, in most experimental studies, frequency is converted to the logarithmic frequency to average out uneven

effects of frequency at the high- and low-frequency types.

Second, the Power Law of Practice should be considered with respect to *Zipf's distribution*, a linguistic distribution known to exist in word frequency (Baayen, 2001, 2008a), n-grams (Yang, 2010) and abstract grammatical units such as phrase-structure rules in the Penn TreeBank and verb-object constructions in CHILDES (Yang, 2008, 2010). The Power Law of Practice and the Zipf's distribution together guarantee the acquisition of high-frequency items without any problem, but predict a large number of low-frequency items that do not benefit from the effect of frequency.

Zipf's Law (Zipf, 1949) states that the rank of a word, $r(w)$ (with the most frequent word assigned rank 1, etc.), and the frequency of a word, $f(w)$, are inversely proportional to a constant C. Zipf's Power Law includes an exponential coefficient α that determines how quickly frequency decreases with rank, but it is often ignored since α depends on the type of linguistic distributions and should be calculated for each data set. Thus, for example, assuming α is 1, if the most frequent word ($r(w) = 1$) has a frequency of 60,000 ($f(w) = 60,000$), then the second most frequent word is expected to have a frequency of 30,000, and the frequency of the third most frequent word is expected to be 20,000.

(106) Zipf's distribution (from Baayen (2001))

a. Zipf's power law
$f(w) = \frac{C}{r(w)^{\alpha}}$
where $f(w)$=frequency of the word, $r(w)$=rank of the word, C=constant

b. Zipf's power law (logarithmic version)
$\log f(w) = \log C - \alpha \log r(w)$

c. The tails of Zipf's power law do not match with empirical data → Zipf-Mandelbrot's adjustment (Mandelbrot, 1953)
$f(w) = \frac{C}{(r(w)+\beta)^{\alpha}}$
α is often close to 1 for word frequency distributions

When transformed into a logarithm (see (106b)), α becomes a coefficient of the log of word rank and constant C becomes an intercept of a simple linear regression form. So, in the logarithmic version of Zipf's power says, α is the slope determining how fast log frequency decreases with log rank, and $\log C$ is intercept (e.g., log rank 0 = the most frequent word). The parameters α and C vary depending on the type of data and can be estimated with the least squares method (i.e., simple regression). Later, Mandelbrot (1953) proposed another parameter β in Zipf's Law to capture the deviances in the two tails of the Zipfian curve (see (106c)). The Zipf-Mandelbrot formula is the simplest adjustment among various proposals for adjustments, and it retains the original idea of Zipf's Power Law (Baayen, 2001) and is applied to various computational techniques such as smoothing[1] and the estimation of a speaker's vocabulary size and growth over time (Baayen, 2001).

To illustrate the Zipf's distribution in actual language data, I plotted children's language input (the mothers' utterances in the CHILDES corpus (MacWhinney, 2000)) at different developmental stages (2-4 years old) in Figures 4.1 to 4.3. Three-thousand words were randomly selected from the CHILDES corpus for each development stage. Frequency plots show the frequency counts with respect to the rank, and the frequency spectrum (Baayen, 2001; Evert & Baroni, 2007) plots the frequency count, m, and the frequency of each frequency count, $V(m)$. The figures

[1]e.g., Good-Turning method (Good, 1953)), which estimates the frequency of $r(w) = V + 1$ and $f(w) = 0$ (where V is vocabulary size or the number of distinct types in the sample); that is, frequency of words that did not appear at all in the corpus.

clearly exhibit the prevalence of Zipf's distribution at all developmental stages of L1 acquisition.

The existence of the Zipf's distribution in the children's input data means that the child finds one specific type of word very frequently in their input. In the simplest case, the frequency of the second-most-frequent word is almost half of the frequency of the most frequent word, and the third-most-frequent word is roughly a quarter of the frequency of the most frequent word. From the perspective of the least-frequent types, it can be said that a large number of words that the child encounters are very infrequent, many of which are *hapax legomena* (words appearing only once in the corpus).

In the data for 2-year-olds (Figure 4.1), for example, the frequency spectrum shows that more than 250 types appeared only once. To be exact, there were 596 types in the randomly sampled data (roughly 3,000 tokens), of which 254 types appeared only once (i.e., 43% was the hapax legomena). Similarly, 47% of the types in the 3-year-old data (299 types among a total of 636 types; see Figure 4.2) and 39% of the types in the 4-year-old data (246 types among a total of 625 types; see Figure 4.3) were the hapax legomemena. In short, the hapax legomena account for a significant proportion of the language input in child-directed speech.

The Power Law of Practice and Zipf's Power Law leave us with a critical problem in language acquisition from the frequentist's perspective. On one hand, the Power Law of Practice states that learners benefit less and less when the same linguistic type is repeated. Zipf's Law, on the other hand, tells us that high-frequency words are extremely high-frequent and, therefore, by virtue of the Power Law of Practice, the language learner will eventually reach asymptote, or a stable stage,

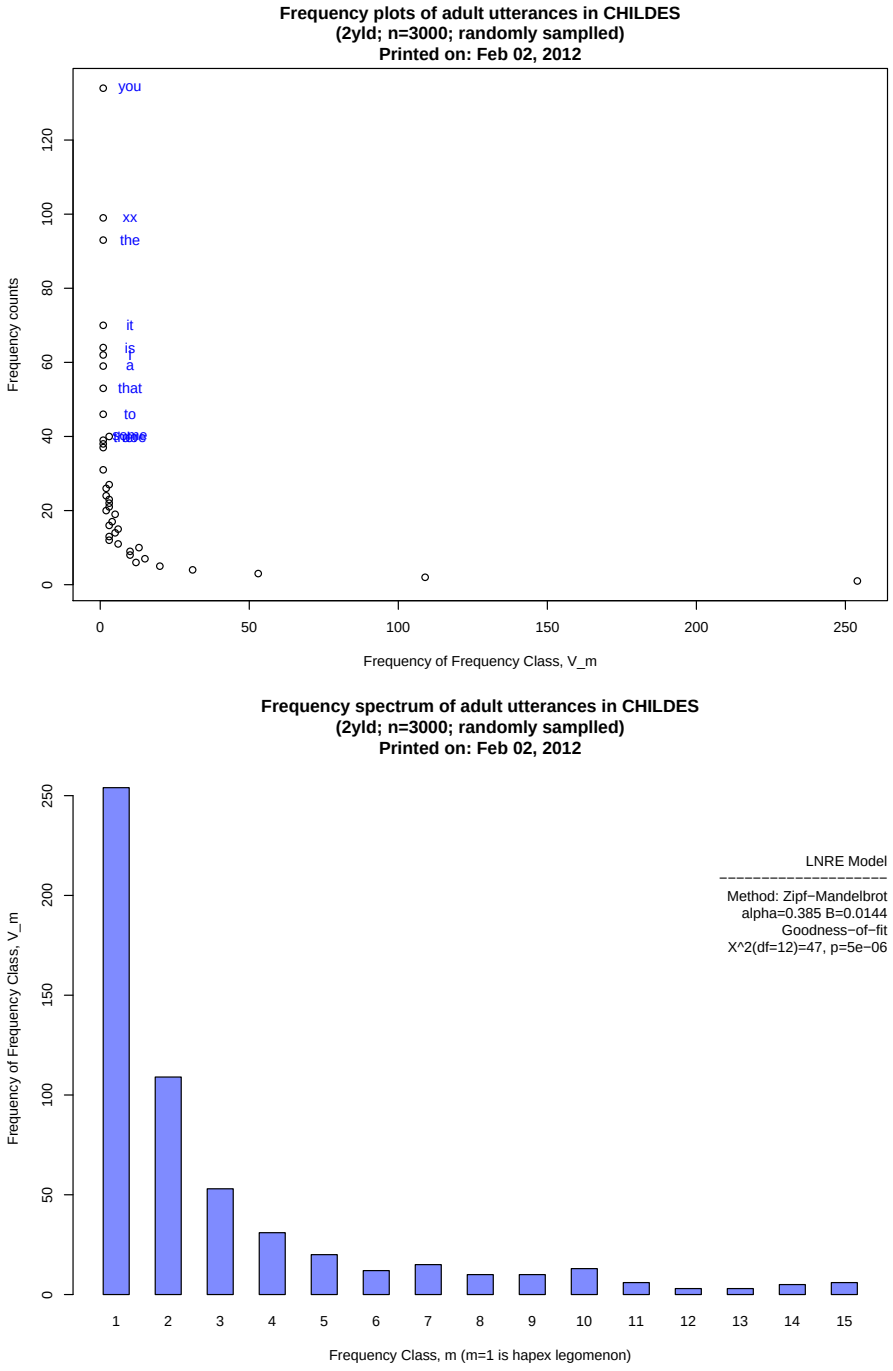


Figure 4.1: Distributions of adults' utterances in the CHILDES corpus (adults' utterances to 2-year-old children)

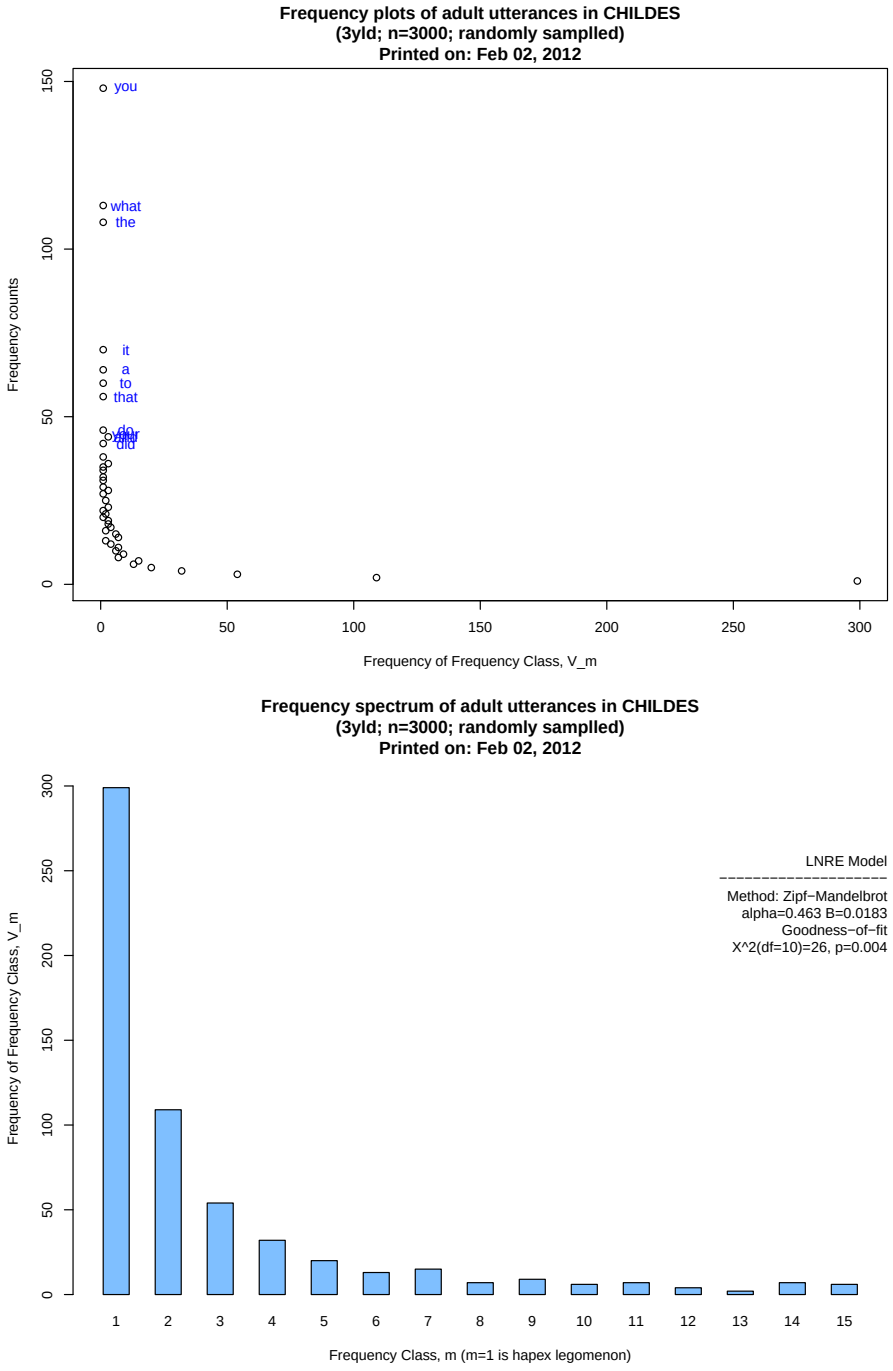


Figure 4.2: Distributions of adults' utterances in the CHILDES corpus (adults' utterances to 3-year-old children)

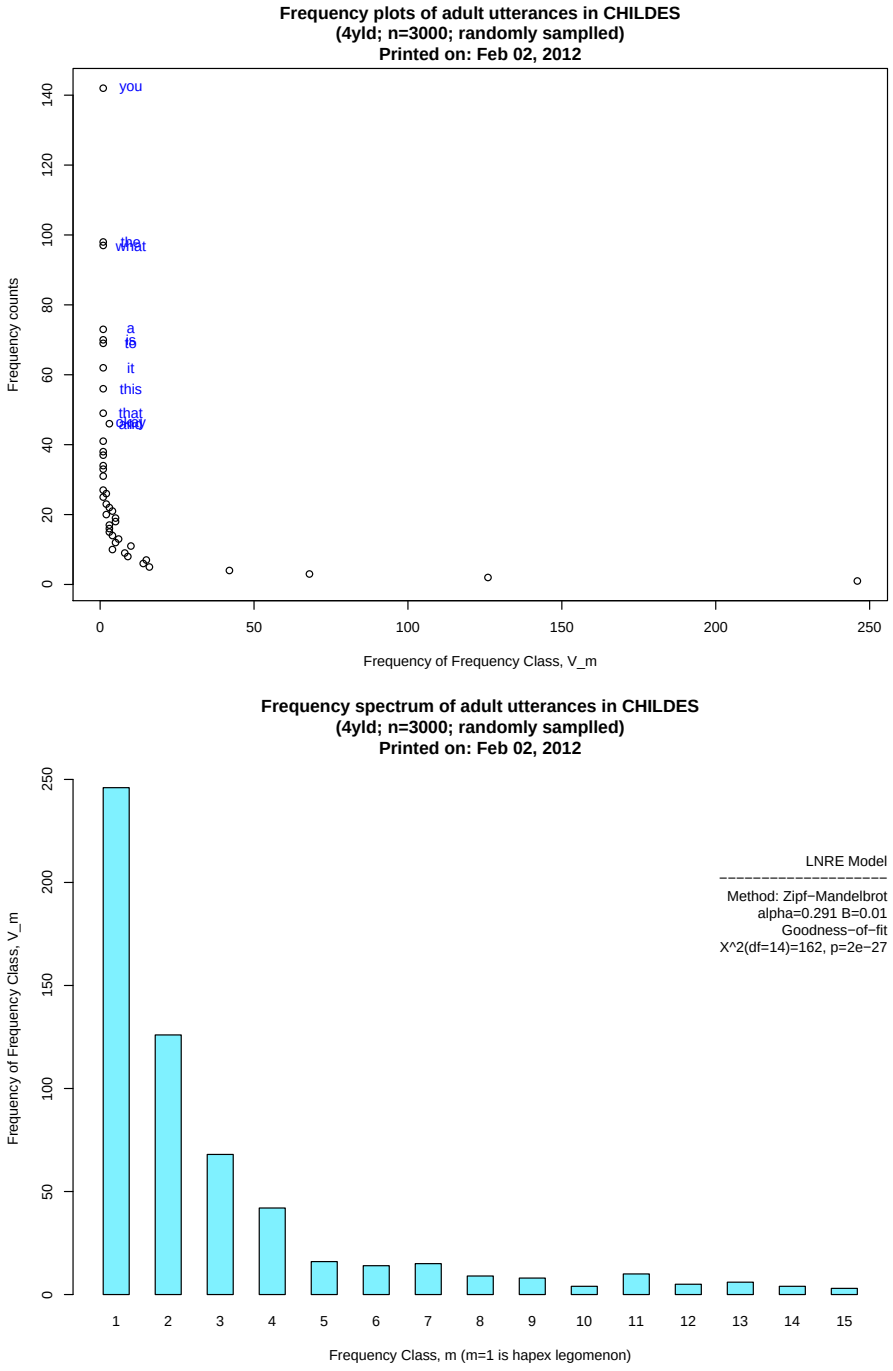


Figure 4.3: Distributions of adults' utterances in the CHILDES corpus (adults' utterances to 4-year-old children)

with high-frequency types. Thus, if one focuses only on the high-frequency types, there is a good reason to believe that the language learners can acquire a language only through the exposure to language input. However, the central problem of language acquisition is its generalizability to low-frequency or unseen types, and Zipf's Law says that a significant proportion of the language input consists of such low-frequency types. In other words, while those two laws ensure the acquisition of high-frequency words, the language learner receives a large number of words that appear only once (or even never) in their experience. Thus, the simple frequency effect alone fails to account for all aspects of language acquisition. There must be some other mechanisms that ensure the acquisition of low-frequency types.

It should be noted that recent studies (Yang, 2008, 2010) show that n-grams (Yang, 2010), phrase-structure rules in the Penn TreeBank, and the verb-object constructions in CHILDES (Yang, 2008, 2010) also exhibit Zipfian-like distributions. Thus, the pattern that low-frequency types account for the large proportion of a linguistic distribution is not unique to the word distribution, but is present in many other linguistic distributions, presumably also in the distribution of the verb semantic classes. In other words, it is predicted that one or two prototypical verbs frequently appear in each verb class whereas the rest of the verbs that belong to the same verb class appear very infrequently or even only once. A critical challenge for frequency-based language acquisition theories is the acquisition of low-frequency verbs and, therefore, research focusing on the frequency effect must be accountable for the acquisition of low-frequency verbs (e.g., *crash* in the change-of-state verb class as opposed to *break* or *moan* in the laugh verb class as opposed to *laugh*). While the total frequency of these low-frequency verbs may not be as large as that

of the high-frequency verbs, the low-frequency verbs account for a much larger proportion of the verb types in each verb class. From the frequentist's perspective, it is expected that language learners (including native speakers) will diverge on their grammatical judgment of low-frequency verbs since the number of exposure to low-frequency verbs is not large enough to reach asymptote.

4.4 The Entrenchment Hypothesis

The *Entrenchment Hypothesis* is an extension of the simple frequency effect to the acquisition of argument structures. The entrenchment hypothesis predicts that frequent exposure to a verb alleviates the difficulty of learning and, therefore, high-frequency verbs are easy to acquire. As discussed above, ample evidence suggests that more frequent exposure to a target token facilitates its acquisition and the same applies to the acquisition of its argument structure.

Brooks et al. (Brooks et al., 1999) found that the frequency of a verb influences its usage in correct argument structures. They investigated 3-, 5-, and 8-year-old children's overgeneralization patterns with early AoA verbs (e.g., *come, hit, take* and *disappear*) and late AoA verbs (e.g., *arrive, strike, remove* and *vanish*). Four different kinds of actions were presented to the children who were later asked to describe actions by using the target verbs. In children's responses, the number of overgeneralized uses of verbs (e.g., *The cow's gonna arrive it.*, *It's hitting.* etc.) was counted. The results showed that, in all age groups, children tend to overgeneralize the late AoA verbs (i.e., less-frequency verbs) more often than the early AoA verbs (i.e., high-frequency verbs), supporting the prediction made by the entrenchment hypothesis.

The same pattern was observed in subsequent studies with different age groups and different experimental methods. Theakston (2004) used a grammatical judgment task with 5- and 8-year-old English-speaking children and adults. The participants were asked to rate English sentences, some of which were in incorrect transitive constructions (e.g., **She came me to school.*, **She arrived her to the park.* etc.). A significant difference was found between high-frequency and low-frequency verbs such that both children and adults accepted ungrammatical sentences containing low-frequency verbs more often than those containing high-frequency verbs.

Finally, Ambridge et al. (Ambridge et al., 2008) explored Pinker's semantic verb class hypothesis (1989) and Braine and Brooks' (1995) entrenchment hypothesis in a picture-cued grammatical judgment experiment. Subjects from three different age groups (5-6 year-olds, 9-10 year-olds, and adults) were asked to make judgments about the grammaticality of sentences presented in either the transitive or intransitive construction. Each sentence contained either a high-frequency verb (e.g., *fall*, *disappear*, and *laugh*), a low-frequency verb (e.g., *tumble*, *vanish*, and *giggle*), or a novel verb. Three verb semantic classes (i.e., Fall verbs, Disappear-verbs, and Laugh-verbs) are not allowed in the transitive construction. Therefore, Ambridge et al. predicted that their subjects would reject all of the verbs in the transitive sentences. Following the entrenchment hypothesis, Ambridge et al. also predicted that high-frequency verbs would be the easiest to reject in the transitive construction, followed by low-frequency verbs, and that the novel verbs would be hardest to reject. The researchers found significant main effects of verb semantic class and sentence type and on the interaction effects between two. They concluded that their subjects successfully identified grammatical constructions and ungrammatical ones across all three verb classes. The data indicated that it was

easier for the language learners in all age groups to make grammaticality judgments when verbs were high-frequency than when they were low-frequency or novel.

To summarize, the entrenchment effect predicts that the verb types that the language learner encounters more frequently are acquired faster than less-frequent types. Several experimental studies found that both children and adults accepted low-frequency verbs in ungrammatical constructions more than high-frequency verbs, supporting the entrenchment effect on the acquisition of the argument structure of verbs.

These results leave us with a question about low-frequency items; in other words, the results must be understood from two contrasting views. From the perspective of a usage-based theory of language acquisition (Bybee, 2006, 2008; N. C. Ellis, 2002; Tomasello, 2000), one can argue that these results are evidence of the entrenchment effects as a primary mechanism of the acquisition of the verb's argument structures. However, from a more conservative view (Ambridge et al., 2008), one can argue that it is evidence that the entrenchment effect exists along with other cognitive or linguistic generalization systems for the acquisition of the verb's argument structure. The frequency effect on high-frequency items cannot be conclusive evidence for the usage-based account. It is so because ample evidence shows that the frequency effects exist in a wide range of general cognitive domains (e.g., memory, motor skills etc.), which children must rely on at least to some extend when acquiring language. Few researchers would claim that language acquisition can take place without memory and, if so, it is not surprising at all to find the frequency effects in high-frequency items. Thus, the central problem of language acquisition in terms of frequency is low-frequency items. The

most significant aspect of language acquisition is that children successfully learn language in an extremely uniform manner with minimal (or even no) exposure to many of the words of the target language. Therefore, any claim about language acquisition must have some account of low-frequency forms.

4.5 The Preemption Hypothesis

The preemption hypothesis is another type of frequency effect that stems from the mapping between linguistic form and meaning. The preemption hypothesis predicts that linking one form with one meaning prevents alternative mappings between the form and other meanings. Several psycholinguistic theories such as *Blocking* (Bowerman, 1989), and the *Principle of Contrast* (E. Clark, 1987), the *Mutual Exclusivity Hypothesis* (Markman, 1989), and the *Competition Model* (E. Bates & MacWhinney, 1989) propose ideas similar to the preemption effect.

One clear example of the preemption effect is seen in the irregular past and irregular plural morphemes in English. The distribution of English irregular morphemes is arbitrary and unpredictable. For example, the plural of *tooth* is *teeth* but the same analogy does not apply to *booth* whose past tense is not *beeth*. By the same token, the past form of *tell* is *told* but the past tense of *yell* is not *yold*. In spite of the arbitrariness of irregularity, children are able to acquire the irregular morphemes after only a brief overgeneralization stage. Pinker (1989) claims that preemption effects make the acquisition of irregular morphemes tractable. Since there is only one form of the plural or past morpheme for each noun and verb in English, only a small amount of exposure to one correct usage (e.g., *teeth*) helps the learner induce that its alternative form (e.g., *tooths*) is unacceptable.

Lexical polysemy is another example of the preemption effect at work. Degrees of polysemy vary since some polysemous expressions have a larger number of senses than others. According to the preemption effect, seeing a word for one sense preempts the other possible senses, so it naturally follows that words with a large number of possible senses are more difficult to learn than words with a few senses. For example, in WordNet (Miller, Beckwith, Fellbaum, Gross, & Miller, 1993), *house* has twelve senses as a noun while *apartment* has only one sense.

(107) senses of *house* (only the first five senses)

a. a dwelling that serves as living quarters for one or more families (e.g., *He has a house on Cape Cod.*, *She felt she had to get out of the house.*)

b. the members of a business organization that owns or operates one or more establishments (e.g., *He worked for a brokerage house.*)

c. the members of a religious community living together

d. the audience gathered together in a theatre or cinema (e.g., *The house applauded.*, *He counted the house.*)

e. an official assembly having legislative powers (e.g., *A bicameral legislature has two houses.*)

f. aristocratic family line (e.g., *the House of York*)

(108) sense of *apartment*

a. a suite of rooms usually on one floor of an apartment house

Thus, between *house* and *apartment*, the preemption effect predicts that the language learner will have more difficulty in learning the word *house* than *apartment*.

Braine & Brooks (1995) extended this effect of preemption to the argument

structure of verbs. They proposed that exposure to a verb (e.g., *disappear*) in the intransitive construction (e.g., *The rabbit disappeared.*) first strengthens the prominence of the construction in the language learner's associative memory and facilitates the use of such a construction by the learner (the entrenchment effect). In addition, the association of the verb *disappear* with the intransitive frame blocks possible connections between *disappear* and the other frames (e.g., the transitive frame **The magician disappeared the rabbit.*). Therefore, the language learner can acquire the correct argument structure for the verb with a limited number of exposures to the verb in the correct argument structure.

Brooks and Tomasello (1999a) conducted an experiment, in which they presented two nonce verbs as descriptions of two different manner-of-motion actions to 2-, 4-, and 6-year-old English-speaking children. The verbs were presented either in a preemption construction or a non-preemption condition as shown in (109)

(109) a. the preemption condition (only transitive or intransitive constructions)
   i. The mouse is meeking the flower.
   ii. The car is tamming.
   b. the non-preemption condition (transitive + passive or intransitive + periphrastic causative)
   i. The mouse is meeking the flower. / The flower is getting meeked.
   ii. The car is tamming. / The doll is helping the car tam.

The participants' natural utterances were coded into the different constructions and the number of ungrammatical production was counted. The results show that only 4- and 6-year-old children performed significantly better with the verb

presented in the preemption condition than those in the non-preemption condition.

As discussed above, preemption is highly effective when a one-to-one mapping is established between a form and its meaning or frame, but it is not as powerful with polysemous expressions and homonyms whose forms are mapped to two or more interpretations or frames. The acquisition of argument structures suffers essentially the same kind of problem since some verbs are allowed to appear in multiple constructions. In distinguishing between causative and non-causative verbs, for example, the language learner cannot induce that *to vanish* is a non-causative verb just by hearing it in the inchoative construction (e.g., *The rabbit vanished.*) since some verbs (e.g., *splinter*) are allowed in both the causative and inchoative constructions. This issue is critical for the verb that appears in the learner's input only once (*hapax legomenon*) since a learner who has seen the verb *splinter* only once in the causative construction (e.g., *Andy splintered the soap box.*) may incorrectly deduce that *splinter* is not allowed in the inchoative construction (e.g., *The soap box splintered.* is not possible) by virtue of the preemption effects.

It should also be noted that the preemption effect is independent from the entrenchment effect, but they are different perspectives of frequency effect. In other words, in the example above, *apartment* is predicted to be easier than *house* by virtue of the preemption effect, but it still requires a certain amount of frequency to be entrenched in the learner's lexicon. Also, although the word *house* is predicted to be difficult on the basis of the preemption effect, the learner may eventually acquire *house* in all of the senses available to the word if they encounter the word frequently enough to entrench each sense. The empirical frequency data suggest that it is actually what is happening. Frequency counts in the Brown Corpus

show that the noun *house* appears 662 times and the frequency of *apartment* is 92. In other words, the difficulty of *house* is alleviated by virtue of the entrenchment effect. In fact, it is generally true that a word with a large number of senses is often a high-frequency word. Data from WordNet and the Brown corpus shows that correlation between the log-frequency and the number of senses of a word is quite high ($r = 0.51; t(11543) = 64.1; p < .001$). Thus, from the language learner's perspective, the degree of polysemy may not be as problematic as expected owing to simple entrenchment effects.

4.6 SUMMARY

The past research shows that frequency plays a significant role in the acquisition of various cognitive skills, including language. However, no conclusive evidence has been presented as to what kinds of frequency are at work in language acquisition. The effect of frequency must be considered along with the Zipfian distribution of language input since the Zipfian distribution suggests that low-frequency types are not negligible part of the language competence. Among various proposals for the frequency effect, the entrenchment hypothesis and the preemption hypothesis are reviewed in this section, for which the past studies present supportive evidence.

CHAPTER 5

RESEARCH QUESTIONS

5.1 RATIONALE FOR THIS STUDY

Before presenting the research questions for this study, I will make short discussion of error patterns in L2 English by the native speakers of Japanese. The purpose is to offer a rationale and argue for the importance of transitivity in L2, which has received too little attention for its significance for a successful acquisition of L2 English.

I will focus on English prepositions, which are known to be challenging for Japanese native speakers learning English. In this short discussion, I attempt to show that the transitivity of a predicate is an underlying factor for the errors of omission and extraneous prepositions in L2 English. I argue that L2 preposition errors consist of two fundamentally different error types – one caused by the issue of transitivity the other is the transfer of the spatial and temporal concepts in L1.

5.1.1 L2 preposition error: the puzzle

Prepositions are one of the most persistent causes of L2 errors, even among very advanced L2 speakers (Celce-Murcia, Larsen-Freeman, & Williams, 1999; E. Izumi, Uchimoto, & Isahara, 2005; Tono, Izumi, & Kaneko, 2004). In the field of computational linguistics, prepositions, especially their error patterns by L2 language learners have recently been the focus of computational modeling (Chodorow, Tetreault, & Han, 2007; Tetreault & Chodorow, 2008; Baldwin, Kordoni, & Villavicencio, 2009), but yet the modeling of L2 preposition errors is one of the least successful areas (Leacock, Chodorow, Gamon, & Tetreault, 2010).

Prepositions are characterized by several different properties. In terms of its syntactic properties, a preposition is either subcategorized by the predicate (e.g., *dispense with*, *chuckle over/at* etc.) or not subcategorized (e.g., *live in Japan*); valence-saturated (e.g., *pick it up*; also known as a *particle*) or valence-unsaturated (e.g., *in the park*) (Baldwin et al., 2009); and case-marking (e.g., *George gave a muffin to the pigeon.*) or not (e.g., *George sleeps on the sofa*). From the semantic perspective, prepositions are the central element of studies by cognitive linguists who argue that the spatial and temporal concepts of the human mind extends to a wide range of interpretations for each preposition (Tyler & Evans, 2003).

The problem of the preposition in the L2 English of Japanese native speakers is somewhat puzzling since the post-position in Japanese functions in a similar manner to the English preposition. Thus, preposition errors cannot be attributed to the lack of a corresponding conceptual system in L1, which is often argued as a source of the problem with the English articles (e.g., *a*, *the*, ϕ) for L1 Japanese learners. As for the preposition, in many cases, there are meaning correspondences

between the Japanese post-position and the English preposition (e.g., English *in* = Japanese *de*). Also, in his extensive analysis of Japanese post-positions using Zwicky's criteria (Zwicky & Pullum, 1983; Zwicky, 1985), Vance (1993) concluded that the Japanese post-positions and the English prepositions are morphologically equivalent classes except for the focus particles such as *wa*, *mo*, *dake*, and *bakari*.

In addition to their equivalent morphological behavior, both the Japanese post-position and the English preposition follow the same selectional process. Both the Japanese post-position and the English preposition are either selected by the head of a predicate (110) or licensed by the adjunct rules (111). For example, *into* in (110a) is selected by the head of the predicate *enter* (equivalently *-ni* is selected by *hairu* in Japanese). In the cases of (110), the selection of the preposition is determined by the predicate to which a preposition belongs irrespective of the complement of the predicate. On the other hand, prepositions in (111) are determined by the head of the adjunct phrase (usually a noun).

(110) Preposition selected by the head

a. by verb

enter into / -ni hashiru

b. by adjective

be notorious for / -de akumyo-takai

c. by (nominalized) noun

departure from / -kara no tabidachi

(111) Preposition as adjunct phrase

a. *in summer*, *on sight*, *with my dog*

natsu ni-, *mokuzen de-*, *tomodachi to-*.

Another similarity between English prepositions and Japanese post-positions is that they are both highly polysemous. For example, English *in* indicates location (e.g., *in Scotland*) and time (e.g., *in one week*). Similarly, Japanese *ni-* can indicate the location of an object (e.g., *tsukue ni* "on the desk"), path (e.g., *gakkou ni-* "to school") and time (e.g., *ichizi ni-* "at one o'clock"). Some adpositions present semantic idiosyncrasies, in which the spatial sense of the preposition is completely lost (e.g., *at first hand*, *on a shoestring* etc.). While adopositions are highly polysemous, each sense exhibits strong selectional restriction on the arguments with which it appears (e.g., English *into* and Japanese *e-* take only Path NP). Finally, in both English and Japanese, adpositions play a significant role in argument structures, especially in the various syntactic argument alternations (e.g., the locative alternation (Levin, 1993; Fukui, Miyagawa, & Tenny, 1985)) and in the predicate's transitivity (e.g., English *run into, knock down, sort out*, and *drop off* are all transitive, but *run out, branch off, freeze over* and *drop off* are intransitive).

5.1.2 L2 preposition error: the classification of errors

Despite the functional similarity, the acquisition of English prepositions is one of the most formidable challenges to non-native English speakers. Chodorow et al. (Chodorow et al., 2007) analyzed ESL grammar errors and estimated 29% of intermediate/advanced ESL students' errors are related to prepositions. Using their NICT JLE Corpus, an error-tagged spoken English corpus consisting of 130K words by 167 native Japanese speakers, other researchers (Tanimura, Takeuchi, & Isahara, 2004; Tono et al., 2004) also found that, among the total of 1624 prepositions errors, 587 (36.15%) are due to the misuse of prepositions (e.g., **They arrived to the town*), 168 (10.34%) are due to the insertion of incorrect prepositions (e.g.,

**They came to inside*), and 869 (53.5%) are the omission of prepositions (e.g., **He is fond this book*).

This classification of L2 preposition errors suggests that the problem with prepositions does not derive from a single source. The misuse of incorrect prepositions indicates that L2 learners have trouble identifying the appropriate preposition that fits the predicate. This type of error is qualitatively different from the omission and extraneous use of prepositions in which the L2 leaners fail to detect necessity or redundancy of the preposition.

I argue that the misuse-type of preposition error can be attributed to the conceptual transfer (Odlin, 2005, 2008) from L1 and the extraneous/omission-type error is caused by the incomplete acquisition of the predicate's transitivity. For example, Jarvis (1998) found that L2 learners have different preference for which preposition the use to describe motion and space, depending on their first language. Jarvis argues that such tendencies are evidence for L1 conceptual transfer, in which L2 learners transfer the way they carve up spatial concepts in L1 to L2. Between English and Japanese, this conceptual transfer may cause various misuses of the locational prepositions such as *the roof *on/over our heads* since there is no distinction between the spatial concepts of *on* and *over* in Japanese.

However, L1 concept transfer falls short in explaining the extraneous and missing types of preposition error. These errors have little to do with L1 conceptual transfer since they are caused by the failure to understand whether or not the preposition is necessary for the predicate. Examples of missing and extraneous prepositions are shown in (112).

(112) a. We discussed (*about) our plan.

b. You can talk *(about) our plan.

c. Dana married (*with) Joe.

d. Dana broke up *(with) Joe.

One way to analyze the extraneous and omission type of preposition errors is as L2 learners' failure to acquire the correct valency of the predicate. For cases of extraneous prepositions (i.e., (112a) and (112c)), L2 leaners may inaccurately think that the predicate is intransitive, which requires a transitive preposition to introduce the direct object. Then, the missing preposition (i.e., (112b) and (112d)) can be understood as a reverse case – they are generated based on the inaccurate assumption that predicates like *talk* are transitive, requiring no transitive preposition for the direct object.

In sum, preposition errors, one of the most formidable types of L2 errors, consist of two qualitatively different problems for L2 English speakers. On one hand, spatial concepts from the L1 influence the selection of prepositions in L2 English, which results in the use of inappropriate prepositions with the predicate. On the other hand, the problem of extraneous and omitted prepositions is better understood as a problem with knowledge of the predicate's valency – in other words, the L2 learners fail to acquire the correct transitive status of the predicate, which results in overuse and failure to use the preposition. Thus, the preposition errors reflect two different sources of difficulty in L2 acquisition. On one hand, the conceptual transfer from L1 influences the selection of prepositions in L2 English, resulting in the misuse of prepositions. On the other hand, the L2 speaker's incorrect understanding of the predicate's transitivity in English contributes to the extraneous/omission-type of preposition error.

5.2 RESEARCH QUESTIONS

The purpose of this study is to investigate the acquisition process of L2 English transitivity by native speakers of Japanese. Three major influences that are known or have been argued to influence L2 acquisition are considered in this study; that is, the verb's semantic class (Chapter 2), the asymmetric relationship between L1 and L2 (Chapter 3), and frequency of the verb (Chapter 4). The previous studies suggest that problems in L2 typically arise when the L1 grammar is a superset of the L2 grammar, and frequency effects have been proposed to influence this process (Ambridge et al., 2008). This study investigates whether or not the same pattern emerges in the second language learners. The research questions for the current study are as following:

(113) Research Questions

a. Where the verb semantic classes constitute a asymmetric relationship between English and Japanese (e.g., the exceptional causative and prototypical causative classes), can L2 learners acquire the usage of the construction that is a subset of their L1?

b. What is the role of frequency in this acquisition process?

More specifically, the following hypotheses are formulated for each class of verb semantic class.

(114) Research Hypotheses

a. Exceptional and Prototypical Causative Verb classes

- The causative verbs in English are subject to finer semantic constraints than those in Japanese and, therefore, the use of causative

verbs comprises a subset of that of Japanese. Japanese native speakers learning English are expected to face a stronger learnability problem when the asymmetric relationship in SLA holds (i.e., Exceptional Causative Verb class) than when no such relationship exits between L1 and L2 (i.e., Prototypical Causative Verb class).

b. Other verb classes

- The Hit-touch (pure transitive) verbs and the Laugh (unergative) verbs behave in a similar manner in English and Japanese. Similarly, the verbs in the Object-drop Verb class are allowed to have null-objects in both English and Japanese. Thus, no learnability problem derived from the asymmetric relationship is expected with those verb classes. However, Japanese native speakers learning English might overextend the null-object pattern to the Hit-touch verb. In such a case, Japanese native speakers will accept the Hit-touch verbs in the intransitive constructions. Similarly, the verbs in the Body-part Verb class in English and Japanese are allowed to be in both the transitive and interactive frames (e.g., *Aaron waved the flag. / Arron waved. / The flag waved.*), but the Japanese verb pairs are morphologically marked.

c. Frequency effect

- Everything else being equal, sentences with a high-frequency verb are easier for L2 learners to make native-like judgments than those with a low-frequency verb.

CHAPTER 6

METHOD

6.1 PARTICIPANTS

6.1.1 Participants

Twenty-six native English-speaking participants (control group) and 35 Japanese-speaking participants (focus group) participated in the experiment. Participants were recruited on three different campuses of the City University of New York (CUNY Graduate Center, Queens College, and LaGuardia Community College). The control participants were recruited on the same three school campuses and through the author's personal contacts. Recruitment was advertised through the Japanese student organization on each campus and through flyers posted on school bulletin boards. None of the control participants had background in linguistics. Participation was voluntary for both the experimental and focus group participants and $10 remuneration was provided for participation.

All participants for the focus group were native speakers of Japanese who used

Japanese as their primary language of instruction at least until high school. All the participants in the focus group had been in the U.S. for at least half a year at the time of the experiment and they were all learning English as a second language. Participants for the control group spoke English as their first language, although some spoke another language as a second language. All participants were 18 years of age or older, had grade-level literacy skills in their first language, and were able to read texts on a computer screen.

Participant demographics were mixed in terms of ethnicity, age, and educational and language background. For example, although the majority of participants were in the range of 18-39 years old, the average of the age range was slightly higher in the focus group. Education also varied from high school to the doctoral level with a slightly higher average in the focus group. A summary of the questionnaire about the participants' ethnic and educational background is presented in Table 6.1.

6.1.2 English proficiency

The English proficiency of the focus group participants was tested using the listening section of The Michigan English Language Assessment Battery (MELAB) (Testing and Certification Division English Language Institute, 2009) and self-evaluation of English proficiency in a questionnaire. The mean number of items correct on the MELAB was 35.51 out of a total of 45 items with a standard deviation of 4.94 and a standard error of 0.84 (see Figure 6.1).

Table 6.1: Summary of the questionnaire data

Ethnic Background	Native	Non-native
African American	8	0
Asian	2	0
Hispanic/Latino	3	0
Japanese	0	35
Other	5	0
White	8	0
Country of Birth		
Japanese	0	35
Others	4	0
United States	22	0
Gender		
Female	10	25
Male	16	10
Age		
under 20 yld	10	1
20-29 yld	10	14
30-39 yld	2	17
40-49 yld	1	2
50-59 yld	3	1
Highest Degree		
1. High School	19	11
2. Associates	4	9
3. Bachelors	3	10
4. Masters	0	4
6. Doctoral	0	1

Current Degree Sought	Native	Non-native
1. High School	3	1
2. Associates	9	10
3. Bachelors	6	6
4. Masters	0	4
5. Business or law	0	1
6. Doctoral	0	2
Handedness		
Both	2	0
Left-handed	2	1
Right-handed	22	34
Length of stay in the US		
0-1 year	-	9
1-2 years	-	4
2-3 years	-	6
4-5 years	-	4
more than 6 years	-	3
TOEFL		
100-160 (33-56)	-	7
161-220 (57-83)	-	9
221-250 (84-100)	-	3
251-280 (101-114)	-	4
351-280 (101-114)	-	1
EIKEN		
2nd grade	-	6
2nd (pre) grade	-	1
1st (pre) grade	-	4

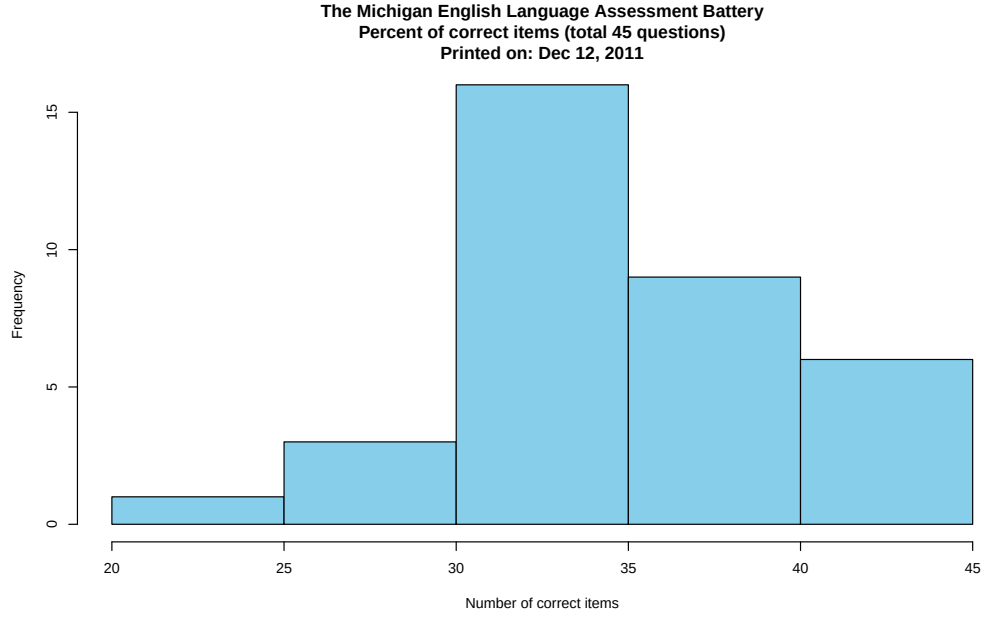


Figure 6.1: Histogram for the MELAB scores of the focus group (Japanese native speakers) participants

The questionnaire items concerning English proficiency were the number of completed ESL classes, the number of completed college-level classes in the U.S., duration of stay in the U.S., self-assessment of listening, speaking, reading, and writing skills in English, TOEFL score (only those who had taken the TOEFL exam), and *Eiken*[1] levels. The summary of the results of those questionnaire items is listed in Tables 6.1 and 6.2.

Table 6.2: Questionnaire data: self-reported English proficiency (non-native participants only)

Listening proficiency	BEGINNER	INTERMEDIATE	ADVANCED	(NEAR)NATIVE
	13	13	7	2
Reading proficiency	BEGINNER	INTERMEDIATE	ADVANCED	(NEAR)NATIVE
	10	19	4	2
Speaking proficiency	BEGINNER	INTERMEDIATE	ADVANCED	(NEAR)NATIVE
	16	12	6	1
Writing proficiency	BEGINNER	INTERMEDIATE	ADVANCED	(NEAR)NATIVE
	14	14	6	1

Table 6.3: Comparison between the TOEFL scores (CBT/iBT) and the mean numbers of correct items in MELAB

TOELF CBT (iBT)	MELAB
100-160 (33-56)	34.14
161-220 (57-83)	35.44
221-250 (84-100)	33.67
251-280 (101-114)	43.00
280-300 (115-120)	41.00

As shown in Table 6.4, the MELAB score was moderately to strongly correlated with the duration of stay in the U.S., TOEFL scores, and the self-assessment measures ($r = 0.40 - 0.57$) and all correlations were significant ($p < 0.01$). The other questionnaire items (i.e., ESL classes, college-level classes, and Eiken) were not

[1]Test of Practical English Proficiency administered by the Ministry of Education in Japan

significantly correlated with MELAB. The self-reported TOEFL score (Table 6.2) showed the highest correlation with MELAB (r=0.57, p= .0003). Table 6.3 shows the mean numbers of correct MELAB items in terms of the reported TOEFL scores.

Table 6.4: Correlation matrix for English proficiency measures

	Correct #	ESL Classes	College Classes	Length in US	Listening
Correct #	1.00	-0.08	0.33	0.40	0.44
ESL Classes	–	1.00	0.08	0.38	-0.14
College Classes	–	–	1.00	0.57	0.22
Length in US	–	–	–	1.00	0.28
Listening Proficiency	–	–	–	–	1.00
Reading Proficiency	–	–	–	–	–
Speaking Proficiency	–	–	–	–	–
Writing Proficiency	–	–	–	–	–
TOEFL	–	–	–	–	–
EIKEN	–	–	–	–	–

	Reading	Speaking	Writing	TOEFL	EIKEN
Correct #	0.47	0.49	0.46	0.57	-0.17
ESL Classes	-0.18	-0.16	-0.02	-0.17	0.42
College Classes	0.25	0.20	0.30	0.35	-0.29
Length in US	0.27	0.41	0.18	0.48	-0.32
Listening Proficiency	0.85	0.83	0.78	0.71	-0.19
Reading Proficiency	1.00	0.76	0.83	0.72	-0.10
Speaking Proficiency	–	1.00	0.79	0.76	-0.35
Writing Proficiency	–	–	1.00	0.70	-0.09
TOEFL	–	–	–	1.00	-0.50
EIKEN	–	–	–	–	1.00

6.1.3 Stimuli

As discussed above, nine verb semantic classes were selected from Levin (1993) and Pinker (1989, 2007) (see (115)). They were then consolidated into six larger classes based on their theoretically-expected acceptability in causative constructions (see Table 6.5).

(115) a. Change-of-state verbs (”Verbs of change of state” and ”Break verbs” (Levin, 1993, p. 28-29))

abate, advance, age, air, alter, atrophy, awake, balance, blast, blur, break, burn, burst, capsize, change, char, chill, chip, clog, close, collapse, collect, compress, condense, contract, corrode, crack, crash, crumble, crush, decompose, decrease, deflate, defrost, degrade, diminish, dissolve, distend, divide, double, drain, ease, enlarge, expand,, explode, fade, fill, flood, fracture, fray, freeze, frost, fuse, grow, halt, heal, heat, hush, ignite, improve, increase, inflate, kindle, light, loop, mature, melt, multiply, overturn, pop, quadruple, rekindle, reopen, reproduce, rip, rupture, scorch, sear, shatter, short, short-circuit, shrink, shrivel, singe,, sink, smash, snap, soak, splay, splinter, split, sprout, steep, stretch, submerge, subside, taper, tear, thaw, tilt, tire, topple, triple, unfold, vary, warp

b. Manner-of-motion verbs (”Roll verbs” (Levin, 1993, p. 265-266), ”Bend verbs” (Levin, 1993, p. 28))

amble, backpack, bend, bolt, bounce, bound, bowl, canter, carom, cavort, charge, clamber, climb, clump, coast, crawl, crease, creep, crinkle, crumple, dan, dash, dodder, drift, file, flit, float, fly, fold, frolic, gallop, gambol, glide, goosestep, hasten, hike, hobble, hop, hurry, hurtle, inch, jog, journey, jump, leap, limp, lollop, lope, lumber, lurch, march, meander, mince, mosey, nip, pad, parade, perambulate, plod, prance, promenade, prowl, race, ramble, roam, roll, romp, rove, rumple, run, rush, sashay, saunter, scamper, scoot, scram, scramble, scud, scurry, scutter, scuttle, shamble, shuffle, sidle, skedaddle, skip, skitter, skulk, sleepwalk, slide, slink, slither, slog, slouch, sneak, somersault, speed, stagger, stomp, stray, streak, stride, stroll, strut, stumble, stump, swagger, sweep, swim, tack, tear, tiptoe, toddle, totter, traipse, tramp, travel, trek, troop, trot, trudge, trundle, vault, waddle, wade, walk, wander, whiz, wrinkle, zigzag, zoom

c. Inherently-directed motion verbs (repeating (30))

advance, arrive, ascend, climb, come, cross, depart, descend, enter, escape, exit, fall, flee, go, leave, meek, plunge, recede, return, rise, tumble

d. Verbs of appearance/disappearance (repeating (25))

annihilate, appear, arise, assassinate, awake, blitz, butcher, come, dawn, decimate, demolish, destroy, devastate, die, disappear, dispatch, eliminate, emanate, emerge, ensue, erupt, eventuate, evolve, execute, expire, exterminate, extirpate, flow, gush, happen, immolate, issue, kill, lapse, liquidate, massacre, materialize, murder, obliterate, occur, perish, plop, ravage, raze, recur, result, rise, ruin, slaughter, slay, steal, stem, stream, supervene, surge, transpire, vanish, waste, wax, wreck

e. Hit-touch verbs ("Hit verbs" (Levin, 1993, p. 148) and "Touch verbs" (Levin, 1993, p. 155))

bang, bash, batter, beat, bump, butt, caress, dash, drum, graze, hammer, hit, kick, kiss, knock, lash, lick, nudge, pat, peck(=kiss), pinch, pound, prod, rap, slap, smack, smash, sting, strike, stroke, tamp, tap, thump, thwack, tickle, touch, whack

f. Laugh verbs ("Breath verbs" (Levin, 1993, p. 148) and "Verbs of nonverbal expression" (Levin, 1993, p. 149))

beam, bleed, breathe, cackle, chortle, chuckle, cough, cough, cry, cry, dribble, drool, frown, gape, gasp, gawk, giggle, glare, glower, goggle, grimace, grin, groan, growl, guffaw, howl, jeer, laugh, moan, pout, puke, scowl, sigh, simper, smile, smirk, sneeze, snicker, sniff, snigger, snivel, snore, snort, sob, spit, sweat, titter, vomit, weep, weep, whistle, yawn

g. Object-drop verbs (repeating (80)

bake, carve, chop, clean, cook, crochet, draw, drink, dust, eat, embroider, hum,

hunt, fish, iron, knead, knit, mend, milk,, mow, nurse, pack, paint, play, plow, polish, read, recite, sew, sculpt, sing, sketch, sow, study, sweep, teach, type, sketch, vacuum, wash, weave, whittle, write

h. Body-part verbs (''Wink verbs'' (Levin, 1993, p. 34))
blink (eyes), clap (hands), nod (head), point (finger), shrug (shoulders), squint (eyes), wag (tail), wave (hand), wink (eye)

Table 6.5: Six verb semantic classes and verbs used in the experiment

VERB CLASS	LEVIN (1993)/PINKER (1989)	STIMULUS VERBS		
		HIGH FREQ	MID FREQ	LOW FREQ
Laugh (unergative)	LAUGH verbs	*laugh*	*cry*	*moan*
Exceptional Causative	Verbs of DISAPPEARANCE	*die*	*disappear*	*vanish*
	INHERENTLY-DIRECTED motion verbs	*go*	*descend*	*tumble*
Hit-touch (pure transitive)	HIT verbs	*strike*	*kick*	*smash*
	TOUCH verbs	*touch*	*kiss*	*tickle*
Object-drop	OBJECT-DROP verbs	*play*	*eat*	*bake*
Body-part	BODY-PART verbs	*wave*	*shrug*	*blink*
Prototypical Causative	CHANGE-OF-STATE verbs	*sink*	*melt*	*crash*
	MANNER-OF-MOTION verbs	*move*	*roll*	*bounce*

Each participant saw three verbs from different frequency strata for a given verb semantic class. For example, in the Exceptional Causative Verb class, *die* (high-frequency disappearance verb), *go* (high-frequency inherently-directed motion verb), *disappear* (mid-freq disappearance), *descend* (mid-freq inherently-directed motion), *vanish* (low-freq disappearance), and *tumble* (low-freq inherently-directed motion) were selected.

Verb frequency was counted with using three different English corpora: Open American National Corpus (OANC) (Reppen, Ide, & Suderman, 2005), the Penn Treebank Corpus (PTB) (M. P. Marcus, Kim, Marcinkiewicz, MacIntyre, & Ferguson, 1994), and CELEX2 (Baayen, Piepenbrock, & Gulikers, 1996). OANC is a

15-million word corpus and the largest genre-balanced American English corpus to date. The benefit of using a large balanced corpus is obvious, but it remained necessary to use multiple corpora to validate the accuracy of its frequency counts. Since OANC was automatically parsed and was assigned part-of-speech information with machine-learning algorithms, accuracy of the frequency count relies on the performance of the machine learning algorithm. For example, *swing* may appear more frequent than *sway* in a simple token count, but the true frequency of the verb *swing* could have been inflated by its zero-derivational nominals (e.g., a bad *swing* in baseball or a *swing* near the sandbox) that was inaccurately judged as a verb. Also, the low-frequency irregular verbs such as *swung*, *span*, *swept*, *torn*, and *sown* may not be tokenized correctly due to their unstable morphological irregularity (Liberman et al., 2007). These problems are not crucial in the PTB corpus since PTB was fully manually annotated and cross-validated and is considered as the most reliable corpus for tags (M. P. Marcus et al., 1994). Finally, CELEX2 is the largest (British) English lexical database. It has been developed by Harald Baayen and his colleagues using various statistical estimation procedures. The advantage of the CELEX2 corpus is the statistically estimated frequency counts for tokenized words and homograph words. In other words, CELEX2 captures frequency such that highly-polysemous words like *roll* (e.g., 1. moving by turning over and over on an axis, 2. turn eyes upwards, 3. lie down and turn over and over, 4. (ship) oscillate around an axis etc.) are not as frequent as monosemous verbs that have the same frequency counts in the other corpora.

Comparisons of the three corpora reveal some differences in the frequency count, but the effects are minimal as far as the verbs selected for the current research. Table 6.1.3 shows the correlations of frequency counts of 3098 lemmanized

words in the three different corpora. The frequency counts in the three corpora are highly correlated in the range of 0.95 to 0.98 (see Table 6.1.3).

	PTB	OANC	CELEX2
PTB	1.00000	0.95053	0.94602
OANC	-	1.00000	0.97740
CELEX2	-	-	1.00000

Table 6.6: Correlations of verb frequencies in the Penn Treebank (PTB; 4.5 million words), the Open American National Corpus (OANC; 15 million words), and the CELEX2 corpus (frequency counts from the 17.5-million-word Cobuild Corpus). 3098 verb lemmas (with WordNet Lemmatizer) that appeared at least once in each of the three corpora are used.

The 27 verbs used as the stimuli in this experiment show that the frequency counts in PTB are not stable for low-frequency words (see Table 6.7). For example, *cry* and *moan* appear to be nearly as frequent in PTB, but the other two larger corpora clearly show *cry* is far more frequent than *moan*. Also, two low-frequency verbs, *tickle* and *bake*, did not appear at all in the PTB corpus. As for the mid- and high-frequency verbs, some verbs (e.g., t*umble* and *crash*) were unexpectedly high in frequency, presumably due to the influence of certain genres (e.g., *tumbling stock market* may appear frequently in business articles) and the misanalysis of their derivational adjectival forms as verb's participles (e.g., *a crashed vehicle* is analyzed as the past-participle (VBN)).

Because of the instability of the frequency counts for low-frequency tokens, for some of the data analyses, verb frequency counted within each class was converted into the ordinal categories (high, mid, and low) in this experiment. When an analysis required interval variables, the logarithmically transformed raw verb frequency derived from CELEX2 was employed.

Table 6.7: Comparisons of the frequency counts of the stimulus verbs in the three different corpora.

	VERBCLASS	WORD	PTB	OANC	CELEX2
1	LAUGH	laugh	14	970	3058
2	LAUGH	cry	4	700	2158
3	LAUGH	moan	3	67	237
4	DISAPPEAR	die	84	4537	4279
5	DISAPPEAR	disappear	25	762	1234
6	DISAPPEAR	vanish	7	196	729
7	INHET_MOT	go	1026	54884	51830
8	INHET_MOT	descend	5	265	448
9	INHET_MOT	tumble	68	106	200
10	HIT	strike	64	1095	1999
11	HIT	kick	29	1004	753
12	HIT	smash	4	121	436
13	TOUCH	touch	19	868	1967
14	TOUCH	kiss	2	254	1056
15	TOUCH	tickle	0	7	77
16	OBJ_DROP	play	189	10326	7245
17	OBJ_DROP	eat	37	3943	5183
18	OBJ_DROP	bake	0	157	423
19	BODY_PART	wave	8	181	1280
20	BODY_PART	shrug	4	152	444
21	BODY_PART	blink	3	77	246
22	CHANGE_STATE	sink	38	333	892
23	CHANGE_STATE	melt	5	229	436
24	CHANGE_STATE	crash	15	359	335
25	MANNER	move	331	6637	7653
26	MANNER	roll	51	840	1287
27	MANNER	bounce	25	291	289

In the experiment, each verb was used in three different frames: an agent intransitive frame (Agent Intransitive, hereafter; e.g., **The man vanished*, in the sense of the man made someone disappear), a theme intransitive frame (Theme Intransitive, hereafter; e.g., *The coin vanished*), and a transitive frame (Transitive, hereafter; **The man vanished the coin*) (see Figure 6.3). Each of these three sentences appeared upon the completion of a video clip, in which an animated agent and potential patient make various kinds of movement. Then, the participant was asked to rate its adequacy of the description of the video on a 5-point Likert scale (see Figure 6.2).

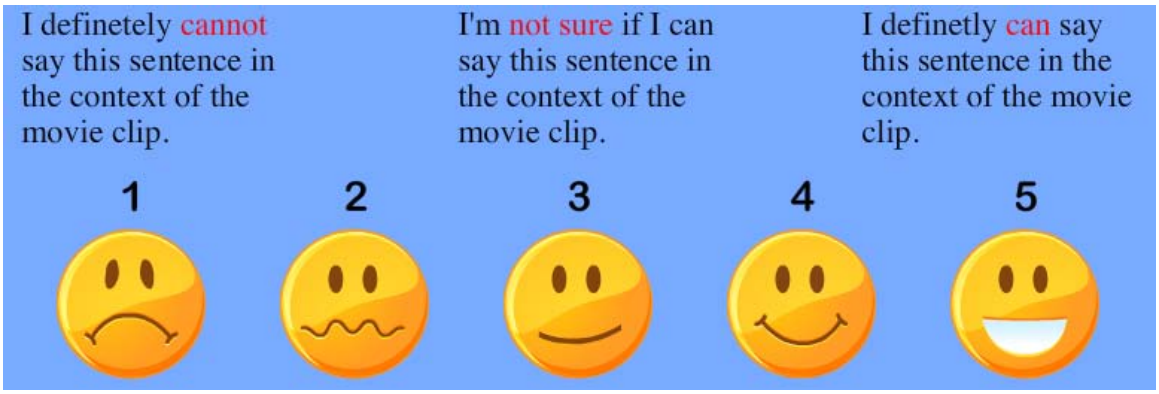


Figure 6.2: Grammaticality judgment scale with smiley face illustrations

One-third of the stimuli were distractor sentences, which appeared in correct descriptions of the movie (e.g., *The man was running.*), inaccurate descriptions of the movie (**The man walked.*), and ungrammatical descriptions (**The man runned.*) (see Figure 6.4). The experiment was self-paced and the stimuli were randomized for each participant. All stimulus sentences are listed in Appendix.

Figure 6.3: Frames from the movie clip for the stimulus verb *vanish* (*The man vanished the coin*; *The man vanished*; and *The coin vanished*.)

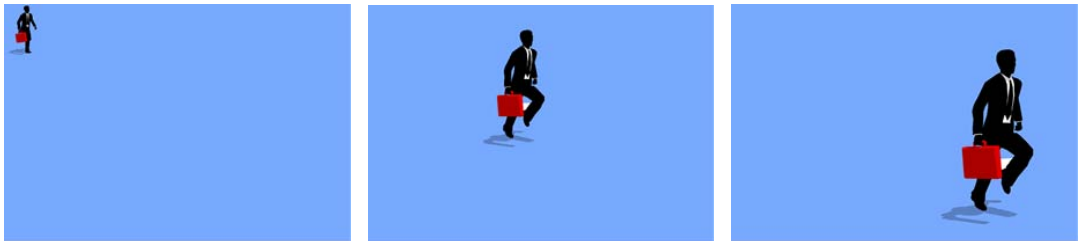


Figure 6.4: Frames from the movie clip for the example verb *run* (*The man was running*; **The man walked*; and **The man runned*.)

6.2 DESIGN

6.2.1 Research design

Many commonly used psycholinguistics experiment packages such as *e-prime* (Schneider, Eschman, & Zuccolotto, 2002) and *DMDX* (Forster & Forster, 2003) do not provide sufficient support for video stimuli, which is a crucial component for the current experiment. Therefore, new open-source experiment modules were developed with Macromedia Flash and ActionScript3. Flash/ActionScript is widely used in many Internet applications and is useful in various experimental tasks as an experiment package (Reimers & Stewart, 2007).

All procedures were carried out at a computer station in a quiet room. The procedure consisted of three parts: (1) Questionnaire, (2) English proficiency assessment, and (3) Grammaticality judgment of English sentences with visual cues.

It took about 45-50 minutes to complete the experiment module for the control-group (native English-speaker) participants and 60-70 minutes for the focus-group (native Japanese-speaker) participants.

- Questionnaire (approximately 5 min.)

  Both the focus- and control-group participants answered the computer-based questionnaire. The questionnaire included questions about each participant's demographic information, and educational background; and for the Japanese native speakers, their English language proficiency and amount of ESL instruction (the last two items are the focus group participants only). A complete list of questionnaire items is attached in Appendix.

- English proficiency assessment (approximately 20 min.)

  Each participant was asked to listen to 47 short questions adopted from MELAB and to select the best answer among the multiple-choice answers. The list of MELAB question items is attached in Appendix. The participant for the control group skipped this section of the experiment.

- Grammaticality judgment of English sentences with visual cues (approximately 45 min.)

  Each participant watched a video clip in which an animated agent and potential patient make various kinds of movement. Upon the completion of the video, the participant saw an English sentence and was asked to rate its adequacy of the description of the video on a 5-point Likert scale (see Figure 6.2). There were a total of 142 prompts in this section, including 4 practice prompts and 57 distractors.

6.2.2 Data analysis procedures

In the analyses of data, the focus group participants were divided into two subgroups: the high-proficiency group (participants who scored above the median score) and the low-proficiency group (below the median score) based on the MELAB scores (see Table 6.8). When an analysis required interval variables, the raw number of correct items was used.

Table 6.8: Proficiency groups of the participants

	NATIVE SPEAKER	HIGH PROFICIENCY	LOW PROFICIENCY
Number of participants	26	18	17

The design of the experiment is the repeated-measure design since each subject saw the verb, representing each level of the experimental factors.

The participants' grammaticality judgment scores were used as the dependent variable. For those stimulus items that were expected to be judged ungrammatical by native speakers, the ratings were reverse coded prior to analysis. For example, disappear is not grammatical in the transitive frame (e.g., **The wizard disappeared the dove.*) and in the agent intransitive frame (e.g., **The wizard disappeared.* in the sense that the wizard disappeared something). In cases such as these, each participant's rating was reversed by converting a 1 to a rating of 5, a 2 to a 4, a 4 to a 2, and a 5 to a 1. After recoding the responses for the ungrammatical items and retaining the original responses for the grammatical items the ratings can be interpreted in a uniform manner as similarity to expected native speaker judgments, with 5 as "most similar" and 1 as "least similar."

The box-and-whisker plot of the reversed grammaticality judgment scores (Fig-

ure 6.5) shows that grammaticality judgment scores suffer from a ceiling effect because many participants selected the highest score (or the lowest score when the sentence is ungrammatical) in each trial. To resolve this problem, the grammaticality judgment scores for each verb in the three different frames were summed to a single score. Since all verbs appeared three times in three different frames, the resulting summed score for each verb ranged from 3 to 15. This transformation resolved the ceiling effect of the original dependent variable as shown in Figure 6.5.

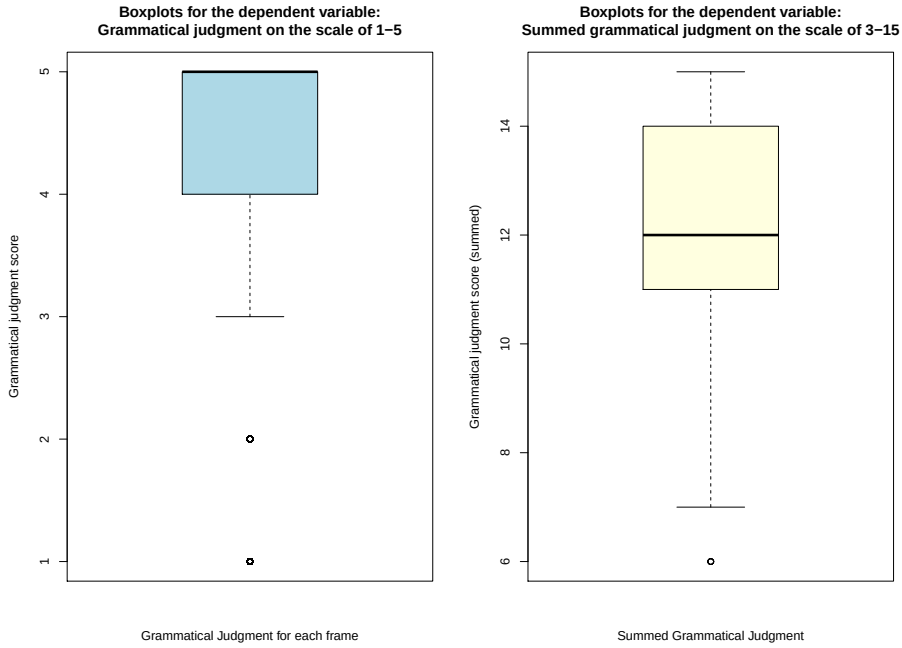


Figure 6.5: Box-and-whisker plots for grammaticality judgment scores and grammaticality preference scores

The traditional statistical analysis that is appropriate for a research design like the current study is a mixed-design Analysis of Variance (mixed-design ANOVA) with scores from each participant treated as a repeated measure. Such analyses are commonly accepted in the language acquisition literature and, in fact, even more basic hypothesis testing procedures like multiple t-tests or multiple ANOVAs are

sometimes used despite their limitation in statistical procedures and larger risks of making Type-I errors.

In the mixed-design ANOVA, which is an extension of the simple factorial ANOVA, the same subject receives multiple treatments (the treatment is *repeated*). Since the individual variability is systematically added to the within-treatment variance, the error term (unaccounted variance) for the mixed-design ANOVA is calculated from the between-subject variance within each group and the variance within each subject excluding the repeated-measure variance and the interaction between variances for between-group and the repeated measure. The schematic illustration of the mixed-design ANOVA is shown in Figure 6.6.

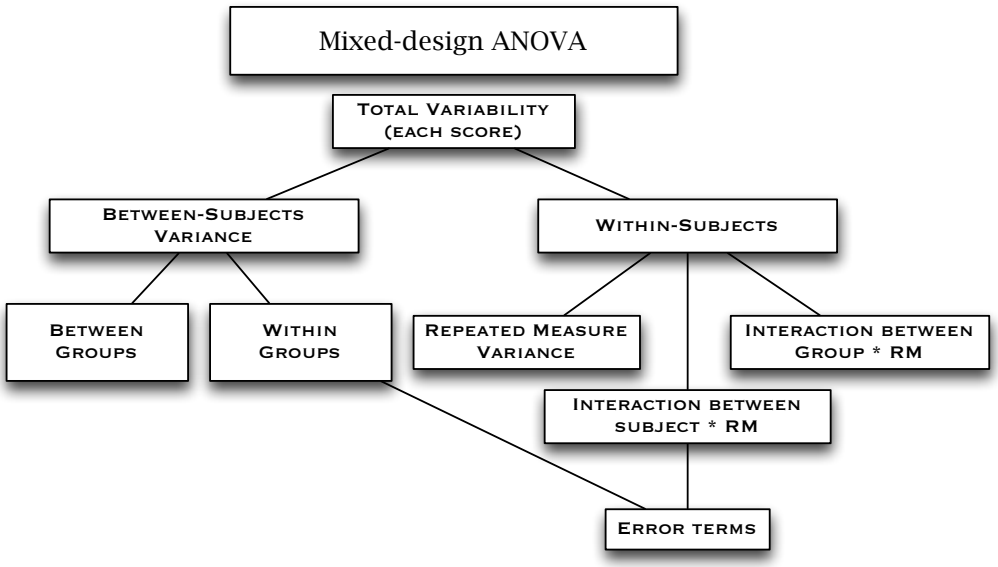


Figure 6.6: Overview of the mixed-design ANOVA

For the mixed-design ANOVA, the current study can be analyzed with a $3\times3\times6$ ANOVA with two within-subject repeated variables (i.e., verb frequency and verb semantic class), one between-participant variable (i.e., English proficiency), and the summed grammaticality judgment score as the dependent variable.

Such analyses are commonly accepted in the psycholinguistic literature (for example, Brooks (Brooks & Zizak, 2002) and Ambridge et al. (Ambridge et al., 2008)), but a more recent and statistically sophisticated analysis attempts to take into consideration the variability between items in the same way that the variability of repeated measures for subject is accounted for in the mixed-design ANOVA. The problem of lack of generalizability across the items is called *language-as-a-fixed-effect problem* and was initially raised by Clark (H. Clark, 1973) and subsequently by many researchers subsequently (Forster & Dickerson, 1976; D. Bates, 2005, 2006).

Clark (H. Clark, 1973), in his seminal paper, pointed out that most linguistic experimental studies attempt to generalize their experimental findings beyond the research participants by treating the participant as a random effect, but they rarely attempt to generalize the findings in terms of the experimental items. Since, like participants, the experimental stimuli (such as sentence or word stimuli in the linguistic research) are randomly selected from a large and usually unknown size of population, the language-as-fixed-effect fallacy proposes to treat items as random effects like participants. In other words, without an assumption that items are randomly selected, the experimental findings will be restricted to a limited scope of linguistic contexts.

Forster and Dikerson (1976) proposed an easy-to-compute solution to the language-as-fixed-effect problem. Their approach, called *minimal-F* or *quasi-F*, involves calculating two F-scores, one for the participant analysis and the other for the item analysis. Min-F has been adopted often for its relatively accurate approximation to a more computationally heavy approach such as the mixed-effect model and the Monte Carlo procedure.

Recently, the mixed-effect (linear) model is becoming a common solution to the language-as-fixed-effect problem (Baayen, Davidson, & Bates, 2008; Faraway, 2006; Pinheiro & Bates, 2000). Unlike the min-F, the mixed-effect model is heavily computationally intensive and is only possible with a highly powerful computational machine that became available among researchers only recently. The mixed-effect model has several major advantages over the repeated-measure approach. First, the mixed-effect model does not assume homogeneity of error variance. While ANOVA is robust against the violation of homogeneity of variance with the uncorrelated variance (*sphericity*), such assumption does not hold especially when the data are correlated (e.g., the treatment is repeated for participants). Also, it is another advantage of the mixed-effect model not to assume independence of observations. Under the assumption of independence of observations, the repeated-measure analyses (e.g., RM ANOVA and paired t-test) treat some portion of the within-subject variance as each participant's unique variability. This traditional approach is theoretically sound, but considerably weakens statistical power of the analysis. Lastly, the mixed-effect model is not vulnerable against the unbalanced design and missing data. This is a boon since experimental studies with a perfectly balanced without missing data are extremely rare and many studies will have to employ some arbitrary scheme to remove outliers in the traditional repeated-measure analysis.

In mixed-effect model, the explanatory factors are divided into *fixed-effect* and *random-effect*. Eisenhart (Eisenhart, 1947) first proposed the difference between the fixed-effect treatment and the random-effect treatment, but the underlying idea existed even during the Fisherian school of the early development of statistic analyses. The fixed-effect is a constant effect estimated from the given data and the

fixed-effect variables have informative factor levels. In other words, there is substantial information to make solid estimation about the population and, therefore, it is meaningful to estimate the mean of the sample, which is known to converge to the population mean due to *the law of large numbers* and *the Central Limit Theorem*. On the other hand, the random-effect treatment influences only the variance of the dependent variable and their means are always expected to be zero[2]. The mean of random-effect samples is expected to be zero since they are selected from a very large sample that we don't have much information to make informative estimations. Also, unlike the fixed-effect sample, each sampling for a random-effect treatment is expected to be correlated each other. The non-independence of sampling contravenes one of the basic assumptions of the statistical testing, *independence of errors*, so the covariance structure of the random-effect treatments must be accounted for in the mixed-effect model.

One of the difficulties associated with the mixed-effect model is the classification of treatments between random and fixed effect. According to Crawley (Crawley, 2007), the rule of thumb is that when if the degrees of freedom for error is considerably large for the given sample size, it is probably caused by the inflation of degrees of freedom due to pseudoreplication, which therefore should be treated as the random effect. Thus, a *pseudoreplicated* treatment such as temporal variables in a growth study and repeated measures must be dealt as the random-effect.

Another caveat of the mixed-effect model is the controversy over using the traditional p-value as a measure to estimate the significance of parameters. Unlike the *Generalized Linear Models* (GLMs), in which the parameters are estimated

[2]The intercepts of random effects are calculated, but under the assumption of random effects, the intercepts are expected to be zero.

with the observed and expected mean squares, the mixed-effect model employs the *Maximum Likelihood* (ML), which estimates a population distribution by maximizing the predictive power of parameters of the model. In other words, ML is theoretically independent of any specific distribution such as Gaussian (z-test), t-distribution, and F-distribuion. It leads to a theoretical argument whether or not (and how) we should use *degrees of freedom* in calculating the p-value in the mixed-effect model. On one hand, researchers like Douglas Bates, who has developed lmer, the mixed-effect package in $\mathcal{R}$, argue that significance of the mixed-effect models should be evaluated only by the model comparisons or with the replicated simulation approach (e.g., *Markov Chain Monte Carlo* sampling). Some researchers are more willing to assume the ad-hoc degrees of freedom in the mixed-effect model. For example, Baayen (2008a) proposes to calculate the degrees of freedom for the mixed-effect parameters by subtracting the number of parameters in the model from the total number of observations (i.e., identical approach to the mixed-design ANOVA).

In this study, the data were analyzed with RM Mixed-design ANOVA using $\mathcal{R}$ (R Development Core Team, 2008) with the $\mathcal{R}$ package *ez* (Lawrence, 2011). The results produced by $\mathcal{R}$ were validated with the analogous analyses on SPSS. The mixed-effect linear model is also conducted with $\mathcal{R}$, using the $\mathcal{R}$ package *lmer* (D. Bates, 2008) and *languageR* (Baayen, 2008b). Following Baayen (2008a), I present MCMC-estimated p-values for the fixed-effect variables. The stepwise comparison of the mixed-effect models were conducted with $\mathcal{R}$ package *LMERConvenienceFunctions* (Tremblay, 2012). The mixed-effect analyses were also conducted with SPSS following the procedure delineated by Field (2009). The results of $\mathcal{R}$ and SPSS were exactly identical.

CHAPTER 7

DATA

7.1 FILLER STIMULI

About one-third of the stimulus verbs in the experiment were filler verbs. The video clip for filler verbs were also displayed three times with different sentence types (see Figure 7.1 for an example); that is, grammatical mis-match, ungrammatical, and grammatical frames (see (116)). Table 7.1 shows the descriptive statistics for the participants' judgment scores on filler stimuli.

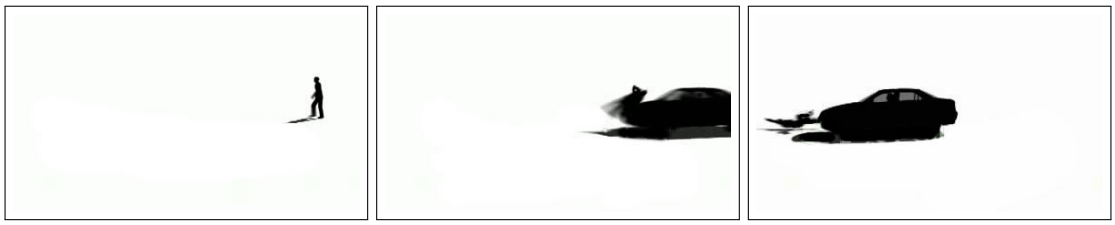


Figure 7.1: One of the video clips for a filler item

(116) a. #The car honked at the man. (grammatical mis-match)

b. *Hit the car man. (ungrammatical)

c. The car hit the man. (grammatical)

Table 7.1: The mean grammatical judgment scores and standard errors (in parentheses) for the filler stimulus verbs

	NATIVE ($n = 23$)	HIGH PROFICIENCY ($n = 15$)	LOW PROFICIENCY ($n = 17$)
Grammatical mis-match	2.48 (0.31)	2.81 (0.41)	2.79 (0.36)
Ungrammatical	1.61 (0.21)	1.84 (0.31)	2.20 (0.36)
Grammatical	4.21 (0.24)	4.34 (0.27)	3.98 (0.31)

The data for the filler stimuli exhibit tendencies that the low-proficient participants rated higher on the ungrammatical sentence and lower on the grammatical sentence than the native and high-proficient participants. Repeated-measure ANOVAs show that Proficiency was significant in the grammatical mis-match type ($F(2, 52) = 3.44, p = 0.04$) and the ungrammatical type ($F(2, 52) = 5.72, p = 0.006$), and was marginally significant in the grammatical type ($F(2, 52) = 3.12, p = 0.052$). The main effect of Proficiency in the filler stimuli is not surprising and, in fact, I consider it favorable since it demonstrates the accurate grouping of non-native English speakers – the higher the participant's proficiency is, the closer his/her grammatical judgments become to those of native English speakers. The keen contrast between the ungrammatical type and the grammatical type across all the proficiency groups should also be noted since it suggests that all participants had little trouble understanding the nature of the experimental tasks.

7.2 QUESTIONNAIRE DATA

The summary of questionnaire responses was discussed in the previous section (Table 6.1). Among the questionnaire items, gender was one notable difference between the control and focus groups such that the focus group had a significantly

larger proportion of female than the control group (38.5% vs. 71.4%). There is a marginal difference between the means of grammatical preference scores by genders in both the native and non-native English-speaking participants as shown in Table 7.2.

Table 7.2: Grammatical preference scores by Gender (the number of participants and standard error in parentheses)

	NON-NATIVE	NATIVE
FEMALE	11.24 (n=25; se=0.40)	12.80 (n=10; se=0.61)
MALE	11.90 (n=10; se=0.48)	11.69 (n=16; se=0.50)

However, a two-way ANOVA (DV: grammatical preference score, IV: gender and native language) shows that gender is not a significant factor in this experiment (main effect: $F(1, 57) = 0.23, p = 0.63$; interaction effect: $F(1, 57) = 2.08, p = 0.15$) and, therefore, this factor is ignored in the further analyses.

Differences between the groups were also observed in age and amount of education (see Table 7.3). The mean age of the native English-speaking participants was lower than that of the non-native English-speaking participants. In the amount of education, the native English-speaking participants had slightly lower degree of education. Age and the amount of education are highly correlated ($r = 0.58, t(40) = 4.52, p < .001$) – unsurprisingly, the young participants had a lower level of education than the older participants. Like gender, these two factors are ignored in the further analyses as they do not significantly contributed to the grammatical preference score (age main effect: $F(1.57) = 2.80, p = 0.10$, age and Proficiency interaction effect: $F(1.57) = 0.14, p = 0.71$; education main effect: $F(1.57) = 3.70, p = 0.06$, education and Proficiency interaction: $F(1.57) = 0.30, p = 0.59$).

Table 7.3: Grammatical preference scores by Gender and by Education (the number of participants and standard error in parentheses)

	NON-NATIVE	NATIVE
30 YEARS OLD OR OLDER	11.10 (n=20; 0.46)	12.00 (n=6; 0.86)
29 YEARS OLD OR YOUNGER	11.87 (n=15; 0.41)	12.35 (n=20; 0.44)
BELOW HIGH SCHOOL	10.09 (n=11; 0.56)	12.37 (n=19; 0.48)
ABOVE HIGH SCHOOL	11.12 (n=24; 0.38)	12.00 (n=7; 0.65)

In addition to the analyses with ANOVA, multiple regression was run to test if any of the three variables (Gender, Education, Age) can predict the grammatical preference score at a significant level. The full-model shown in Table 7.4 was not significant ($R^2 = 0.12, F(7, 53) = 1.03, p - 0.42$). In the full-model, only the two-way interaction between Age and Education ($b = -2.15$, $t(53) = -1.90$, $p = .06$) and the three-way interaction ($b = -1.25$, $t(53) = 1.87$, $p = .07$) were marginally significant.

Table 7.4: The results of the multiple regression analysis of grammatical preference scores by gender, education, and age

	Estimate	Std. Error	t-value	$Pr(>\|t\|)$
Intercept	7.74	4.36	1.77	0.08
Age	2.42	1.70	1.42	0.16
Education	4.44	3.05	1.46	0.15
Gender	2.70	2.82	0.96	0.34
Age:Education	-2.15	1.13	-1.90	0.06
Age:Gender	-1.55	1.16	-1.33	0.19
Education:Gender	-2.61	1.83	-1.43	0.16
Age:Education:Gender	1.25	0.67	1.87	0.07

Stepwise (backward) analyses were also carried out, but no model reached the significance.

7.3 DESCRIPTIVE DATA

Descriptive data for the experiment stimuli are given in Appendix Tables A.1 - A.3. Overall, native English speakers' judgments (control group judgments) followed the expected pattern except for a few cases. The stimulus verbs with which native speakers' judgment diverged from the expected scores are highlighted in the Tables and possible reasons for each case is provided in the footnote. An analysis of these unexpected cases revealed that the responses of the unexpected cases are in the bimodal distraction with a lot of outliers. Thus, outliers, defined as greater than or less than ± 1.5 interquartile ranges, were removed and were replaced with the upper-bound or lower-bound of the 1.5 interquartile scores of the verb in each frame. Out of the total of 4941 data points for the main experiment (61 participants $\times$ 27 verbs in 3 frames = 4941), 272 responses (5.5% of the total response) were identified as the outliers.

In the next two analyses, Summed Grammatical Preference (Grammatical Preference, hereafter) is used as the dependent variable. As discussed in the Method section, the stimulus items expected to be judged as ungrammatical by native speakers of English were reverse coded prior to analysis and the grammatical judgment scores in the three frames of a verb were summed to a single score. Thus, Grammatical Preference has a scale of 3-15, 15 being the theoretically expected score. Table 7.5 and Figure 7.2 show the descriptive statistics of the Grammatical Preference scores.

Table 7.5: Means of Grammatical Preference scores in six semantic classes by native language groups (standard error in parentheses)

	NATIVE ($n = 26$)	HIGH PROFICIENCY ($n = 18$)	LOW PROFICIENCY ($n = 17$)
HIT-TOUCHV	12.22 (0.12)	12.00 (0.15)	11.66 (0.15)
OBJECT-DROPV	13.32 (0.17)	12.81 (0.19)	13.16 (0.22)
BODY-PARTV	12.12 (0.25)	11.02 (0.28)	10.57 (0.30)
LAUGHV	13.55 (0.18)	13.15 (0.23)	13.22 (0.24)
EXCEPTIONAL CAUSATIVEV	13.03 (0.12)	12.64 (0.19)	12.17 (0.19)
PROTOTYPICAL CAUSATIVEV	12.05 (0.15)	11.74 (0.19)	10.95 (0.23)

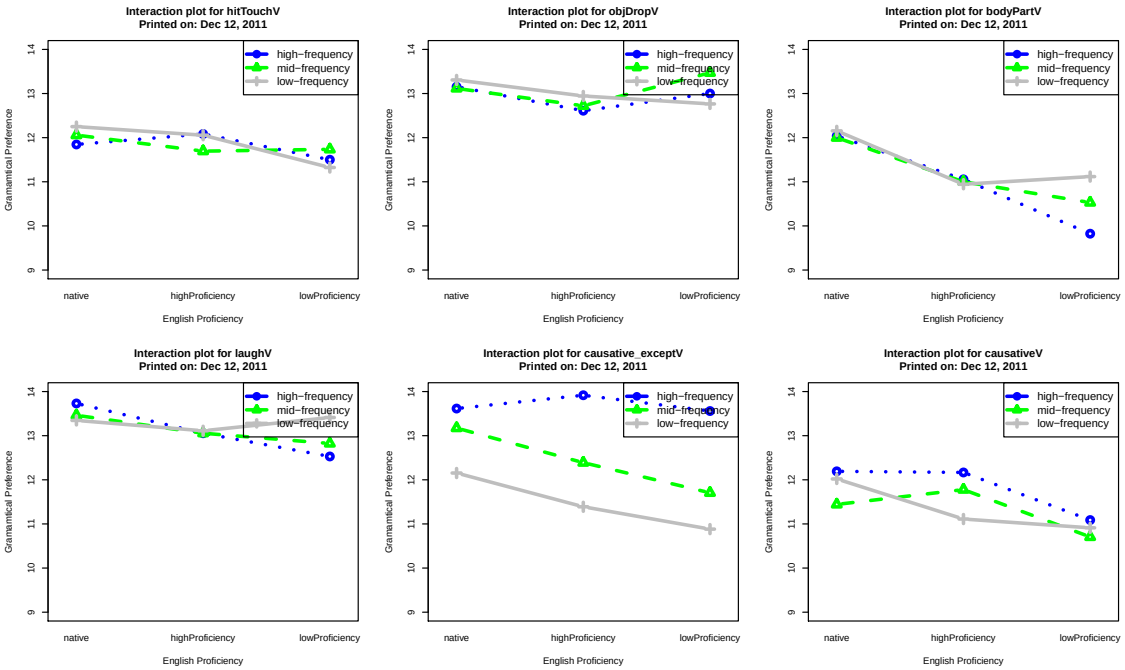


Figure 7.2: Plots for Grammatical Preference scores for each verb class

7.4 OVERALL ANALYSES

7.4.1 Analyses with the mixed-design ANOVA

A 3×3×6 mixed-design ANOVA was conducted with English Proficiency (Proficiency, hereafter) as a between-subject factor and Verb Frequency (Frequency, hereafter) and Verb Semantic Class (Class, hereafter) as within-subject factors. Grammatical Preference is used as the dependent variable after transformation of the outlier data points (i.e., beyond ± 1.5 interquartile ranges) to their upper- and lower-bound values. $\mathcal{R}$ was used to run statistical analyses and equivalent analyses were carried out with SPSS in order to ensure the accuracy of the analyses with $\mathcal{R}$. The analysis codes for $\mathcal{R}$ and the SPSS syntax code can be found in Appendix (Listings E.1 and E.2 for the $\mathcal{R}$ and SPSS codes for the current analyses).

The results of the ANOVA is listed in Table 7.6. The results showed significant main effects in all three factors (Proficiency ($F(2, 58) = 7.75, p < .001$), Frequency ($F(2, 116) = 4.85, p = .001$), and Class ($F(5, 290) = 38.21, p < .001$ after the correction for sphericity using the Greenhouse-Geisser correction ($\epsilon = 0.57$)). In addition, a significant two-way interaction between Frequency and Class ($F(10, 580) = 7.12, p < .001$ after the HF correction, $\epsilon = 0.69$) was found. The three-way interaction among Proficiency, Frequency, and Class was not significant ($F(20, 580) = 1.27, p = .22$ after the GG correction $\epsilon = 0.69$).

In order to investigate the source of the interaction effects, a series of post-hoc two-way Proficiency×Frequency ANOVAs was conducted for each verb semantic class (see Listings E.3 and E.4).

Table 7.6: The results of three-way ANOVA (DV: Grammatical Preference, Within: Frequency, Class, Between: Proficiency)

Effect	DFn	DFd	F	p	ges
Proficiency	2	58	7.75	0.00*	0.04
Frequency	2	116	4.85	0.01*	0.01
Proficiency:Frequency	4	116	0.67	0.61	0
Class	5	290	38.21	0.00*	0.18
Proficiency:Class	10	290	1.66	0.09	0.02
Frequency:Class	10	580	7.12	0.00*	0.05
Proficiency:Frequency:Class	20	580	1.27	0.19	0.02

In the post-hoc tests, significant effects found in the previous three-way ANOVA were absent in Hit-touch Verbs (Proficiency: $F(2, 58) = 1.64, p = .20$; Frequency: $F(2, 116) = 0.20, p = .82$; Interaction: $F(4, 116) = 1.16, p = .33$), Object-drop Verbs (Proficiency: $F(2, 58) = 0.79, p = .46$; Frequency: $F(2, 116) = 0.25, p = .78$; Interaction: $F(4, 116) = 0.95, p = .44$), and Laugh Verbs (Proficiency: $F(2, 58) = 2.48, p = .09$; Frequency: $F(2, 116) = 0.09, p = .91$; Interaction: $F(4, 116) = 0.70, p = .59$). The main effect of Proficiency was found in Body-part Verbs (Proficiency: $F(2, 58) = 5.84, p < .001$; Frequency: $F(2, 116) = 0.64, p = .53$; Interaction: $F(4, 116) = 0.76, p = .55$). Probably the most interesting results in the post-hoc analyses are the differences between the Exceptional Causative Verb class and the Prototypical Causative Verb class. The main effects of Proficiency and Frequency were significant in the Exceptional Causative Verb class (Proficiency: $F(2, 58) = 6.68, p < .001$; Frequency: $F(2, 116) = 73.88, p < .001$) and in the Prototypical Causative Verb class (Proficiency: $F(2, 58) = 3.41, p = .04$; Frequency: $F(2, 116) = 3.13, p = .05$). However, a significant interaction effect between Proficiency and Frequency was attested only in the Exceptional Causative Verb class ($F(4, 116) = 3.96, p < .001$), such that the effect of Frequency was stronger among the low-proficiency L2 English learners. Such an interaction effect was absent in the Prototypical Causative

Verb class ($F(4, 116) = 1.49, p = .21$).

7.4.2 Analyses with the mixed-effect linear model

A mixed-effect model confirms the same tendencies in the data. As discussed in the Method section, the mixed-effect linear model divides the explanatory variables into *fixed-effect*, whose effects are constant and informative that can be estimated from the data, and *random-effect*, whose effects are uninformative variance-covariance structure of the data (Crawley, 2007).

For the current study, the three explanatory factors (i.e., Proficiency, Frequency, Class) are the fix-effect variables while the random-effects of Participant (variability among subjects) and Verb (variability among verbs/items) also exist in the data. Since the mixed-effect model readily processes the interval variable, the raw scores of the Michigan Test (MELAB) were used instead of the nominal variable Proficiency, and the log frequency of verbs was used in place of the nominal variable Frequency.

The full mixed-effect model (see Formula F.2 in Appendix) produced much more conservative results than the comparative analyses in the mixed-design ANOVA. As summarized in Table 7.7, only the main effects of Proficiency (Michigan Test) ($\hat{\beta} = 0.13, p = .03$) turned out to be significant. Frequency ($\hat{\beta} = 0.79, p = .08$) and a two-way interaction between Frequency$\times$Proficiency ($\hat{\beta} = -0.02, p = .09$) were marginally significant. The other factors were not significant when Participant and Verb were entered as random-effect variables.

In analogy to the post-hoc mixed-design ANOVAs, the full mixed-effect model was submitted to the stepwise likelihood test using the $\mathcal{R}$ package LMERCon-

Table 7.7: A summary table of the mixed-effect linear model: Estimates of fixed-effect variables and p-values using the Markov Chain Monte Carlo approach for the full model (F.2)

	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	5.7578	5.7158	-0.3208	12.0955	0.0760	0.0639
verbClass	-0.0237	-0.0198	-1.5421	1.3173	0.9776	0.9739
verbLogFreq	0.7892	0.7953	-0.0747	1.7311	0.0802	0.0814
Michigan	0.1338	0.1344	0.0136	0.2603	0.0316	0.0328
verbClass:verbLogFreq	-0.0299	-0.0305	-0.2388	0.1797	0.7720	0.7766
verbClass:Michigan	-0.0066	-0.0066	-0.0359	0.0212	0.6510	0.6521
verbLogFreq:Michigan	-0.0156	-0.0157	-0.0336	0.0022	0.0870	0.0862
verbClass:verbLogFreq:Michigan	0.0016	0.0016	-0.0025	0.0058	0.4346	0.4400

venienceFunctions. By default, LMERConvenienceFunctions processes all fixed-effect in a backward elimination, followed by a forward-fit of random effects and another backward-fit of the fixed effects. For the forward-fit of random effects, Verb with both intercept and by-semantic class adjustment and Subject with both intercept and by-proficiency adjustment are considered. At the first step of the analysis, the three-way interactions (Class×Frequency×Proficiency) was removed since the simplified model was not significantly different from the original full model ($p = .44$). At the second iteration, a two-way interaction between Class×Frequency was removed ($p = .50$) and, at the third iteration, another two-way interaction between Class×Proficiency was removed ($p = .14$). Finally, at step 4, the main effect of Class are removed ($p = .77$). The resulting model after the backward elimination has Frequency and Proficiency and their interaction (Frequency×Proficiency) as the fixed-effect factors and Verb and Subject as the random-effect factors. The results of this simplified model is presented in Table 7.8.

The simplified model shows that both main effects of Frequency ($\hat{\beta} = 0.65, p < .001$) and Proficiency ($\hat{\beta} = 0.10, p < .001$) are significant. The interaction term Frequency×Proficiency ($\hat{\beta} = -0.01, p = .02$) had a weak but significant on the predicting the Grammatical Judgment scores.

Table 7.8: A summary table of the mixed-effect linear model: Estimates of fixed-effect variables and p-values using the Markov Chain Monte Carlo approach for the simplified model model

	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	5.8994	5.8977	3.2461	8.4629	0.0001	0.0000
verbLogFreq	0.6455	0.6454	0.2867	1.0017	0.0006	0.0004
Michigan	0.1035	0.1035	0.0505	0.1573	0.0002	0.0001
verbLogFreq:Michigan	-0.0087	-0.0087	-0.0156	-0.0012	0.0180	0.0180

Although the Class was removed in the stepwise analysis, a series of mixed-effect analyses were carried out in each level of Class in order to make post-hoc analyses comparable to those in the mixed-design ANOVA (with Frequency and Proficiency as the fixed-effect factors in each level; see Listing E.7). The results of the post-hoc analyses are presented in Table 7.9.

The results in Table 7.9 show the same trends as the results of the post-hoc mixed-design ANOVAs. The significant main effects and interaction effect of Frequency and Proficiency in the Exceptional Causative Verb class remain to be significant in the mixed-effect model (Frequency: $\hat{\beta} = 1.02, p < .001$; Proficiency: $\hat{\beta} = 0.18, p < .001$; Interaction: $\hat{\beta} = -0.02, p = .001$), but neither the main effects nor interaction effects exist in the Prototypical Causative Verb class.

7.5 Analyses of individual verb classes

In this sections, I will discuss the data divided into three verb groups: the verb semantic class in which the usage in Japanese might form a superset of that in English (cf. Table A.1 in the Appendix); the verb semantic class in which Japanese and English share the same usage (cf. Table A.2 in the Appendix); and the verb semantic class in which the usage in English forms a superset of that in Japanese

Table 7.9: A summary table of the mixed-effect linear model: Estimates of fixed-effect variables and p-values using the Markov Chain Monte Carlo approach (for each level of Verb Semantic Class)

			HIT-TOUCH VERB			
	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	7.7713	7.7572	3.0682	12.9364	0.0028	0.0011
Michigan	0.1079	0.1080	-0.0051	0.2205	0.0598	0.0511
verbLogFreq	0.4355	0.4391	-0.2929	1.1950	0.2520	0.2181
verbLogFreq:Michigan	-0.0119	-0.0120	-0.0290	0.0050	0.1664	0.1482
			OBJECT-DROP VERB			
	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	8.6737	8.6099	-0.3658	17.7798	0.0620	0.0034
Michigan	0.1072	0.1079	-0.0542	0.2645	0.1780	0.1206
verbLogFreq	0.4842	0.4922	-0.6944	1.5956	0.3364	0.1801
verbLogFreq:Michigan	-0.0120	-0.0120	-0.0313	0.0085	0.2342	0.1600
			BODY-PART VERB			
	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	16.6096	16.5948	-4.7675	41.1071	0.1034	0.0128
Michigan	-0.0941	-0.0919	-0.4382	0.2513	0.5938	0.5459
verbLogFreq	-1.4079	-1.4060	-5.1161	2.1806	0.3286	0.1789
verbLogFreq:Michigan	0.0285	0.0282	-0.0259	0.0841	0.3052	0.2476
			LAUGH VERB			
	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	16.5898	16.5814	6.4116	26.5885	0.0088	0.0001
Michigan	-0.0731	-0.0730	-0.2616	0.1173	0.4492	0.4493
verbLogFreq	-0.6738	-0.6712	-2.0646	0.7447	0.3174	0.2409
verbLogFreq:Michigan	0.0151	0.0150	-0.0113	0.0414	0.2654	0.2656
			EXCEPTIONAL CAUSATIVE VERB			
	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	2.9422	2.9308	-1.5756	7.2503	0.1842	0.1818
Michigan	0.1760	0.1765	0.1007	0.2529	0.0001	0.0000
verbLogFreq	1.0153	1.0168	0.4413	1.6017	0.0012	0.0004
verbLogFreq:Michigan	-0.0168	-0.0169	-0.0269	-0.0072	0.0010	0.0006
			PROTOTYPICAL CAUSATIVE VERB			
	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	9.5020	9.5258	3.4930	15.8189	0.0034	0.0017
Michigan	0.0086	0.0081	-0.1330	0.1505	0.9098	0.9032
verbLogFreq	0.0106	0.0070	-0.9269	0.8661	0.9828	0.9803
verbLogFreq:Michigan	0.0058	0.0058	-0.0150	0.0264	0.5932	0.5688

(cf. Table A.3 in the Appendix). To reiterate the predictions by the asymmetricrelationship in SLA, if the asymmetricrelationship holds in SLA, the native speakers of Japanese learning English will face difficulty with the first verb group (i.e., when their L1 (Japanese) forms a superset of L2 (English)), but not in the other verb class groups. Specifically, they are expected to have minimal difficulty in acquiring the native-like usage of the last verb class group. For example, Japanese native speakers should be able to acquire the transitive alternation with the body-part verb.

In the analyses to follow, the raw grammatical judgment score is used as the dependent variable (Grammatical Judgment, hereafter). The scale of Grammatical Judgment is from 1 to 5, with the predicted (theoretical) values for native speakers vary depending on the verb semantic class and the frame.

7.5.1 Exceptional and Prototypical causative classes

The mean Grammatical Judgment scores by the sentence frame (Frame, hereafter) and by Proficiency for the Exceptional Causative Verb class (i.e., inherently-directed motion and disappear verbs) and the Prototypical Causative Verb class (i.e., manner-of-motion and change-of-state verbs) are shown in Figures 7.3.

In the Exceptional and Prototypical Causative Verb classes, the expected judgment score for Agent Intransitive Frame is 1 (least adequate sentence) because the sentence has an agentive entity as the subject (e.g., *Aaron disappear.* in a sense that Aaron made something disappear.). These sentences can be perceived as grammatical by the participants but must be rejected due to the mismatch between the sentence and the stimulus video clip (in the video clip, Aaron made the coin disappear). The expected judgment score for Theme Intransitive Frame is 5 (most

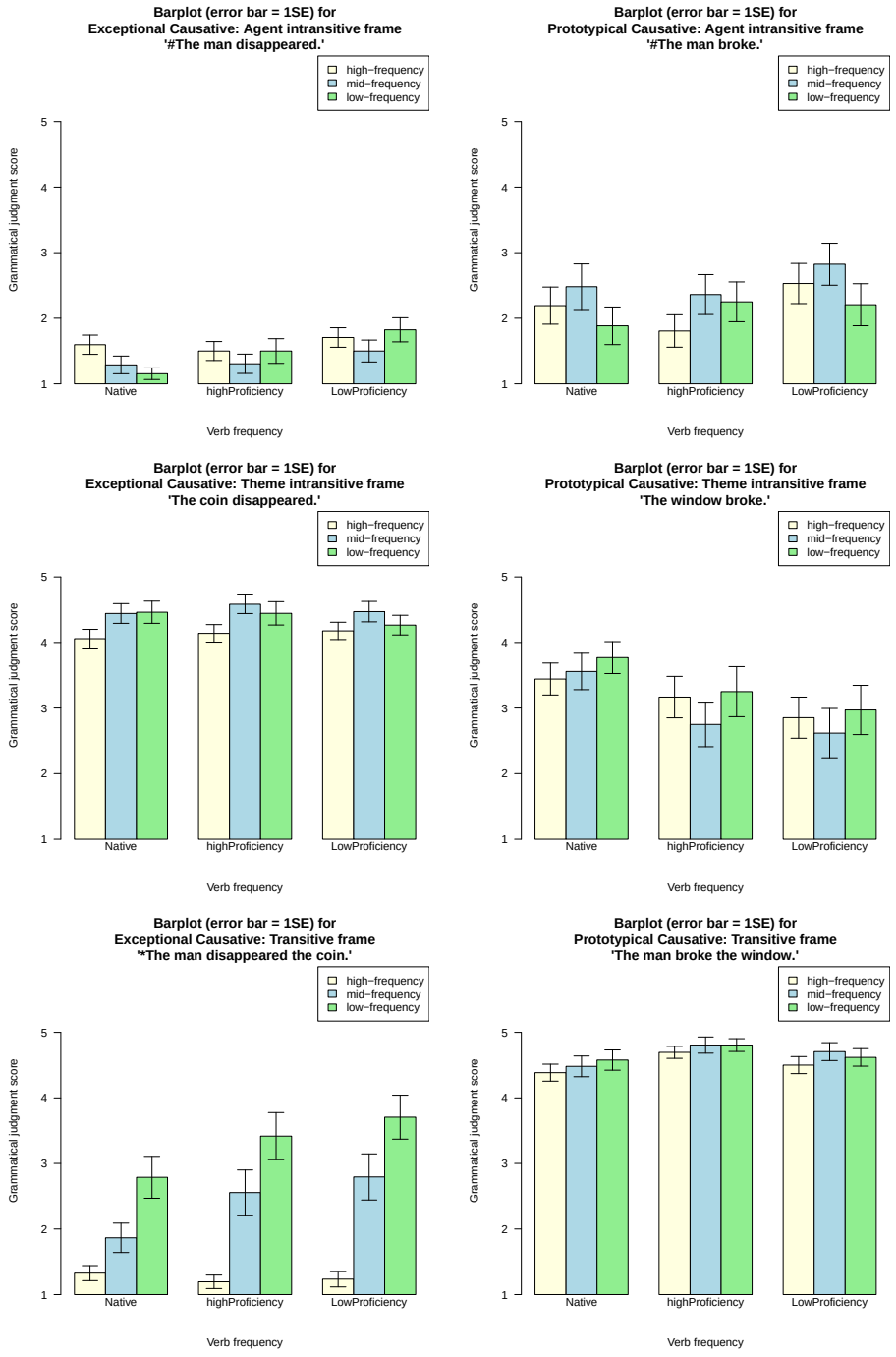


Figure 7.3: Plots for Grammatical Judgment scores for the Exceptional Causative Verb class and the Prototypical Causative Verb class

adequate). Finally, the native and non-native participants' responses in Transitive Frame are the main interest among Prototypical and Exceptional Causative Verb classes. The expected judgment score for Transitive Frame differs between the Prototypical Causative Verb class and the Exceptional Causative Verb class; the expected judgment score for Prototypical Causative Verb is 5 (e.g., *Aaron broke the window.*) whereas for Exceptional Causative Verb it is 1 (e.g., **Aaron disappear the coin.*). To repeat, the verbs in the Exceptional Causative Verb class are acceptable in the L2 participants' native language (i.e., Japanese) and, therefore, it was predicted that native Japanese speakers learning English as L2 will face a problem in rejecting the causative sentence with verbs in the Exceptional Causative Verb class.

A $2 \times 3 \times 3 \times 3$ four-way mixed-design ANOVA (DV: Grammatical Judgment Score, IV: Class, Frequency, Frame, and Proficiency) was conducted with the Exceptional Causative Verb class and the Prototypical Causative Verb class. The results show that Class has a significant main effect ($F(1, 58) = 194.39, p < .001$), significant two-way interactions (with Frequency: $F(2, 116) = 24.93, p < .001$), with Frame: $F(2, 116) = 328.74, p < .001$, and with Proficiency: $F(2, 116) = 2.06, p = .04$), and three-way interaction with Frequency and Frame ($F(4, 232) = 31.90, p < .001$).

Follow-up 3×3 two-way mixed-design ANOVAs (DV: Grammatical Judgment, IV: Frequency, Proficiency) were carried out for each sentence frame for each of the Exceptional Causative Verb class and the Prototypical Causative Verb class. The results are presented in Table 7.10. In the Agent Intransitive Frame (e.g., *Aaron disappeared.* and *Aaron broke.* etc.), there were significant main effects (Proficiency: $F(2, 58) = 4.10, p = .02$ and Frequency: $F(2, 116) = 5.27, p < .01$) and interaction effect between Proficiency and Frequency ($F(4, 116) = 3.00, p = .02$) in

Exceptional Causative Verb. In Prototypical Causative Verbs, on the other hand, only the main effects of Frequency ($F(2, 116) = 6.75, p = .001$) was significant in the Agent Intransitive Frame. In the Theme Intransitive Frame (e.g, *The coin disappeared.* and *The window broke.* etc.), significant main effects of Frequency ($F(2, 116) = 11.51, p < .001$) in the Exceptional Causative Verbs, and Proficiency ($F(2, 58) = 4.14, p = .02$) and Frequency ($F(2, 116) = 3.15, p = .05$) in Prototypical Causative Verbs were found. In the Theme Intransitive Frame, neither interaction effect was significant.

Finally, in the Transitive Frame (e.g., **Aaron disappeared the coin* and *Aaron broke the window*), where the influence of L1 was predicted, while the significant main effects of Proficiency and Frequency existed in both Exceptional Causative Verb and Prototypical Causative Verb class, were there significant interaction effects between Proficiency and Frequency only for the Exceptional Causative Verb class ($F(4, 116) = 3.61, p < .001$), but not for the Prototypical Causative Verb class ($F(4, 116) = 0.42, p = .79$).

In sum, the results suggest that the simple main effects of Proficiency and Frequency were primarily present in Exceptional Causative Verbs. In addition, in Transitive Frame, where the difference between L1 and L2 is the most contrastive, a significant interaction effect between frequency and proficiency indicates a tendency that low-proficiency L2 English participants were subject to a stronger influence of frequency than the high-proficiency L2 participants and native-speaker participants.

Comparable analyses with the mixed-effect model (fixed effects: Frequency, Proficiency, and their interactions; random effects: Verb and Participant) were car-

Table 7.10: A summary table of the mixed-design ANOVA in Exceptional Causative Verb and Prototypical Causative Verb classes

EXCEPTIONAL CAUSATIVE VERB

AGENT INTRANSITIVE FRAME

Effect	df_{num}	df_{den}	F	p-value	η^2
englishLevel	2	58	4.10	0.02*	0.07
verbFreq	2	116	5.27	0.01*	0.04
englishLevel:verbFreq	4	116	3.00	0.02*	0.05

THEME INTRANSITIVE FRAME

Effect	df_{num}	df_{den}	F	p-value	η^2
englishLevel	2	58	0.34	0.72	0.01
verbFreq	2	116	11.51	0.00*	0.10
englishLevel:verbFreq	4	116	0.74	0.57	0.01

TRANSITIVE FRAME

Effect	df_{num}	df_{den}	F	p-value	η^2
englishLevel	2	58	6.46	0.00*	0.09
verbFreq	2	116	102.17	0.00*	0.50
englishLevel:verbFreq	4	116	3.61	0.01*	0.07

PROTOTYPICAL CAUSATIVE VERB

AGENT INTRANSITIVE FRAME

Effect	df_{num}	df_{den}	F	p-value	η^2
englishLevel	2	58	1.45	0.24	0.03
verbFreq	2	116	6.75	0.00*	0.04
englishLevel:verbFreq	4	116	1.76	0.14	0.02

THEME INTRANSITIVE FRAME

Effect	df_{num}	df_{den}	F	p-value	η^2
englishLevel	2	58	4.14	0.02*	0.09
verbFreq	2	116	3.15	0.05*	0.02
englishLevel:verbFreq	4	116	0.74	0.57	0.01

TRANSITIVE FRAME

Effect	df_{num}	df_{den}	F	p-value	η^2
englishLevel	2	58	3.89	0.03*	0.07
verbFreq	2	116	3.56	0.03*	0.02
englishLevel:verbFreq	4	116	0.43	0.79	0.01

ried out and their results are presented in Table 7.11. In contrast with the mixed-design ANOVA analysis, the main effects and the interaction effects appear to be significant in both the Exceptional Causative Verbs and the Prototypical Causative Verbs in the Transitive Frame. A notable difference is found the main effect of Frequency (Log Frequency) – the effect of Frequency in the Exceptional Causative Verbs ($\hat{\beta} = -0.79, p < .001$) is noticeably higher than the other effects. Frequency in the Prototypical Causative Verbs is not significant ($\hat{\beta} = -0.22, p = .12$), which suggests that the frequency effect mainly existes in the Exceptional Causative Verbs in the Transitive Frame.

7.5.2 Laugh (unergative), hit-touch (pure transitive), and object-drop classes

The mean Grammatical Judgment scores by the sentence frame (Frame, hereafter) and by Proficiency for the Laugh Verb (unergative), the Hit-touch Verb (pure transitive), and the Object-drop Verb are plotted in Figures 7.4 to 7.6. The Laugh Verb class, commonly known as the unergative verbs, is only acceptable in the Theme Intransitive Frame (e.g., *The baby laughed.*) in both English and Japanese and, therefore, no effect of L1 was expected. By the same token, the Hit-touch Verb (pure transitive) class and the Object-drop Verb class are the two verb classes that behave in similar manners in both English and Japanese. The Hit-touch Verb class is only allowed in Transitive Frame (e.g., *Aaron hit the ball.*) and should exhibit a mild ungrammatical judgment in the Agent Intransitive Frame (e.g., #*Aaron hit.*). Finally, verbs in the Object-drop Verb class are expected to be acceptable in Agent Intransitive Frame (i.e., null-object construction; e.g., *Aaron ate.*) and the Transitive Frame (e.g., *Aaron ate chocolate.*).

Table 7.11: A summary table of the mixed-effect linear model: Estimates of fixed-effect variables and p-values using the Markov Chain Monte Carlo approach (Exceptional and Prototypical Causative Verb classes)

EXCEPTIONAL CAUSATIVE VERB

AGENT INTRANSITIVE FRAME

	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	2.4530	2.4631	0.7384	4.1276	0.0086	0.0018
michigan	-0.0395	-0.0396	-0.0713	-0.0068	0.0154	0.0149
verbLogFreq	-0.0374	-0.0384	-0.2600	0.1825	0.7294	0.7068
verbLogFreq:michigan	0.0030	0.0030	-0.0013	0.0070	0.1544	0.1372

THEME INTRANSITIVE FRAME

	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	3.7444	3.7491	2.0308	5.3952	0.0004	0.0000
michigan	0.0320	0.0319	-0.0033	0.0641	0.0632	0.0622
verbLogFreq	0.0772	0.0768	-0.1470	0.2920	0.4890	0.4447
verbLogFreq:michigan	-0.0043	-0.0043	-0.0086	0.0003	0.0544	0.0538

TRANSITIVE FRAME

	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	9.5317	9.5169	5.8499	13.2123	0.0001	0.0000
michigan	-0.1228	-0.1228	-0.1819	-0.0662	0.0001	0.0000
verbLogFreq	-0.7901	-0.7881	-1.2707	-0.3017	0.0040	0.0012
verbLogFreq:michigan	0.0120	0.0120	0.0042	0.0194	0.0038	0.0017

PROTOTYPICAL CAUSATIVE VERB

AGENT INTRANSITIVE FRAME

	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	4.9769	4.9347	-0.0092	9.9309	0.0494	0.0345
michigan	-0.1138	-0.1134	-0.2060	-0.0238	0.0170	0.0117
verbLogFreq	-0.2930	-0.2875	-1.0349	0.4196	0.4204	0.3873
verbLogFreq:michigan	0.0143	0.0142	0.0016	0.0278	0.0378	0.0274

THEME INTRANSITIVE FRAME

	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	2.4056	2.3937	-2.1452	6.9403	0.2952	0.2595
michigan	0.0501	0.0501	-0.0415	0.1447	0.2940	0.2772
verbLogFreq	-0.1066	-0.1069	-0.7698	0.5453	0.7568	0.7240
verbLogFreq:michigan	-0.0020	-0.0020	-0.0154	0.0113	0.7704	0.7590

TRANSITIVE FRAME

	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	6.3945	6.3924	4.2976	8.4957	0.0001	0.0000
michigan	-0.0528	-0.0528	-0.0923	-0.0129	0.0092	0.0089
verbLogFreq	-0.2235	-0.2227	-0.5230	0.0881	0.1464	0.1196
verbLogFreq:michigan	0.0068	0.0068	0.0011	0.0126	0.0208	0.0178

Laugh verb

As shown in the interaction plots in Figure 7.4, in the unergative verb class, all participants in both the control and target groups rejected the Agent Intransitive Frame and the Transitive Frame whereas accepted the Theme Intransitive frame. The only exception to this pattern is the high-frequency verb in the Transitive Frame, which will be discussed below. A series of 3×3 mixed-design ANOVAs in each frame (Table 7.12) show that the main effect of Frequency is significant in the Agent Intransitive Frame ($F(2, 116) = 124.81, p < .001$) as well as the Transitive frame ($F(2, 116) = 13.46, p < .001$) and there was an interaction effect in the Transitive Frame ($F(2, 116) = 4.96, p < .001$).

Such effects were not expected for the unergative verbs, but as it is obvious in the plotted data, the main effect of Frequency was primarily caused by the high acceptance score of the high-frequency token *laugh* in the Transitive Frame (i.e., #*The father laughed.*) by both native and non-native participants. This sentence should have been rejected on the ground that, in the video clip for this sentence, the father was making his baby laugh but the father himself was not laughing. The high acceptability of this sentence can possibly be attributed to the participants' misinterpretation of the stimulus video clip – the participants, both native and non-native speakers alike, probably assumed that the father must have been laughing as he makes his baby laugh. Such misinterpretation is much more likely with the verb *laugh* than the other stimulus verbs (e.g., *cry* and *moan*), both of which were rejected by all the participants, as expected.

The mixed-effect analyses (fixed effects: Frequency, Proficiency, and their interactions; random effects: Verb and Participant) show that such spurious main

effects of Frequency disappear when Verb was entered as the random-effect factor. In fact, as shown in Table 7.13, none of the factors appeared to be significant in the mixed-effect analyses[1].

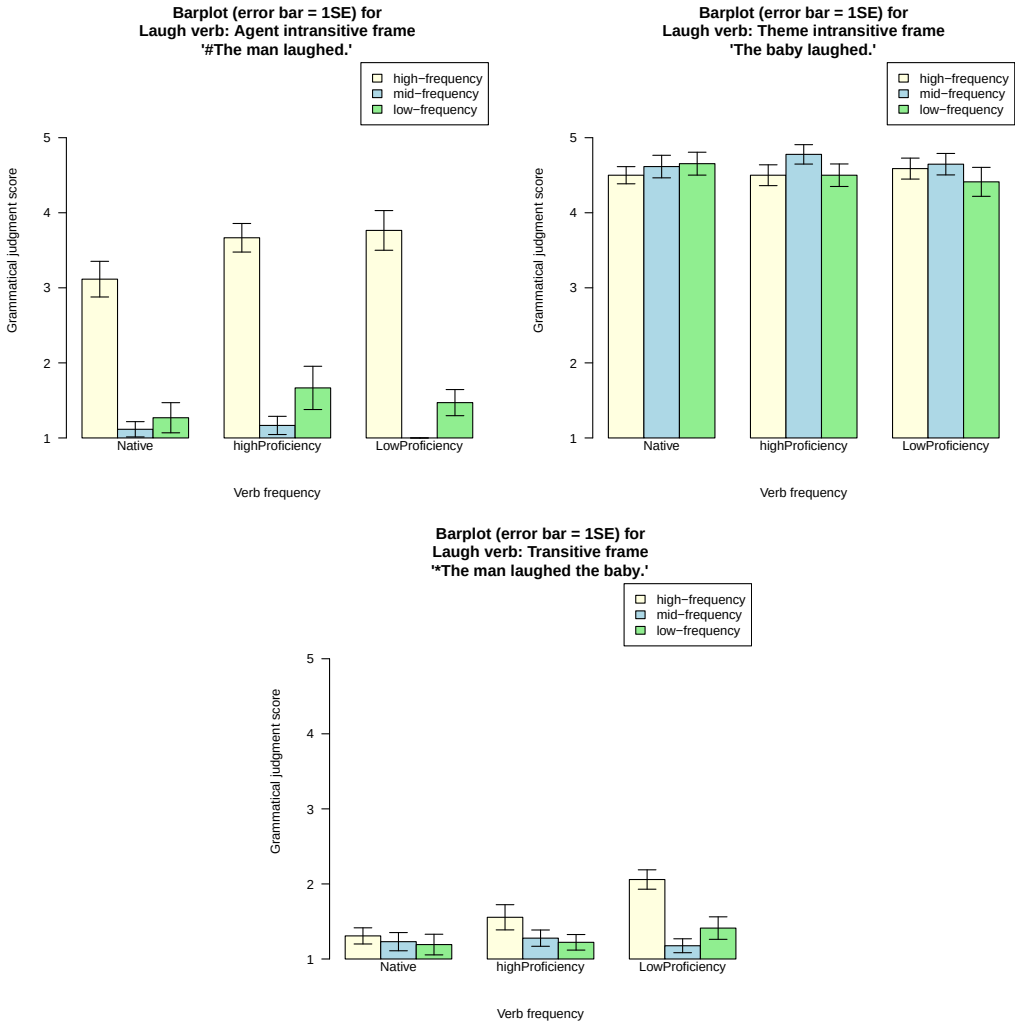


Figure 7.4: Plots for Grammatical Judgment scores for the laugh (unergative) verb

[1]This change was mainly caused by the use of the interval scales in *Proficiency* and *Frequency* rather than the introduction of the random-effect factors.

Table 7.12: A summary table of the mixed-design ANOVA for the Laugh Verb class

AGENT INTRANSITIVE FRAME

Effect	df_{num}	df_{den}	F	p-value	η^2
englishLevel	2	58	2.40	0.10	0.03
verbFreq	2	116	124.81	0.00*	0.59
englishLevel:verbFreq	4	116	1.07	0.37	0.02

THEME INTRANSITIVE FRAME

Effect	df_{num}	df_{den}	F	p-value	η^2
englishLevel	2	58	0.06	0.94	0.00
verbFreq	2	116	1.08	0.34	0.01
englishLevel:verbFreq	4	116	0.66	0.62	0.01

TRANSITIVE FRAME

Effect	df_{num}	df_{den}	F	p-value	η^2
englishLevel	2	58	2.32	0.11	0.05
verbFreq	2	116	13.46	0.00*	0.08
englishLevel:verbFreq	4	116	4.96	0.00*	0.06

Table 7.13: A summary table of the mixed-effect linear model: Estimates of fixed-effect variables and p-values using the Markov Chain Monte Carlo approach (Laugh verb class)

AGENT INTRANSITIVE FRAME

	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	-0.9323	-0.8729	-9.0237	6.8120	0.8276	0.8791
michigan	-0.0062	-0.0061	-0.1171	0.0914	0.9060	0.9053
verbLogFreq	0.5105	0.5028	-0.6070	1.6267	0.3472	0.5518
verbLogFreq:michigan	-0.0014	-0.0014	-0.0158	0.0132	0.8546	0.8484

THEME INTRANSITIVE FRAME

	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	2.2306	2.2494	-2.8381	7.0100	0.2624	0.1422
michigan	0.0535	0.0535	-0.0198	0.1245	0.1474	0.1285
verbLogFreq	0.3184	0.3165	-0.4410	0.9507	0.2574	0.1325
verbLogFreq:michigan	-0.0072	-0.0072	-0.0173	0.0029	0.1612	0.1397

TRANSITIVE FRAME

	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	0.2865	0.3235	-4.1988	5.4045	0.8606	0.8397
michigan	0.0127	0.0123	-0.0471	0.0751	0.6924	0.6364
verbLogFreq	0.2389	0.2332	-0.4440	0.9085	0.3986	0.2216
verbLogFreq:michigan	-0.0039	-0.0038	-0.0122	0.0049	0.3734	0.2904

Hit-touch verb

As shown in Figure 7.5, both native and non-native participants responded to the verbs from the Hit-touch Verb class as predicted – the participants in both groups exhibited a slight divergence of the grammatical acceptability in Agent Intransitive Frame (e.g., ?*Aaron hit.*), ungrammatical judgment in Theme Intransitive Frame (e.g., **The ball hit.*), and grammatical judgment in Transitive Frame (e.g., *Aaron hit the ball.*).

For each frame, 3 $\times$ 3 mixed-design ANOVAs was calculated (Table 7.14). There was a significant main effects of Proficiency in Agent Intransitive Frame ($F(2, 58) = 3.33, p = .04$) and Frequency in all frames (Agent Intransitive Frame: $F(2, 116) = 19.81, p < .001$, Theme Intransitive Frame: $F(2, 116) = 5.36, p = .01$, and Transitive Frame: $F(2, 116) = 3.95, p = .02$). However, like in the Laugh Verb class, these significant effects disappear in the mixed-effect analyses (Table 7.15).

Table 7.14: A summary table of the mixed-design ANOVA for the Hit-touch Verb class

AGENT INTRANSITIVE FRAME

Effect	df_{num}	df_{den}	F	p-value	η^2
englishLevel	2	58	3.33	0.04*	0.07
verbFreq	2	116	19.81	0.00*	0.12
englishLevel:verbFreq	4	116	0.81	0.52	0.01

THEME INTRANSITIVE FRAME

Effect	df_{num}	df_{den}	F	p-value	η^2
englishLevel	2	58	0.20	0.82	0.00
verbFreq	2	116	17.07	0.00*	0.08
englishLevel:verbFreq	4	116	2.76	0.03*	0.03

TRANSITIVE FRAME

Effect	df_{num}	df_{den}	F	p-value	η^2
englishLevel	2	58	0.21	0.81	0.00
verbFreq	2	116	7.17	0.00*	0.05
englishLevel:verbFreq	4	116	2.09	0.09	0.03

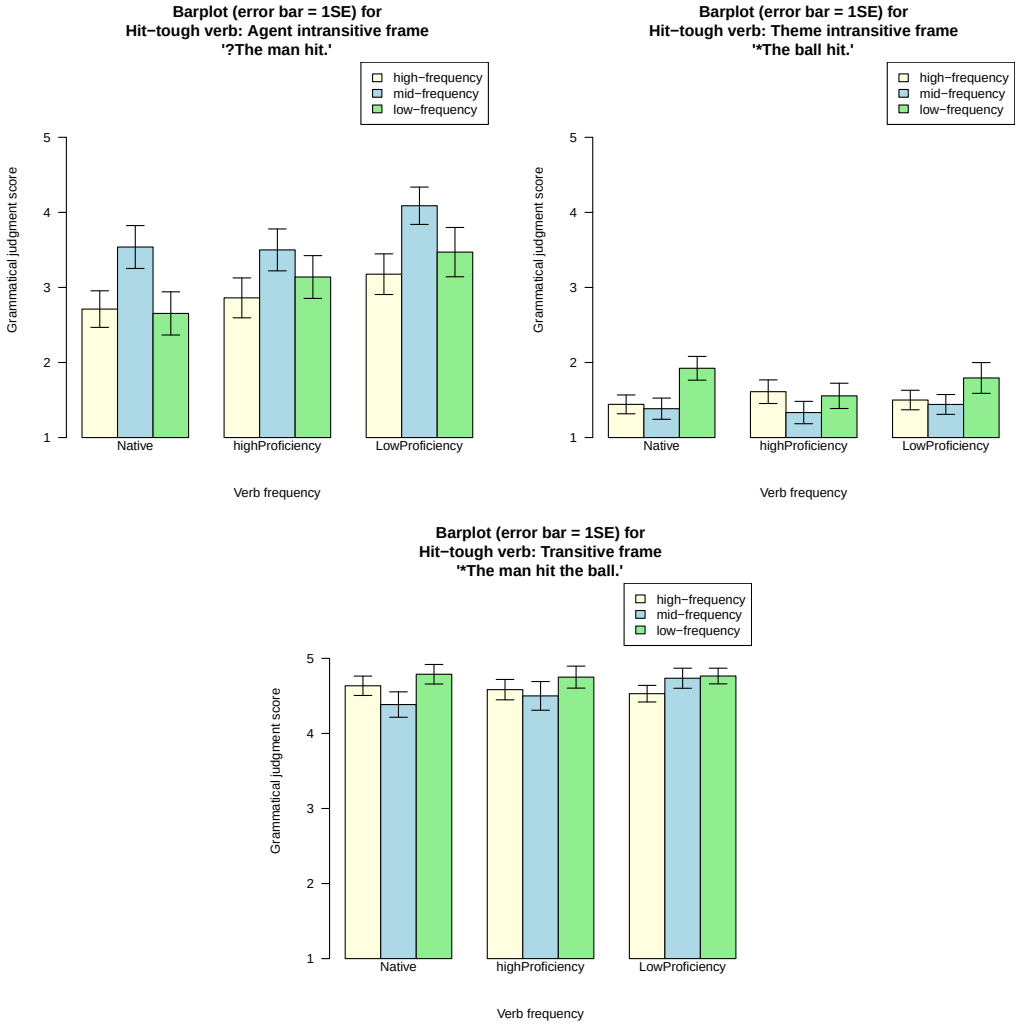


Figure 7.5: Plots for Grammatical Judgment scores for the hit-touch (pure transitive) verb

Table 7.15: A summary table of the mixed-effect linear model: Estimates of fixed-effect variables and p-values using the Markov Chain Monte Carlo approach (Hit-touch verb class)

AGENT INTRANSITIVE FRAME

	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	5.3005	5.3148	0.3847	9.9789	0.0296	0.0162
michigan	-0.0486	-0.0492	-0.1390	0.0401	0.2816	0.2760
verbLogFreq	-0.1353	-0.1367	-0.8454	0.6139	0.7042	0.6823
verbLogFreq:michigan	0.0030	0.0030	-0.0106	0.0165	0.6652	0.6574

THEME INTRANSITIVE FRAME

	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	1.7431	1.7462	-0.7311	4.1256	0.1602	0.1131
michigan	0.0090	0.0090	-0.0362	0.0578	0.7116	0.6913
verbLogFreq	-0.0214	-0.0216	-0.3776	0.3630	0.8844	0.8957
verbLogFreq:michigan	-0.0016	-0.0016	-0.0089	0.0052	0.6562	0.6361

TRANSITIVE FRAME

	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	5.2234	5.2358	2.8331	7.5093	0.0002	0.0000
michigan	-0.0012	-0.0014	-0.0443	0.0432	0.9448	0.9548
verbLogFreq	-0.0951	-0.0968	-0.4468	0.2641	0.5772	0.5597
verbLogFreq:michigan	0.0002	0.0003	-0.0065	0.0068	0.9358	0.9396

Object-drop verb

The interaction plots for the Object-drop Verb class in Figure 7.6 exhibit two interesting patterns in the data. One is that non-native participants, whose native language allows a wide range of verbs to drop their object, accepted the verbs in the Object-drop Verb class in Agent Intransitive Frame (e.g., *Aaron ate.*) no more than the English native participants. The other is that both native and non-native participants consistently highly rated the object-drop verbs in Transitive Frame (e.g., *Aaron ate the cake.*). In fact, all participants except a few outlier responses rated all stimuli in this category as 5, which resulted in the absence of variance in the Transitive Frame. Thus, the analyses were conducted only in the Agent Intransitive Frame and the Theme Intransitive Frame.

For each frame, 3 $\times$ 3 mixed-design ANOVAs (Table 7.16) were calculated. There were a significant main effect of Frequency in Theme Intransitive Frame

($F(2, 116) = 23.78, p < .001$) and a significant interaction effect of Proficiency and Frequency in the Agent Intransitive Frame ($F(4, 116) = 2.45, p = .05$) and in Theme Intransitive Frame ($F(4, 116) = 3.33, p = .01$). The mixed-effect analyses (fixed effects: Frequency, Proficiency, and their interactions; random effects: Verb and Participant; see Table 7.17) show that the interaction effects in the Agent Intransitive ($\hat{\beta} = 0.004, p = .60$) and both main effects (Frequency: $\hat{\beta} = -0.11, p = .75$ and Proficiency: $\hat{\beta} = -0.01, p = .92$) are not significant . However, in Theme Intransitive Frame, the main effect of Proficiency ($\hat{\beta} = 0.09, p < .01$) and the interaction effect ($\hat{\beta} = -0.01, p = .01$) are significant. These results were not expected, but due to the marginal influence of these two factors ($\hat{\beta}$s are 0.09 and -0.01, respectively), I assume that these patterns are not contradictory to the initial hypotheses for this verb class.

Table 7.16: A summary table of the mixed-design ANOVA in Object-drop Verb class

AGENT INTRANSITIVE FRAME

Effect	df_{num}	df_{den}	F	p-value	η^2
englishLevel	2	58	1.88	0.16	0.04
verbFreq	2	116	1.07	0.35	0.01
englishLevel:verbFreq	4	116	2.45	0.05*	0.03

THEME INTRANSITIVE FRAME

Effect	df_{num}	df_{den}	F	p-value	η^2
englishLevel	2	58	2.47	0.09	0.04
verbFreq	2	116	23.78	0.00*	0.18
englishLevel:verbFreq	4	116	3.33	0.01*	0.06

7.5.3 Body-part verb

The interaction plots for the Body-part Verb class are presented in Figure 7.7. The responses by the native participants in the Theme Intransitive Frame were not as expected; that is, the native participants did not accept the body-part verbs in Theme Intransitive Frame (e.g., *His head nodded.*). I have no explanation to offer

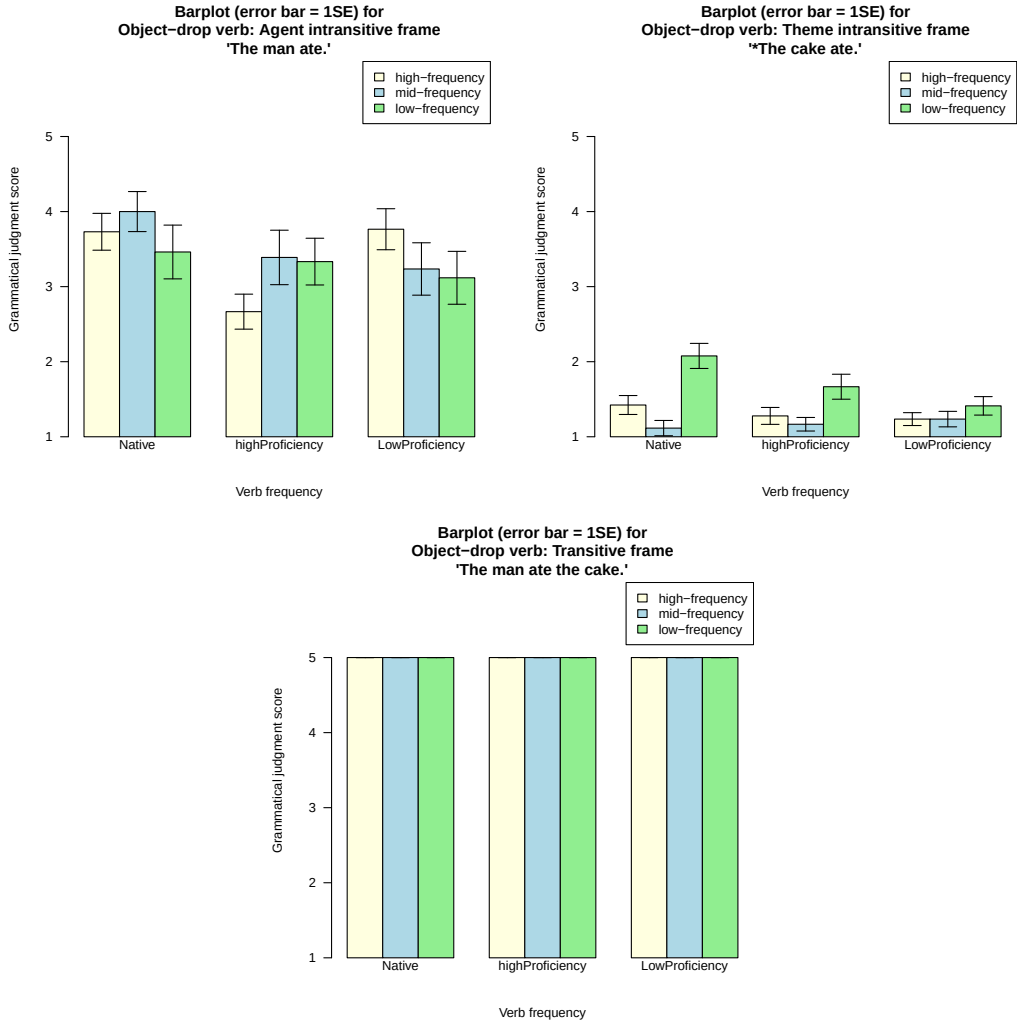


Figure 7.6: Plots for Grammatical Judgment scores for the object-drop verb

Table 7.17: A summary table of the mixed-effect linear model: Estimates of fixed-effect variables and p-values using the Markov Chain Monte Carlo approach (Object-drop verb class)

AGENT INTRANSITIVE FRAME

	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	3.2132	3.1376	-5.1164	11.9737	0.3832	0.2411
michigan	-0.0061	-0.0053	-0.1445	0.1439	0.9456	0.9239
verbLogFreq	-0.1090	-0.1001	-1.1961	0.9605	0.8214	0.7469
verbLogFreq:michigan	0.0041	0.0040	-0.0144	0.0217	0.6632	0.6030

THEME INTRANSITIVE FRAME

	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	-0.9048	-0.8772	-5.9810	3.9253	0.6194	0.5058
michigan	0.0911	0.0908	0.0283	0.1523	0.0046	0.0022
verbLogFreq	0.2298	0.2270	-0.3452	0.9037	0.3470	0.1782
verbLogFreq:michigan	-0.0100	-0.0100	-0.0179	-0.0023	0.0126	0.0070

as to why the native speakers rejected this type of sentence. Since the baseline by the native-speaker participants wasn't established, the Theme Intransitive Frame of the Body-part Verb was excluded from the further analyses.

For each frame, a 3×3 mixed-design ANOVAs was calculated (Table 7.18). Both the main effects and the interaction effect were significant in Agent Intransitive Frame (Proficiency: $F(2, 58) = 5.97, p < .001$, Frequency: $F(2, 116) = 3.14, p < .05$, and interaction: $F(4, 116) = 4.15, p < .001$). Also, the interaction effect in Transitive Frame ($F(4, 116) = 3.38, p = .01$) were also significant.

The mixed-effect analyses (fixed effects: Frequency, Proficiency, and their interactions; random effects: Verb and Participant) as presented in Table 7.19 show the comparable patterns. All effects remain significant in Agent Intransitive Frame (Proficiency (Michigan test): $\hat{\beta} = -0.22, p = .03$, Frequency (Verb Log Frequency): $\hat{\beta} = -2.01, p = .001$, and interaction: $\hat{\beta} = 0.04, p < .01$). None of the variables was significant in the Transitive Frame. A noteworthy pattern in the data is the relatively higher contribution of Frequency in this class to the mixed-effect model ($\hat{\beta}$ are -2.01 and 0.60, respectively), a similar pattern that was observed in the Ex-

ceptional Causative Verb class.

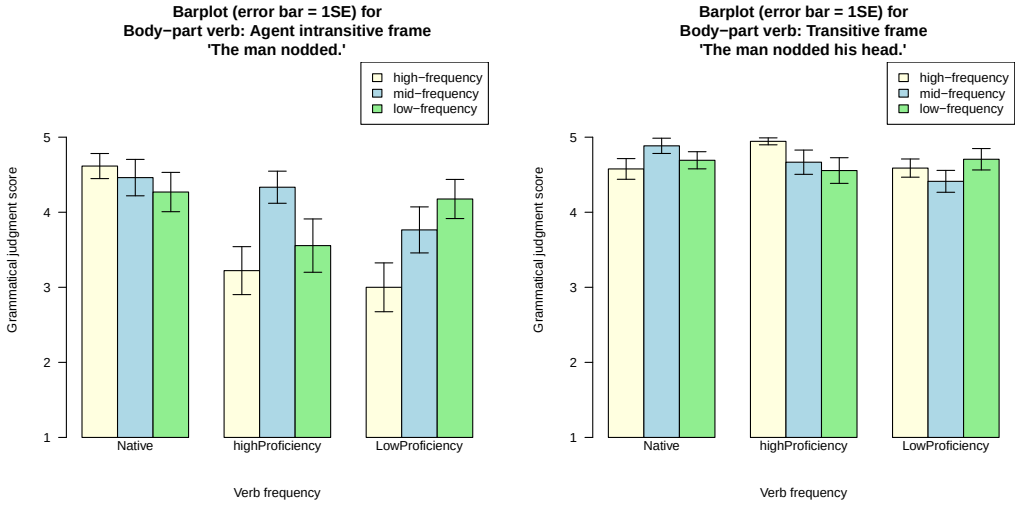


Figure 7.7: Plots for Grammatical Judgment scores for the body-part verb

Table 7.18: A summary table of the mixed-design ANOVA in Body-part verb class

AGENT INTRANSITIVE FRAME

Effect	df_{num}	df_{den}	F	p-value	η^2
englishLevel	2	58	5.97	0.00*	0.09
verbFreq	2	116	3.14	0.05*	0.03
englishLevel:verbFreq	4	116	4.15	0.00*	0.07

TRANSITIVE FRAME

Effect	df_{num}	df_{den}	F	p-value	η^2
englishLevel	2	58	0.86	0.43	0.01
verbFreq	2	116	0.09	0.92	0.00
englishLevel:verbFreq	4	116	3.38	0.01*	0.06

Table 7.19: A summary table of the mixed-effect linear model: Estimates of fixed-effect variables and p-values using the Markov Chain Monte Carlo approach (Body-part verb class)

AGENT INTRANSITIVE FRAME

	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	14.4197	14.4487	-0.5092	28.6300	0.0518	0.0004
michigan	-0.2195	-0.2207	-0.4172	-0.0211	0.0288	0.0169
verbLogFreq	-2.0082	-2.0095	-4.3537	0.2183	0.0694	0.0018
verbLogFreq:michigan	0.0433	0.0435	0.0119	0.0750	0.0062	0.0030

TRANSITIVE FRAME

	Estimate	MCMCmean	HPD95lower	HPD95upper	pMCMC	$Pr(>\|t\|)$
Intercept	1.8193	1.8530	-3.3478	7.2161	0.4416	0.3314
michigan	0.0659	0.0657	-0.0287	0.1597	0.1678	0.1357
verbLogFreq	0.3974	0.3911	-0.4719	1.2018	0.3022	0.1806
verbLogFreq:michigan	-0.0091	-0.0091	-0.0246	0.0054	0.2338	0.1923

CHAPTER 8

DISCUSSION

8.1 PROFICIENCY EFFECT

The significant effect of L2 learners' proficiency on the grammatical judgment of a verb's transitivity (see Table 7.6 for the mixed-design ANOVA analysis and Table 7.8 for the mixed-effect model analysis) indicates an important yet unrecognized role of transitivity in the L2 interlanguage. The grammatical judgments of verb transitivity that L2 learners made in the experiment were significantly different from those of native English speakers. The data show a pattern that the lower an L2 speaker's proficiency is, the wider is the difference between the native speaker's judgment and the L2 speaker's judgment.

One conclusion that can be drawn from this result is that there is a critical contribution of transitivity to the L2 interlanguage system. Compared with the other kinds of typical L2 interlangauge errors, transitivity is much less deductible since L2 learners can avoid the transitivity error with a simple parsimonious strategy. For example, in natural spontaneous conversation, L2 learners are rarely coerced to demonstrate their knowledge of the causative and non-causative verbs.

L2 learners do not need to know that verbs such as *break* and *open* are causative verb unless they venture to use these verbs in the inchoative construction (e.g., *My car broke.*) rather than other syntactic constructions such as the passive and the peripheral passive (e.g., *My car got broken.*). Similarly, the non-causativity of *disappear* and *descend* rarely appears as an L2 error since such an error happens only when L2 learners attempt to generalize these verbs in the causative construction. With respect to object-drop verb such as *eat* and *play*, L2 speakers can avoid making transitivity errors by consistently supplying the direct object. In short, transitivity has a very weak link to L2 errors on the surface level and the transitivity error rarely happens when the L2 learners are conservative.

In this respect, the significant main effect of proficiency is an interesting finding. The clear pattern in which the L2 proficiency is correlated with the native-like judgment of the verb's transitivity shows that transitivity is, in fact, one of the critical grammatical features that L2 learners need to acquire for successful L2 acquisition. While relatively little attention has been paid to the acquisition of transitivity in both SLA research and L2 pedagogy, this finding is not counter-intuitive since transitivity underlies the grammatical errors that are known to be typical of L2 learners. As discussed in the previous chapter, if one assumes that transitivity plays a role in the correct use of the preposition in L2, the error of omission and extraneous prepositions can be analyzed as a simple misconstrual of the predicate's transitivity. An extraneous preposition (e.g., **recognize about the fact*, **visit at my friend's* etc.) can be seen as a systematic product of L2 interlanguage (Selinker, 1972) since the L2 learners have correctly employed a transitive preposition for the predicate that they misconstrued as intransitive. In sum, the finding of a significant effect of proficiency on the acquisition of native-like judgements of transitivity

offers a new perspective on the L2 errors such as the preposition errors, which are caused by an underlying grammatical feature for the predicate's transitivity.

This finding also offers a pedagogical implication related to the type of negative feedback. Negative feedback on the use of prepositions may not be effective in some cases since some of the omission and extraneous preposition errors occur even when the L2 learner has acquired an accurate L2 interlanguage for the preposition. In the example of extraneous preposition errors above, the extraneous preposition was supplied because the L2 learner misconstrued the predicate as intransitive, for which a transitive preposition is necessary to introduce a direct object. In this case, the cause of extraneous preposition errors is not the preposition but the transitivity of the predicate. So, in these cases, explicit negative feedback that focuses on the extraneous preposition is misleading to L2 learners. More effective feedback should address the fact that the verb *recognize* along with other perceptual verbs like *acknowledge* and *accept* are transitive predicates in English while their equivalent predicates in the L2 learner's native language may not be used transitively.

The influence of transitivity is not limited to preposition errors and can be associated with other types of errors that are known to be persistent among Japanese native speakers learning English. The choice between the present-participle and the past-participle adjectives is a notorious challenge to L2 learners (e.g., **I'm interesting.*, **I'm boring.* etc.), especially with psych-verbs (e.g., *bore, frighten, please* etc.), but it also occurs with unergative verbs (e.g., *a *cried/crying baby*; cf. the adversative passive (Tsujimura, 2002a; S. Izumi & Lakshmanan, 1998)). A somewhat related issue is the telic interpretation of the achievement/accomplishment verbs (e.g., *The flight is arriving/arrived.* (Gabriele, 2009)). The misconstrual of how L2

learners realize the predicate's transitivity may be an important factor in understanding what makes these errors so persistent among L2 learners.

Another possible but less interesting interpretation of the significant effect of proficiency in the experiment is that the L2 participants were simply more conservative than the native speaker participants in making grammatical judgments. In other words, unlike the native speakers who do not hesitate to choose definitive grammatical judgments such as "*definitely* grammatical" and "*definitely* ungrammatical", L2 learners make less definitive judgments because they are not confident about their grammatical judgment in L2. The observed correlation between L2 proficiency and grammatical judgment can be obtained if the low-proficiency L2 learners are more conservative than the high-proficiency L2 learners. However, this interpretation of the data is not compatible with the further analyses of the proficiency effect in relation to the verb semantic class. The proficiency effect shows a nearly significant interaction with the verb semantic class ($F(10, 290) = 1.66, p < .09$) in the mixed-design ANOVA (see 7.6), and the main effects of proficiency were attested only in a limited set of the verb semantic classes. While it is probably true that the L2 learners are more conservative in grammatical judgment than the native speakers are, an explanation based on the L2 learner's conservatism will not account for the fact that L2 learners at differing proficiency levels can make judgments as confident as those of the native speaker for some verb semantic classes.

Thus, if not simple conservatism of the L2 learners, a natural and plausible answer to the question of why L2 learners rated the verb's transitivity differently from the native speakers is the influence of L1 (Odlin, 1989). As the full-transfer hypothesis argues, the initial state of the L2 learner's knowledge about the verb's transitivity can be the replication of the L1 transitivity and the mismatch between

L1 and L2 causes the difficulty. I will revisit the issue of transfer again later in this chapter, but tentatively I conclude that the existing data are on par with the interpretation that the L2 learners failed to make native-like judgements due to the influence of L1.

8.2 Frequency effect

The overall analyses show a significant main effect of frequency (see Table 7.6 for the mixed-design ANOVA analysis and Table 7.8 for the mixed-effect model analysis) and a significant interaction effect between frequency and verb semantic class. The post-hoc tests in each verb semantic class show that the effect of frequency predominantly exists in the Exceptional Causative Verb class (e.g., *die*, *disappear*, *vanish*, *go*, *descend*, and *tumble*). The frequency effects show that while L2 learners were able to make native-like grammatical judgments with the high-frequency verbs in the Exceptional Causative Verb class (e.g., *die* and *go*), they failed to do the same with mid- and low-frequency verbs (e.g., *vanish* and *tumble*).

A similar pattern was also observed in the earlier research on the acquisition of transitivity in L1. Ambridge et al. (Ambridge et al., 2008) investigated the acquisition of transitivity of the verbs of falling (inherently-directed motion verbs), the disappear verbs, and the laugh (unergative) verbs among 5- and 9-year-old L1 English children and adult English speakers. In their study, the high-frequency verbs consistently received higher grammatical preference scores than the low-frequency and the novel verbs across all the age groups. In addition, such frequency effects existed to the greatest degree in the disappear verbs and to the least degree in the laugh verbs. Ambridge et al. (2008) argued that the frequency effect works along

with the prototypicality of the verb semantic class since the participants made accurate but less consistent grammatical judgment about the novel verbs. In their account, both the frequency effect and the verb semantic class are necessary to explain their data about the novel verbs. The frequency effect theory would predict that the participant will not be able to make any systematic judgments of the novel verb (i.e., verbs with no frequency). The verb semantic class theory, on the other hand, will predict that the participants can make grammatical judgment on the novel verb as accurately as on the high- and low-frequency verbs since novel verbs were presented in such a way that they would satisfy the semantic criteria to be in the semantic class that they are assigned to. Since the data did not support either prediction, Ambridge et al. (2008) concluded that the combination of frequency and semantic prototype must operate together and complement each other. In other words, in Ambridge et al's study, L1 English children are required to have higher exposure to the disappear verbs than to the other verb classes since the semantics of the disappear verbs is prototypically permitted to be in the causative construction.

Although the current study investigated the acquisition of transitivity in SLA rather than FLA, the same pattern as in Ambridge et al. (2008) was observed in the verbs of falling and the disappearing verbs. Similarly, in the current study, among the extended range of verb semantic classes, the verbs of falling and the disappear verbs, collectively grouped as the Exceptional Causative Verb class, are the only class with major significant frequency effects. An especially interesting contrast is the lack of or a weakened frequency effect in the Prototypical Causative Verb (i.e., change-of-state and manner-of-motion verbs), whose semantic properties exhibit similarities to those of the Exceptional Causative Verb class.

The contrast between the Exceptional Causative Verb class and the rest of the verb classes in terms of the frequency effect does not support the widespread effect of simple frequency (i.e., the entrenchment hypothesis) in SLA. The overall pattern of the frequency effect shows that the influence of simple frequency is limited only to the Exceptional Causative Verb class. Thus, the current data are not consistent with the prototype interpretation of the frequency effect that Ambridge et al. (2008) suggested. The absence of the frequency effect in the Prototypical Causative Verb class is at odds with the prototype interpretation of the frequency effect since, assuming that prototype is determined on semantic grounds (Lakoff, 1987; Taylor, 1989), the Prototypical Causative Verb class is expected to show some degree of frequency effect due to its semantic affinity with the Exceptional Causative Verb class. However, the data showed a rather local influence of the frequency effect and did not exhibit any similar effect of frequency between the two verb classes. In fact, Ambridge et al. themselves postulated an alternative account that the observed frequency effect might not hold across all the semantic classes from the patterns observed in their data. The data in the current study are more compatible with this alternative account that the frequency effect is a local effect on the acquisition of transitivity that applies only to a specific subset of the semantic classes.

My data suggest that the fall verbs and the disappear verbs, the two verb semantic classes in which the frequency effect was attested, are simply marked and irregular semantic classes. The prototype interpretation of the frequency effect would predict that the frequency effect will arise with all verb classes whose semantic properties are not prototypically direct, unmediated, and externally caused, such as the laugh verbs and the hit-touch verbs. However, such effects were not attested in the current study. Therefore, a more probable explanation for the fre-

quency effect is that the fall verbs and the disappear verbs are linguistically exceptional classes of the change-of-location and the change-of-state verbs and they are not allowed in the causative construction despite their semantic relationship to the causative verbs. These irregular classes exist only in English and the verb classes equivalent to these classes in Japanese have no restriction in the causative construction. Thus, I speculate that both L1 and L2 learners of English must learn the irregularity of these two verb classes since no semantic property can single out these two verb classes among the causative verb.

One important fact in both Ambridge et al. (2008) and the current study is that the frequency effect existed among the adult (control) group in the fall verbs and the disappear verbs (but not in the laugh verb and the other verb classes[1]. The existence of the frequency effect in the adult control group is worth attention since it presents an important question about the nature of grammatical competence of the adult L1 speakers. If one argues that simple frequency is a key component for successful language acquisition, the data must be interpreted as showing that the native control group in the two studies have not reached the stable stage of grammatical competence with the fall verbs and the disappear verbs. If one assumes the entrenchment hypothesis, the data must be interpreted as showing that even adult native speakers haven't been exposed to the low-frequency verbs frequently enough to make a confident judgment about them. So, does it mean that the adult native speakers will never reach a stage where they can judge the low-frequency verbs as accurately as the high-frequency verbs? To put it differently, will the low-frequency verbs be low-frequency no matter how many times a language learner

[1]Ambridge et al. (2008) reported a significant frequency effect in the laugh verb class among the adult control group, but this significant effect is caused only by the non-sense verb (i.e., *tamm/meek* as opposed to *laugh/giggle* and *fall/tumble*

encounters them in their input? If one proposes the entrenchment hypothesis as a theory about language acquisition, it is difficult to understand the existence of the frequency effect among the adult control group. In addition, the fact that the control group (L1) participants were subject to the frequency effect only in the Exceptional Causative Class, like the target group (L2) participants, is not congruent with the entrenchment hypothesis. At least, we need to acknowledge that some elements other than frequency are at work in the L2 acquisition process for transitivity.

Admittedly, this view of the frequency effect is rather restricted and not generalizable to the verb classes other than the Exceptional Causative Verb class. However, I believe that a widespread effect of simple frequency is not justifiable given the other possible forms of the frequency effect. In this experiment, the frequency effect is simply defined in terms of the appearance of the occurrences of verbs (i.e., the entrenchment effect). In the analyses with the mixed-design ANOVA, frequency is defined as a nominal factor (e.g., *high-*, *mid-*, and *low*-frequency), and the log transformed frequency is used in the mixed-effect model. On the other hand, the preemption effect, another form of the frequency effect that I discussed in an earlier chapter (Chapter 4), was simply not considered in the design of the current study. Yet, the preemption effect and other forms of frequency effects are known to influence various linguistic tasks, let alone in the acquisition of transitivity. This is another reason why I must take a rather conservative position about the frequency effect. As discussed above, in some cases (e.g., *house* and *apartment*), the entrenchment effect may be offset by the effect of preemption. In the current study, verbs in the Exceptional Causative Verb class are allowed only in the intransitive construction (e.g., *The dove disappeared.*) but not in the other constructions (e.g., **The*

*magician disappeared the dove./*The magician disappeared*). On the other hand, verbs in the Prototypical Causative Verb class are allowed in multiple constructions (e.g., *The window broke./The boy broke the window.*). Thus, the Exceptional Causative Verb class must be easier on the grounds of the preemption effect since the one-to-one mapping between semantics and syntax in the Exceptional Causative Verb class is easier to acquire than the one-to-many mapping in the Prototypical Causative Verb class. Although the pattern in the current study did not show such tendencies (i.e., L2 learners had more difficulty with mid-frequency and low-frequency verbs in the Exceptional Causative Verb class than those in the Prototypical Causative Verb class), it is premature to conclude that the preemption effect does not influence the acquisition of transitivity given a possible interaction between the entrenchment and preemption effects. The current study simply was not designed to provide a test of the existence or absence of the preemption effect independent of the entrenchment effect.

In sum, although some influence of simple frequency was attested in the current study, the effect of other forms of frequency could have factored in the acquisition of transitivity in SLA. Given the possible offsetting interactions among the various forms of the frequency effects, I'm constrained to make a weak argument for the existence of the simple frequency effect (i.e., entrenchment effect) in the acquisition of transitivity in SLA. The simple frequency effect was observed only in the Exceptional Causative Verb class in this study, but the interpretation of this pattern depends on further analyses of the possible interaction of various forms of the frequency effect.

8.3 ASYMMETRIC RELATIONSHIP IN SLA

The asymmetric relationship, with an assumption of the full-transfer hypothesis, predicts that the L2 learners face difficulty when the usage of language is wider in L2 than that of L1. The data in the current study largely fit in the predictions made by the asymmetric relationship hypothesis since the Japanese native speakers learning English as L2 have more difficulty in making native-like judgments in the Exceptional Causative Verb class and partially in the Body-part Verb class.

8.3.1 Exceptional Causative Verb

Significant effects of proficiency, frequency, and their interaction were found in the Exceptional Causative Verb class, but such strong effects were absent in the Prototypical Causative Verb class. In the mixed-design ANOVA (see Table 7.10), the interaction effect was absent in the Prototypical Causative Verb and, in the mixed-effect model (see Table 7.11), the significant effects in the Exceptional Causative Verb were considerably weaker (i.e., lower estimated β) than those in the Prototypical Causative Verb. As discussed above, the main effects of proficiency in the data show that the lower-proficiency L2 English learners had more difficulty with the inherently-directed motion verbs and the disappear verbs than the high-proficiency and the native-speaker participants. The main effect of frequency indicates that the amount of exposure to the verbs in the Exceptional Causative Verb class has a statistically significant influence on the acquisition of these verbs. In addition, the interaction effect between proficiency and frequency suggests that the low-proficiency learners are subject to stronger effects of frequency than the proficient learners and the native speakers.

The post-hoc tests analyzed the data in the three different frames in each verb class. To repeat, in the experiment, the participants were asked to make grammatical judgment on the same verb three times in three different constructions. For example, the verb *vanish* was presented in the following constructions.

(117) a. Agent intransitive frame: #*The man vanished.*

b. Theme intransitive frame: *The coin vanished.*

c. Transitive frame: **The man vanished the coin.*

The data (see Tables 7.10 and 7.11) show that the main and the interaction effects were primarily caused by the Transitive frame. In other words, the non-native speakers had difficulty in rejecting the ungrammatical transitive sentence with an inherently-directed motion verb or a disappear verb (e.g., **The man descended the airplane.* and **The man vanished the coin.*). The strong effects in the Transitive frame and the absence of or weakened main and interaction effects in the other two sentence frames are exactly what the asymmetric relationship between Japanese and English predicts.

In Japanese, neither the inherently-directed motion verb nor the disappear verbs is subject to the semantic constraint in the causative alternation and, therefore, transitive sentences with these two verb classes are grammatical in Japanese. Thus, as illustrated in Figure 8.1, the usage in Japanese constitutes a superset of the usage in English. Assuming the absence or ineffectiveness of negative feedback, Japanese native speakers learning English as L2 will have no means to rectify their (inaccurate) interlanguage grammar.

Thus, the transitive sentence with an inherently-directed motion verb or a dis-

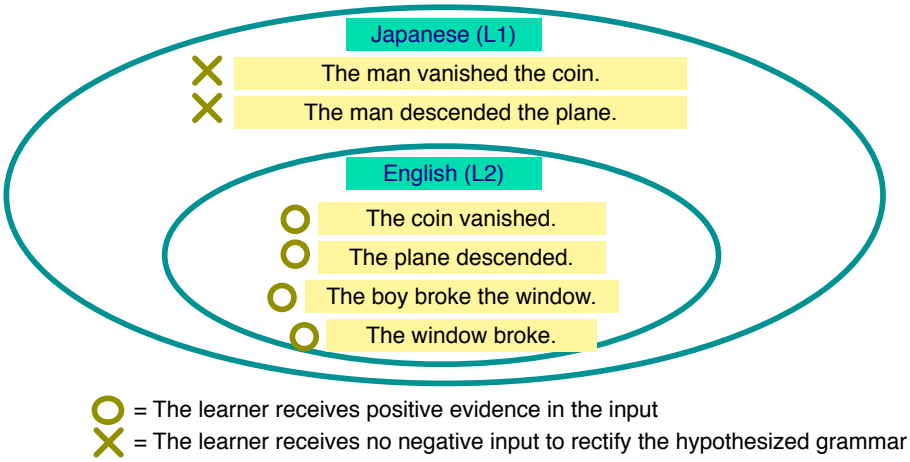


Figure 8.1: The asymmetric relationship of the Exceptional Causative Verb class

appear verbs is expected to present a learnability problem. And, as predicted, the data show that the Japanese-speaking participants failed to make native-like judgments on this specific sentence type. The Japanese-speaking participants failed to detect the ungrammaticality of verbs in the Exceptional Verb Class in the transitive construction, but such difficulty wasn't observed in the other two sentence frames.

A noteworthy contrast is that the same L2 participants had little trouble in making native-like judgment with the Laugh Verb, which is also prohibited in the transitive sentence frame. One crucial difference of the Laugh Verb from the Exceptional Causative Verb is that they are also prohibited from the transitive sentence frame in Japanese[2], which, therefore, does not constitute an asymmetric relationship (see Figure 8.2).

One straightforward and reasonable conclusion from this contrast is that L2

[2]The Japanese laugh verb such as *naku* "cry" does appear in the transitive sentence frame such as *Taro-ga Kodomo-o nakasu.* "Literary: Taro cried a child." However, as discussed in the earlier chapter, the laugh verbs in the transitive frame are consistently marked with the morphological causative marker *-(s)are* such as *nak-ase-ru* "cry", *waraw-ase-ru* "laugh", *unar-ase-ru* "moan.", which are considered as the morphological causative rather than the lexical causative.

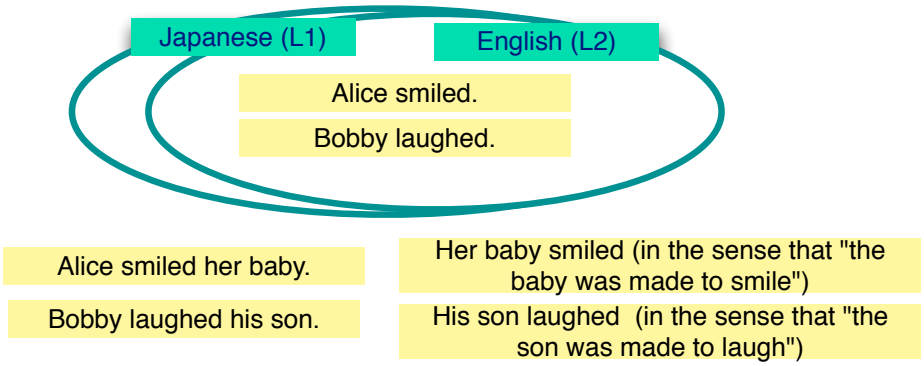


Figure 8.2: The asymmetric relationship of the Laugh Verb class

learners transferred the grammatical setting for the verb transitivity in Japanese (L1) to English (L2) and, then, they had difficulty in rectifying the superset grammar due to the lack of or ineffectiveness of negative evidence. The fact that the same participants had no difficulty with the Laugh verbs supports this conclusion since no influence of L1 is expected in this verb class. The fact that the frequency effect was remarkably stronger in the Exceptional Causative Verb class presents supportive evidence since it shows that the input plays a significant role in the L2 learners' acquisition of the Exceptional Causative Verb class. In other words, the frequency effect can be interpreted as evidence that L2 learners rely on their exposure to the actual usage of the target verbs in their input. It logically follows that the absence of the frequency effect in the Laugh verbs (and other verb classes) indicates that L2 learners are equipped with native-like grammatical performance with less reliance on the input owing to the other resource available to L2 learners, which is, most naturally, their grammatical knowledge in the native language.

Although the data largely fit the predicted patterns, this conclusion is not free from problems. One problem lies in the grammatical judgments of low-frequency verbs in the transitive frame. The non-native participants did not completely ac-

cept the Exceptional Causative Verb in the transitive sentence frame and, instead, exhibited ambivalent judgments of them (The mean Grammatical Judgment for the low-frequency Exceptional Causative Verb by the low-proficiency participants was 3.71). This pattern is a problem in the full-transfer view that is presented above because, if the L1 grammar fully transfers to L2 and constitutes the initial state of L2 acquisition, then the low-proficiency participants should have accepted the transitive constructions with low-frequency Exceptional Causative verbs as confidently as the low-frequency Prototypical Causative verbs (cf. the mean Grammatical Judgment for Prototypical Causative verbs is 4.62). In short, the pattern in the data clearly shows the shift from the L1 grammar to the L2 grammar, but it is not clear why the low-proficiency learners thought that the low-frequency Exceptional Causative verb was not as acceptable as the Prototypical Causative verb. It is very unlikely that the low-proficiency learners received negative feedback concerning their overgeneralized sentence productions with these low-frequency verbs (e.g., **She tumbled her baby.*) – L2 learners at this proficiency level will not productively use low-frequency verbs (e.g., *moan, vanish, tumble*) and, therefore, no negative feedback should have been available to them. Positive evidence concerning low-frequency Exceptional Causative verbs (e.g., *Her baby tumbled.* and *The coin vanished.*) by themselves do not preempt the ungrammatical usage in the Transitive frame since many other verbs do alternate between the two constructions (e.g., *The ball bounced.* $\leftrightarrow$ *She bounced the ball.*).

Thus, to conclude, the current data show the pattern predicted by the full-transfer hypothesis and the influence of L1 grammar. However, in some specific verb classes, the input seems at work as well. In other words, the influence of input cannot be ignored in some verb classes in order to justify the L2 asymmetric

relation hypothesis.

8.3.2 Body-part Verb

Verbs in the Body-part Verb class alternate in all three constructions in this study (e.g., *Bob waved his hands. / Bob waved (his hands). / Bob's hands waved.*) in English and Japanese. Since the usage of verbs in this class is identical in both languages, no difficulty was expected for L2 learners under the asymmetric relationship. However, the L2 participants had difficulty this verb class, especially in the Agent Intransitive frame (e.g., *Aaron nodded*; see Tables 7.18 and 7.19)

One possible explanation for this difficulty is the morphological marking. Montrul (2001c, 2001b, 2001a) shows that, in her study of the causative morphemes in Spanish and Turkish, the native speakers of Spanish had difficulty with accepting the inchoative causative sentence in English (e.g., *The window broke.*) as a grammatical sentence. The Spanish native speakers learning English as L2 consistently preferred the peripheral causative sentence (e.g., *The window got broken.*) far more than did the control English native-speaker participants. Montrul concludes that the Spanish speakers preferred the peripheral causative sentence because the Spanish-speaking participants anticipated some morphological marking in the inchoative causative sentence in English, that would substitute for the Spanish anti-causative morpheme *se*. Interestingly, a weak but similar pattern was observed among Turkish native speakers learning English, whose L1 causative morpheme is equipollent as in Japanese. Although there is no strong evidence to show the influence of morphology in the current study, the unexpected difficulty in the Body-part Verb class may be attributed to some influence of the L1 causative morphology.

8.4 L2 TRANSFER AND PINKER'S (1989) SEMANTIC HIERARCHY

I propose that the acquisition of transitivity in SLA consists of two fundamentally different systems. On one hand, some groups of verbs' transitivity shows cross-linguistic invariability and lack of frequency effect. This was especially true with the change-of-state verbs and the manner-of-motion verbs in the current study. I propose that this part of verbs' transitivity is a reflection of *linguistic competence* (among many Valian (1991) for FLA, and Schwartz (1993) for SLA) that is biologically hardwired in the grammatical system. The lack of frequency effect is strong evidence that the transitivity of these two semantic classes entail little *learning* since both native and non-native participants were able to make grammatical judgments on the low-frequency verbs as accurately as the high-frequency verbs. On the other hand, transitivity of the other group of verbs exhibits cross-linguistic variability (between English and Japanese) and the frequency effect, especially for the L2 learners. I interpret the existence of the frequency effect as evidence for *learning* since it shows that the amount of exposure is the key element for successful acquisition of the verbs' transitivity. This part of the verbs' transitivity can be a reflection of *performance*, an extra-linguistic ability that overlays linguistic competence. In sum, I argue that the existence of the frequency effect can be attributed to the classic distinction between competence and performance.

Bley-Vroman and Yoshinaga (1992) and Bley-Vroman and Joo (2001) also reported similar patterns in their studies. Native speakers of Japanese learning English (tested on the dative alternation) and native speakers of Korean learning English (tested on the locative alternation) both showed that L2 learners are sensitive to linguistically universal rules but not to the language-specific rules. The L2 par-

ticipants in both studies exhibited the effect of frequency (real verbs vs. nonsense verbs in their studies) only in the language-specific rules. The lack of native-like sensitivity with the nonsense verbs was interpreted as supporting evidence for the *Fundamental Difference Hypothesis* (Bley-Vroman, 1988) that argues that L2 acquisition and L1 acquisition are fundamentally different processes since L2 acquisition is largely based on the skill acquisition.

While my data show the same pattern in the acquisition of the causative alternation by Japanese speakers learning English, my interpretation of the data is quite different from that of Bley-Vroman and his colleagues. In my interpretation, since the language-specific rules are not available in all languages, they are not necessarily central part of the language universal. Or at most, the language-specific rules are parametric factors in the language acquisition that L2 learners will have to *learn* unlike the linguistically universal rules that are guaranteed to exist in any language. Thus, the L2 learners' insensitivity to the language-specific rules is not surprising. In Bley-Vroman and his colleagues' studies, the L2 learners performed significantly better with the real verbs than the nonsense verbs for the language-specific rules. It suggests that L2 learners are in the process of *learning* these language-specific rules.

Pinker (1989) proposed a hierarchical semantic theory, on which my account can be further developed. Pinker's semantics hierarchy hypothesis consists of *broad-range semantic constraints* and *narrow-range semantic constraints*. The first rule, the broad-range rule, specifies necessary but not sufficient conditions for verb class, which may be overwritten by the second and more specific rule, the narrow-range rule.

In Pinker's broad-range rules, each verb has an internal structure consisting of a small number of conceptual constituents such as EVENT, STATE, THING, and MANNER (Pinker, 1989: 208). The constituent is expanded by relational functions such as ±dynamic, ±control, place-function, path-function etc. For example, the following broad-range rule (8.3) is proposed for a causative (anti-causative) verb by Pinker (1989).

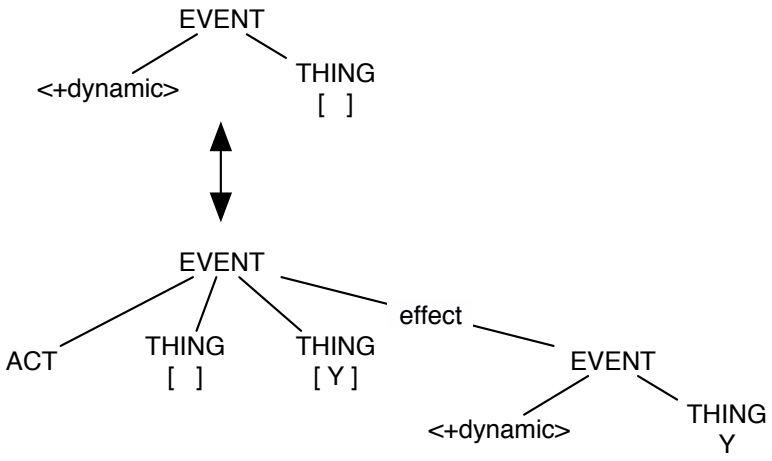


Figure 8.3: Broad-range and narrow-range rules from Pinker (1989)

The board-range rule for causative verbs captures the fact that causative verbs always denote an EVENT and no stative verb such as *be*, *have*, and *stay* participates in the causative alternation. The causative verb in the transitive form (e.g., *Bobbie boiled the eggs.*) has an embedded predicate that indicates a change in the causative object because of the effect of the action by the causative subject. Thus, the broad-range rule predicts that verbs whose core semantic entails change-of-state (or change-of-location) undergo the causative alternation.

As stated before, this prediction overgeneralizes a certain group of verbs such as inherently-directed motion verbs and disappear verbs. In order to solve this problem, Pinker defines a set of narrow-range rules that license verbs in various

syntactic alternations. For the causative alternation, the following rules are proposed by Pinker (Pinker, 1989, p. 223-228).

(118) **Narrow-range rule for the causative alternation – causativizable**

a. Change-of-state verbs (e.g., *break*, *melt*, *burn*)

b. Manner-of-motion verbs (e.g., *roll*)

(119) **Narrow-range rule for the causative alternation – non-causativizable**

a. Inherently directed motion verbs (e.g., *ascend, rise* (up), *descend, fall* (down), *arrive* (to PLACE), *leave* (from PLACE), *exit* (from in THING), *enter* (to in THING), *come* (to HERE), *go* (to THERE))

b. Change-of-existence verbs

c. Action verbs (e.g., *jog, laugh*)

d. Verbs of emission

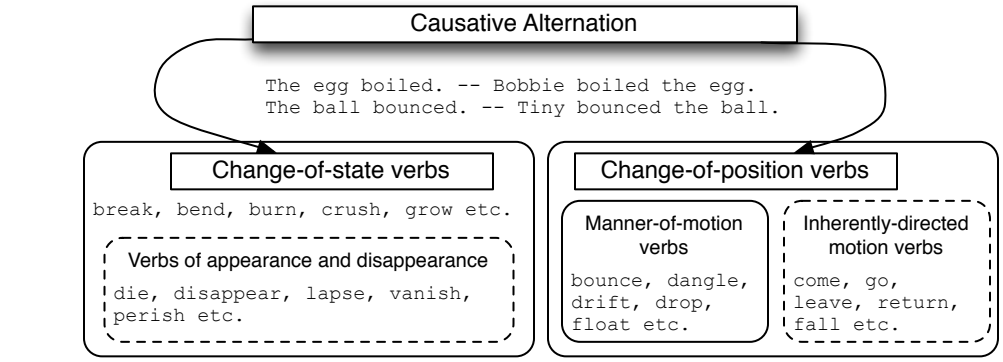


Figure 8.4: The narrow-range rules (dotted line) for the causative alternation

Unlike the broad-range rules, which are defined with a limited set of basic semantic elements, the narrow-range rules employ much finer semantic properties that are unique to each narrow-range class. Although it is not clearly stated, it

appears that Pinker (1989) assumes that children are equipped with the broad-range rules innately since children's overgeneralizeation error (e.g., **Go me to the bathroom.*) is explained as a "one-shot innovation based on broad-range rules" or a misclassification of a verb into an inaccurate narrow-range semantic group.

Since Pinker (1989) only investigated the argument alternation in English and English L1 acquisition, the implications of Pinker's (1989) semantic hierarchy hypothesis in languages other than English has not been clear. The primary goal of Pinker (1989) was to present a solution to the poverty of stimulus problem by postulating the semantic structure that L1 English children can employ to generalize the language input (*semantic bootstrap hypothesis* (Gropen et al., 1991; Pinker, 1989)). The current study can contribute to the cross-linguistic generalizability of Pinker's (1989) semantic hierarchy hypothesis in the SLA setting.

Based on the findings of this study, I propose that, from a cross-linguistic perspective, the broad-range rule is invariable across languages whereas narrow-range rules may display language-specific variability that must be learned for each language. In other words, the L2 learners have access to the necessary but not sufficient conditions (broad-range rules) for the causative alternation (and possibly for the other alternations), but they do not know fine semantic conditions that establish exceptions to the board-range rules. Since the L2 learners have to *learn* these semantic conditions from the input, we expect that the learning process of the narrow-range rules is subject to the frequency effect and, in the SLA setting, the asymmetric relationship between L1 and L2.

CHAPTER 9

CONCLUSION

In this study, I investigated the acquisition of English verb transitivity by native speakers of Japanese. In my survey of lexical transitivity in English and Japanese, two interconnected issues came to light. First, languages differ in the way they manifest lexical causativity and, in the case of Japanese and English, Japanese exhibits a richer inventory of lexical transitive pairs than English. The different patterns of lexical causativity results in an asymmetric relationship between L1 and L2. In this study, such an asymmetric pattern was observed mainly in two semantic groups of verbs, the inherently-directed motion verbs and the verbs of disappearance. Verbs in these two classes are not allowed to be in the transitive construction only in English, but not in Japanese. This asymmetric relationship in SLA was the second issue that this study examined. The asymmetric relationship in SLA predicts that L2 learners will face difficulties when acquiring the verb usages that exist in L1 but not in L2. The superset-to-subset relationship in the L1 and L2 usages is expected to be difficult because it requires corrective evidence to rectify the overgeneralized usage in the L2 interlanguage grammar.

The third issue that I investigated in this study was the effect of frequency. The

frequency effect has drawn a lot of attention among second language acquisition researchers, and various instantiations of usage-based language acquisition theories have been proposed. These theories, in varying degrees, consider the input to be primarily responsible for language acquisition, and they minimize the role of grammatical knowledge. I argued that such theories must be validated with low-frequency items since the real challenge in language acquisition is the acquisition of low-frequency items, some of which may appear only once in the L2 learner's experience.

The data collected in the current experiment suggest an interesting interaction between the asymmetric relationship between L1 and L2 and the effect of frequency. As expected, the L2 learners faced problems when the usage of a certain grammatical construction is wider in L1 than in L2, but this difficulty was not attested when the usage of the construction is equivalent or more constrained in L1. This confirms the hypothesis that the asymmetric relation between L1 and L2 plays a significant role in SLA. In addition, such difficulties are greater when the sentence contains a low-frequency verb. When the verb is highly frequent, L2 learners, especially those who are high-proficiency L2 speakers, had lesser difficulty in making native-like judgments. The frequency effect, at least the simple entrenchment effect, was not attested or was considerably weaker with constructions where no asymmetry exists between English and Japanese.

With these results, I came to the conclusion that the frequency effect is not a widespread effect in language acquisition, as argued by the usage-based theories, at least in SLA. Instead, I argued that frequency is a local influence that occurs only when the learner has to receive negative feedback to rectify their overgeneralized interlanguage grammar. In other words, frequency is a necessary and, in fact,

critical factor when an asymmetric relation exists between L1 and L2 due to the language-specific constraint in L2.

In this view, the significant interaction between frequency and semantic class is not surprising since L2 learners have to learn irregular constraints that exist only in L2. Specifically, the fact that the inherently-directed motion verbs and the verbs of disappearance are not allowed in transitive sentences in English may be an idiosyncratic constraint that the L2 learners have to learn from the input. Since these two semantic classes do not have any structural consequence in Japanese, native speakers of Japanese must receive a substantial amount of exposure in order to acquire the correct usages of these two verb classes in English. In other words, I do not consider frequency to be a principal cause of language acquisition. Rather, I believe that frequency is a complementary factor that plays an important role in learning idiosyncrasies that exist in the target language.

The data from the laugh verbs support this analysis since the laugh verbs are cross-linguistically unergative verbs, whose constraint in the transitive usage is probably rooted in a language-general grammatical feature. The lack of frequency effect in the laugh verb class in this study is exactly what we would expect in the prediction that frequency is necessary only when the L2 learners learn idiosyncratic constraints. In other words, frequent encounter with the verbs in the input is less crucial when no idiosyncratic constraint exists in the semantic verb class, as can be seen with the laugh verbs.

To conclude, between Japanese and English, the L1-L2 asymmetry exists for some semantic classes but not for others. When the asymmetry is present, the L2 learner must use negative evidence to unlearn L1 generalizations, but negative

evidence is more likely to be available for higher frequency verbs than for lower frequency ones. This complex set of interrelationships is reflected in the interaction between semantic class and verb frequency that was found in the current experiment. Future cross-linguistic research between Japanese and a lanuage other than English is necessary to corroborate the findings of the current study.

APPENDIX A

DESCRIPTIVE STATISTICS OF THE EXPERIMENT STIMULI

[1]Native speakers didn't accept the stimulus sentence "The men went." probably because of the lack of the path prepositional phrase (e.g., *to the store*).

[2]The stimulus sentence was "The father laughed.", which must have been rejected because the father was not laughing in the movie clip. The movie clip shows a father making his baby laugh, but he himself was not laughing. Both native and non-native speaker participants accepted the sentence probably because they thought that the father was also laughing in the movie clip.

[3]The stimulus sentence was "The bread baked." which was accepted because "bake" is polysemous between the object-drop class and the causative class.

Table A.1: Grammatical judgement scores for each experiment stimulus 1

			Native	High Prof	Low Prof
EXCEPTIONAL CAUSE	die	Agent intra	1.19	1.17	1.24
		Theme intra	4.46	4.44	4.24
		Transitive	1.27	1.22	1.24
	disappear	Agent intra	1.19	1.28	1.35
		Theme intra	4.50	4.78	4.53
		Transitive	2.19	2.94	3.53
	vanish	Agent intra	1.08	1.39	1.76
		Theme intra	4.54	4.50	4.29
		Transitive	2.69	3.61	3.88
	go	Agent intra	1.81	1.50	1.76
		Theme intra[1]	3.65	3.83	4.12
		Transitive	1.38	1.17	1.24
	descend	Agent intra	1.12	1.56	1.65
		Theme intra	4.38	4.39	4.24
		Transitive	2.88	3.22	3.53
	tumble	Agent intra	1.38	1.28	1.59
		Theme intra	4.38	4.39	4.41
		Transitive	1.54	2.17	2.06
PROTOTYPICAL CAUSE	sink	Agent intra	1.19	1.44	1.94
		Theme intra	3.77	3.89	3.53
		Transitive	4.50	4.67	4.47
	melt	Agent intra	1.62	2.28	2.35
		Theme intra	3.85	3.44	3.47
		Transitive	4.69	4.83	4.71
	crash	Agent intra	1.46	2.00	2.59
		Theme intra	3.62	3.00	2.47
		Transitive	4.54	4.78	4.82
	move	Agent intra	3.19	2.17	3.12
		Theme intra	3.12	2.44	2.18
		Transitive	4.81	4.89	4.65
	roll	Agent intra	3.50	2.72	3.06
		Theme intra	3.50	2.50	2.76
		Transitive	4.77	4.89	4.65
	bounce	Agent intra	2.15	2.22	2.06
		Theme intra	3.69	3.06	2.47
		Transitive	4.58	4.89	4.65

Table A.2: Grammatical judgement scores for each experiment stimulus 2

			Native	High Prof	Low Prof
		Agent intra[2]	3.12	3.67	3.76
LAUGH	laugh	Theme intra	4.58	4.50	4.71
		Transitive	1.31	1.44	1.65
	cry	Agent intra	1.12	1.17	1.00
		Theme intra	4.62	4.78	4.82
		Transitive	1.23	1.22	1.18
	moan	Agent intra	1.27	1.67	1.47
		Theme intra	4.69	4.50	4.53
		Transitive	1.19	1.17	1.35
HIT-TOUCH	strike	Agent intra	2.69	2.89	3.06
		Theme intra	1.50	1.72	1.59
		Transitive	4.54	4.61	4.65
	kick	Agent intra	3.58	3.22	3.88
		Theme intra	1.31	1.28	1.29
		Transitive	4.69	4.94	5.00
	smash	Agent intra	2.31	3.11	3.29
		Theme intra	1.62	1.56	1.59
		Transitive	4.81	4.72	4.82
	touch	Agent intra	2.73	2.83	3.29
		Theme intra	1.31	1.50	1.24
		Transitive	4.81	4.56	4.47
	kiss	Agent intra	3.50	3.78	4.29
		Theme intra	1.42	1.33	1.47
		Transitive	4.35	4.11	4.59
	tickle	Agent intra	3.00	3.17	3.65
		Theme intra	1.65	1.33	1.76
		Transitive	4.77	4.78	4.82

Table A.3: Grammatical judgement scores for each experiment stimulus 3

			Native	High Prof	Low Prof
OBJ-DROP	play	Agent intra	3.73	2.67	3.76
		Theme intra	1.42	1.28	1.24
		Transitive	4.85	4.94	4.53
	eat	Agent intra	4.00	3.39	3.24
		Theme intra	1.12	1.17	1.24
		Transitive	4.65	5.00	4.24
	bake	Agent intra	3.46	3.33	3.12
		Theme intra[3]	2.96	2.17	2.00
		Transitive	4.35	4.89	4.88
BODY-PART	wave	Agent intra	4.62	3.22	3.00
		Theme intra	2.38	1.83	1.82
		Transitive	4.58	4.94	4.47
	shrug	Agent intra	4.46	4.33	3.76
		Theme intra	2.58	2.33	2.18
		Transitive	4.77	4.67	3.94
	blink	Agent intra	4.27	3.56	4.18
		Theme intra	3.73	3.56	2.82
		Transitive	4.38	4.39	4.71

APPENDIX B

QUESTIONNAIRE ITEMS

(1) **Date of birth**

(2) **Country of birth**
   a. Japan
   b. U.S.A.
   c. other (please provide the name of the country)

(3) **Sex**
   a. Female
   b. Male

(4) **Ethnic identity**
   a. Japanese
   b. Asian other than Japanese (Chinese, Korean, Filipino, Vietnamese, Indian etc.)
   c. White
   d. African American
   e. Hispanic/Latino
   f. Other

(5) **Handedness**
   a. Left-handed
   b. Right-handed
   c. Both

(6) **What is the highest college degree are you seeking?**
   a. Doctoral degree (Ph.D., Ed.D. etc.)
   b. (Graduate-level) Business or law degree (MBA, LD etc.)
   c. Master's degree (MA, MS, M.Phil. etc.)
   d. Bachelor's degree (BA, BS etc.)

e. High school or high-school equivalent diploma
f. Not applicable

(7) **If you are in a degree program, what degrees you are seeking for?**
a. Doctoral degree (Ph.D., Ed.D. etc.)
b. (Graduate-level) Business or law degree (MBA, LD etc.)
c. Master's degree (MA, MS, M.Phil. etc.)
d. Bachelor's degree (BA, BS etc.)
e. High school or high-school equivalent diploma
f. Not applicable

(8) **Do you speak any language other than English and Japanese? If so, please write those languages and self-evaluation of your proficiency in those languages.**
a. Language
b. Proficiency
i. Native or near-native level
ii. Advanced level
iii. Intermediate level
iv. Beginner/Conversational level

Only the non-native speaker group subjects will answer the following questions

(9) **How long have you been in the U.S.? (in years)**

(10) **How many college-level courses have you taken in the U.S. or any other English-speaking country? (do not include ESL courses)**

(11) **How many ESL courses have you taken in the U.S. or any other English-speaking country?**

(12) **How do you evaluate your reading proficiency in English?**
a. Native or near-native level
b. Advanced level
c. Intermediate level
d. Beginner/Conversational level

(13) **How do you evaluate your writing proficiency in English?**
a. Native or near-native level
b. Advanced level
c. Intermediate level
d. Conversational level

(14) **How do you evaluate your speaking proficiency in English?**

a. Native or near-native level
b. Advanced level
c. Intermediate level
d. Beginner/Conversational level

(15) **How do you evaluate your listening proficiency in English?**

a. Native or near-native level
b. Advanced level
c. Intermediate level
d. Beginner/Conversational level

(16) **If you have taken the TOEFL exam, please provide your best score.**

(17) **If you have taken the STEP (*eiken*) exam, please provide your grade.**

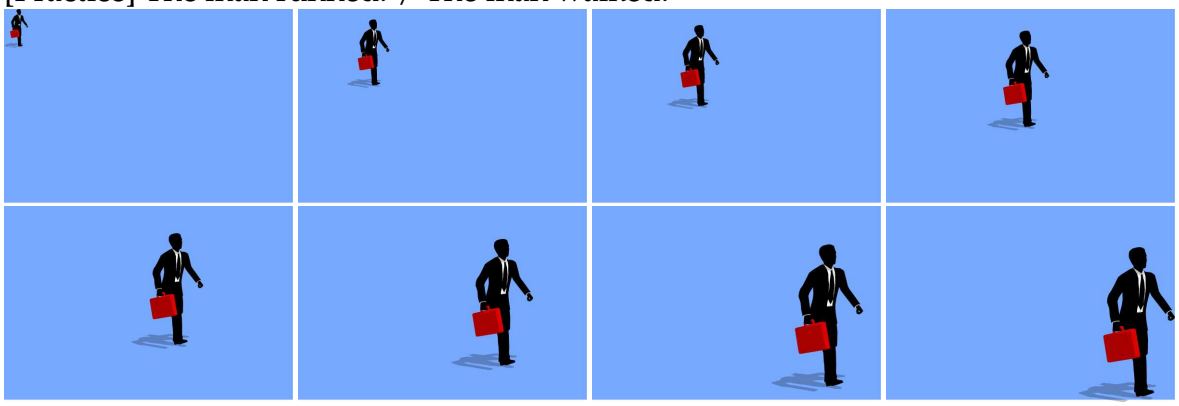
a. 1st grade
b. pre-1st grade
c. 2nd grade
d. pre-2nd grade
e. 3rd grade
f. lower than pre-3rd grade

APPENDIX C

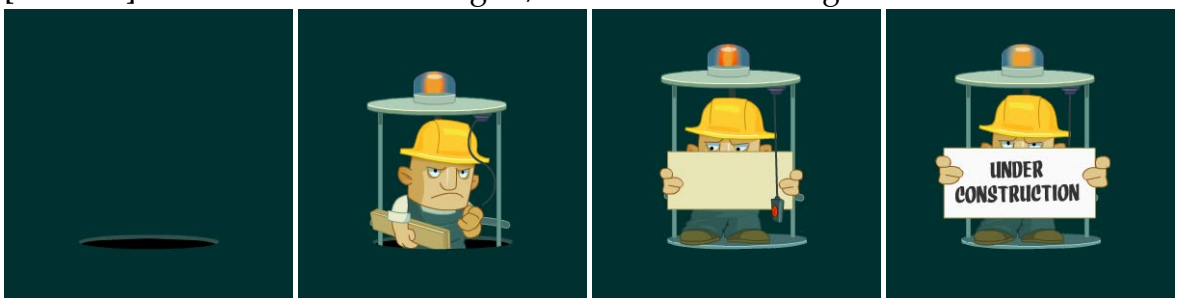
STIMULI

C.1 PRACTICE STIMULI

1. [Practice] The man runned. / The man walked.



2. [Practice] The man showed the sign. / The man saw the sign.



C.2 STIMULI

1. The man blinked his eye. / The eye blinked. / The man blinked.
2. The woman shrugged her shoulders. / The shoulders shrugged. / The woman shrugged.
3. The man waved his hand. / The hand waved. / The man waved.
4. The man melted the glass. / The glass melted. / The man melted.
5. The boys crashed the plate. / The plate crashed. / The boys crashed.
6. The person sank the pill. / The pill sank. / The person sank.
7. The man vanished the coin. / The coin vanished. / The man vanished.
8. The wizard disappeared the dove. / The dove disappeared. / The wizard disappeared.
9. The doctor died the patient. / The patient died. / The doctor died.
10. The man descended the plane. / The plane descended. / The man descended.
11. Snow tumbled the man. / The man tumbled. / Snow tumbled.
12. The woman went the cars. / The cars went. / The woman went.
13. The boy smashed the piggy bank. / The piggy bank smashed. / The boy smashed.
14. The man kicked the ball. / The ball kicked. / The man kicked.
15. The man struck the ball. / The ball struck. / The man struck.
16. The bone moaned the dog. / The dog moaned. / The bone moaned.
17. The man laughed the baby. / The baby laughed. / The man laughed.
18. The father cried his baby. / The baby cried. / The father cried.
19. The man bounced the ball. / The ball bounced. / The man bounced.
20. The player rolled the dice. / The dice rolled. / The player rolled.

21. The player moved the chess pieces. / The chess pieces moved. / The player moved.
22. The man baked the bread. / The bread baked. / The man baked.
23. The woman ate the chocolate. / The chocolate ate. / The woman ate.
24. The woman played the game. / The game played. / The woman played.
25. The man tickled the girl. / The girl tickled. / The man tickled.
26. The woman touched the screen. / The screen touched. / The woman touched.
27. The girl kissed the father. / The father kissed. / The girl kissed.
28. The men went the dogs. / The dogs went. / The men went.

C.3 Filler stimuli

1. The arrow stabbed the heart. / The arrow heart stab. / The arrow pierced the heart.
2. The birds are flocking. / The flock birds flew. / The birds flew the ocean.
3. The captain charged at the enemy. / The soldiers charging. / The soldiers marched.
4. The car honked at the man. / Hit the car man. / The car hit the man.
5. The doctor trained. / The man does train. / The man is being trained.
6. The woman is watering. / The woman drink water. / The woman drinks water.
7. The flower died. / The withering is the flower. / The flower withered.
8. The mother and girl bubbled. / The girl blowed soap bubbles. / The girl blew soap bubbles.
9. The girl bit the fork. / The biting fork girl. / The girl licked the fork.
10. The girls jumped each other. / The girls jumped bed. / The girls jumped on the bed.

11. The dog played with the girl. / The girl the playing dog. / The girl walked with the dog.

12. The baby screamed. / The screaming baby is. / The baby giggled.

13. The tree collapsed. / The lumberjack cutted the tree. / The lumberjack cut the tree.

14. The man decided to chill out. / Room cleaning chilled. / The room was cleaned.

15. The water tank exploded. / Drained water tank the. / The water tank drained.

16. The parents fed the baby. / The parents feeding the baby. / The parents and the baby walked.

17. The shovel destroyed the rock. / The shovel broken the rock. / The shovel broke the rock.

18. The woman dozed off. / The nodded head woman. / The woman nodded repeatedly.

19. The man found a cellphone. / The cellphone was fell. / The cellphone fell.

APPENDIX D

JAPANESE LEXICAL VERBS

From Jacobsen, W. (1992). The Transitive Structure of Events in Japanese. Kuroshio Publishers, Tokyo, Japan.
Semantic class and Class of English conterpart verbs were added to the original list. Also, Japanese kanji transcripts and some homographic words (kiru = 切る、着る etc.) were also added
morphological causative: Consotnant-ending: [a]seru / [a]su; Verb-ending: saseru / sasu

Num	Semantic class	Type	Marked	English class	Kana (intra)	V	o English (intra)	Kanji (intra)	Morphological causative	Morphologcal causative Kanji	kana (trans)	V	o English (trans)	Kanji (trans)	Morphological causative	Morphological causative kanji
1	manner-of-motion	-e-/-	intra	causative	hageru	V	peel off	剥げる	hagesaseru/hagesasu	剥げさせる/剥げさす	hagu	C	peel off	剥ぐ	hagaseru/hagasu	剥がせる/剥がす
2	change-of-state	-e-/-	intra	causative	hirakeru	V	open	開ける	hirakesaseru/hirakesasu	開けさせる/開けさす	hiraku	C	open	開く	hirakaseru/hirakasu	開かせる/開かす
3	change-of-state	-e-/-	intra	no_simple_intr	hodokeru	V	come untied	ほどける	hodokesaseru/hodokesasu	ほどけさせる/ほどけさす	hodoku	C	untie	ほどく	hodokaseru/hodokasu	ほどかせる/ほどかす
4	manner-of-motion	-e-/-	intra	causative	hureru	V	shake	振れる	huresaseru/huresasu	振れさせる/振れさす	huru	C	shake	振る	huraseru/hurasu	振らせる/振らす
5	stative	-e-/-	intra	causative	kakeru	V	lack	欠ける	kakesaseru/kakesasu	欠けさせる/欠けさす	kaku	C	lack	欠く	kakaseru/kakasu	欠かせる/欠かす
6	change-of-state	-e-/-	intra	no_simple_intr	kireru	V	become cut off,severe	切れる	kiresaseru/kiresasu	切れさせる/切れさす	kiru	C	cut, sever	切る	kiraseru/kirasu	切らせる/切らす
7	change-of-state	-e-/-	intra	no_simple_intr	kudakeru	V	become smashed	砕ける	kudakesaseru/kudakesasu	砕けさせる/砕けさす	kudaku	C	smash	砕く	kudakaseru/kudakasu	砕かせる/砕かす
8	change-of-state	-e-/-	intra	no_simple_intr	kuzikeru	V	become crushed	挫ける	kuzikesaseru/kuzikesasu	挫けさせる/挫けさす	kuziku	C	crush	挫く	kuzikaseru/kuzikasu	挫かせる/挫かす
9	manner-of-motion	-e-/-	intra	no_simple_intr	makureru	V	become tucked up	まくれる	makuresaseru/makuresasu	まくれさせる/まくれさす	makuru	C	tuck up	まくる	makuraseru/makurasu	まくらせる/まくらす
10	change-of-location	-e-/-	intra	suppletive	mogeru	V	come off	もげる	mogesaseru/mogesasu	もげさせる/もげさす	mogu	C	pluck off	もぐ	mogaseru/mogasu	もがせる/もがす
11	change-of-state	-e-/-	intra	suppletive	momeru	V	become wrinkled	揉める	momesaseru/momesasu	揉めさせる/揉めさす	momu	C	wrinkle	揉む	momaseru/momasu	揉ませる/揉ます
12	manner-of-motion	-e-/-	intra	causative	mukeru	V	peel	剥ける	mukesaseru/mukesasu	剥けさせる/剥けさす	muku	C	peel	剥く	mukaseru/mukasu	剥かせる/剥かす
13	manner-of-motion	-e-/-	intra	no_simple_intr	nezireru	V	become twisted	ねじれる	neziresaseru/neziresasu	ねじれさせる/ねじれさす	neziru	C	twist	ねじる	neziraseru/nezirasu	ねじらせる/ねじらす
14	manner-of-motion	-e-/-	intra	suppletive	nugeru	V	come off	脱げる	nugesaseru/nugesasu	脱げさせる/脱げさす	nugu	C	take off	脱ぐ	nugaseru/nugasu	脱がせる/脱がす
15	inherently-directed	-e-/-	intra	suppletive	nukeru	V	come out	抜ける	nukesaseru/nukesasu	抜けさせる/抜けさす	nuku	C	pull out	抜く	nukaseru/nukasu	抜かせる/抜かす
16	change-of-state	-e-/-	intra	causative	oreru	V	break	折れる	oresaseru/oresasu	折れさせる/折れさす	oru	C	break	折る	oraseru/orasu	折らせる/折らす
17	transaction	-e-/-	intra	causative	sabakeru	V	sell	さばける	sabakesaseru/sabakesasu	さばけさせる/さばけさす	sabaku	C	sell	さばく	sabakaseru/sabakasu	さばかせる/さばかす
18	change-of-state	-e-/-	intra	causative	sakeru	V	tear	裂ける	sakesaseru/sakesasu	裂けさせる/裂けさす	saku	C	tear	裂く	sakaseru/sakasu	裂かせる/裂かす
19	mental state	-e-/-	intra	no_simple_intr	sireru	V	become known	知れる	siresaseru/siresasu	知れさせる/知れさす	siru	C	come to know	知る	siraseru/sirasu	知らせる/知らす
20	change-of-state	-e-/-	intra	no_simple_intr	sogeru	V	become worn down	削げる	sogesaseru/sogesasu	削げさせる/削げさす	sogu	C	slice off	削ぐ	sogaseru/sogasu	削がせる/削がす
21	manner-of-motion	-e-/-	intra	causative	sureru	V	rub	擦れる	suresaseru/suresasu	擦れさせる/擦れさす	suru	C	rub	擦る	suraseru/surasu	擦らせる/擦らす
22	change-of-state	-e-/-	intra	no_simple_intr	tigireru	V	become torn off	千切れる	tigiresaseru/tigiresasu	千切れさせる/千切れさす	tigiru	C	tear off	千切る	tigiraseru/tigirasu	千切らせる/千切らす
23	change-of-state	-e-/-	intra	causative	tokeru	V	dissolve	溶ける	tokesaseru/tokesasu	溶けさせる/溶けさす	toku	C	dissolve	溶く	tokaseru/tokasu	溶かせる/溶かす
24	change-of-location	-e-/-	intra	no_simple_intr	toreru	V	be taken, harvested	取れる	toresaseru/toresasu	取れさせる/取れさす	toru	C	take, harvest	取る	toraseru/torasu	取らせる/取らす
25	manner-of-motion	-e-/-	intra	no_simple_intr	tureru	V	be caught (of fish)	釣れる	turesaseru/turesasu	釣れさせる/釣れさす	turu	C	catch (fish)	釣る	turaseru/turasu	釣らせる/釣らす
26	transaction	-e-/-	intra	causative	ureru	V	sell	売れる	uresaseru/uresasu	売れさせる/売れさす	uru	C	sell	売る	uraseru/urasu	売らせる/売らす
27	change-of-state	-e-/-	intra	causative	wareru	V	break	割れる	waresaseru/waresasu	割れさせる/割れさす	waru	C	break	割る	waraseru/warasu	割らせる/割らす
28	change-of-state	-e-/-	intra	causative	yabureru	V	tear	破ける	yaburesaseru/yaburesasu	破けさせる/破けさす	yaburu	C	tear	破る	yaburaseru/yaburasu	破らせる/破らす
29	change-of-state	-e-/-	intra	causative	yakeru	V	burn	焼ける	yakesaseru/yakesasu	焼けさせる/焼けさす	yaku	C	burn	焼く	yakaseru/yakasu	焼かせる/焼かす
30	manner-of-motion	-e-/-	intra	no_simple_intr	yozireru	V	become twisted	よじれる	yoziresaseru/yoziresasu	よじれさせる/よじれさす	yoziru	C	twist	よじる	yoziraseru/yozirasu	よじらせる/よじらす
31	mental state	-e-/-	intra	no_simple_intr	mieru	V	become visible	見える	miesaseru/miesasu	見えさせる/見えさす	miru	V	see	見る	misaseru/misasu	見させる/見さす
32	change-of-state	-e-/-	intra	causative	nieru	V	boil	煮える	niesaseru/niesasu	煮えさせる/煮えさす	niru	V	boil	煮る	nisaseru/nisasu	煮させる/煮さす
33	change-of-state	-/e-	trans	causative	aku	C	open	開く	akaseru/akasu	開かせる/開かす	akeru	V	open	開ける	akesaseru/akesasu	開けさせる/開けさす
34	change-of-location	-/e-	trans	no_simple_intr	doku	C	get out of the way	どく	dokaseru/dokasu	どかせる/どかす	dokeru	V	remove	どける	dokesaseru/dokesasu	どけさせる/どけさす
35	inherently-directed	-/e-	trans	no_simple_tran	hairu	C	enter	入る	hairaseru/hairasu	入らせる/入らす	ireru	V	put in	入れる	iresaseru/iresasu	入れさせる/入れさす
36	change-of-location	-/e-	trans	suppletive	hikkomu	C	draw back	引っ込む	hikkomaseru/hikkomasu	引っ込ませる/引っ込ます	hikkomeru	V	pull back	引っ込める	hikkomesaseru/hikkomesasu	引っ込めさせる/引っ込めさす
37	stative	-/e-	trans	suppletive	hisomu	C	lurk	潜む	hisomaseru/hisomasu	潜ませる/潜ます	hisomeru	V	conceal	潜める	hisomesaseru/hisomesasu	潜めさせる/潜めさす
38	stative	-/e-	trans	causative	hukumu	C	include	含む	hukumaseru/hukumasu	含ませる/含ます	hukumeru	V	include	含める	hukumesaseru/hukumesasu	含めさせる/含めさす
39	change-of-location	-/e-	trans	suppletive	husu	C	lie down	伏す	husaseru/husasu	伏させる/伏さす	huseru	V	lay down	伏せる	husesaseru/husesasu	伏せさせる/伏せさす
40	mental state	-/e-	trans	suppletive	itamu	C	hurt	痛む	itamaseru/itamasu	痛ませる/痛ます	itameru	V	injure	痛める	itamesaseru/itamesasu	痛めさせる/痛めさす
41	change-of-state	-/e-	trans	causative	kagamu	C	bend	屈む	kagamaseru/kagamasu	屈ませる/屈ます	kagameru	V	bend	屈める	kagamesaseru/kagamesasu	屈めさせる/屈めさす
42	stative	-/e-	trans	no_simple_intr	karamaru	C	become connected	絡まる	karamaraseru/karamarasu	絡まらせる/絡まらす	karameru	V	connect	絡める	karamesaseru/karamesasu	絡めさせる/絡めさす
43	stative	-/e-	trans	no_simple_intr	komu	C	become crowded	込む	komaseru/komasu	込ませる/込ます	komeru	V	fill with	込める	komesaseru/komesasu	込めさせる/込めさす
44	mental state	-/e-	trans	suppletive	kurusimu	C	suffer	苦しむ	kurusimaseru/kurusimasu	苦しませる/苦します	kurusimeru	V	torment	苦しめる	kurusimesaseru/kurusimesa	苦しめさせる/苦しめさす
45	change-of-location	-/e-	trans	suppletive	mukau	C	face	向かう	mukaaseru/mukaasu	向かわせる/向かわす	mukaeru	V	meet, welcome	迎える	mukaesaseru/mukaesasu	迎えさせる/迎えさす
46	change-of-location	-/e-	trans	no_simple_tran	muku	C	face	向く	mukaseru/mukasu	向かせる/向かす	mukeru	V	cause to face	向ける	mukesaseru/mukesasu	向けさせる/向けさす
47	manner-of-motion	-/e-	trans	causative	katamuku	C	lean	傾く	katamukaseru/katamukasu	傾かせる/傾かす	katamukeru	V	lean	傾ける	katamukesaseru/katamukesa	傾けさせる/傾けさす
48	change-of-location	-/e-	trans	suppletive	somuku	C	turn (ones back) on	背く	somukaseru/somukasu	背かせる/背かす	somukeru	V	turn away	背ける	somukesaseru/somukesasu	背けさせる/背けさす
49	change-of-location	-/e-	trans	no_simple_tran	utumuku	C	look down	うつむく	utumukaseru/utumukasu	うつむかせる/うつむかす	utumukeru	V	cause to face down	うつむける	utumukesaseru/utumukesas	うつむけさせる/うつむけさす
50	mental state	-/e-	trans	no_simple_intr	nagusamu	C	become consoled	慰む	nagusamaseru/nagusamasu	慰ませる/慰ます	nagusameru	V	console	慰める	nagusamesaseru/nagusames	慰めさせる/慰めさす
51	change-of-location	-/e-	trans	causative	narabu	C	line up	並ぶ	narabaseru/narabasu	並ばせる/並ばす	naraberu	V	line up	並べる	narabesaseru/narabesasu	並べさせる/並べさす
52	stative	-/e-	trans	no_simple_intr	nurumu	C	become lukewarm	温む	nurumaseru/nurumasu	温ませる/温ます	nurumeru	V	make lukewarm	温める	nurumesaseru/nurumesasu	温めさせる/温めさす
53	inherently-directed	-/e-	trans	no_simple_tran	sirizoku	C	retreat	退く	sirizokaseru/sirizokasu	退かせる/退かす	sirizokeru	C	drive back	退ける	sirizokeraseru/sirizokerasu	退けらせる/退けらす

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Semantic class and Class of English conterpart verbs were added to the original list. Also, Japanese kanji transcripts and some homographic words (kiru = 切る、着る etc.) were also added
morphological causative: Consotnant-ending: [a]seru / [a]su; Verb-ending: saseru / sasu

Num	Semantic class	Type	Marked	English class	Kana (intra)	V o	English (intra)	Kanji (intra)	Morphological causative	Morphologcal causative Kanji	kana (trans)	V o	English (trans)	Kanji (trans)	Morphological causative	Morphological causative kanji
54	change-of-state	-/e-	trans	causative	sizumu	C	sink	沈む	sizumaseru/sizumasu	沈ませる/沈ます	sizumeru	V	sink	沈める	sizumesaseru/sizumesasu	沈めさせる/沈めさす
55	inherently-directed	-/e-	trans	suppletive	sitagau	C	go along with	従う	sitagaaseru/sitagaasu	従わせる/従わす	sitagaeru	V	take along with	従える	sitagaesaseru/sitagaesasu	従えさせる/従えさす
56	change-of-state	-/e-	trans	suppletive	sodatu	C	grow up	育つ	sodataseru/sodatasu	育たせる/育たす	sodateru	C	bring up, raise	育てる	sodateraseru/sodaterasu	育てらせる/育てらす
57	stative	-/e-	trans	suppletive	sorou	C	become complete	揃う	soroaseru/soroasu	揃わせる/揃わす	soroeru	C	make complete	揃える	soroeraseru/soroerasu	揃えらせる/揃えらす
58	stative	-/e-	trans	no_simple_tran	sou	C	go along with	添う	soaseru/soasu	添わせる/添わす	soeru	V	add	添える	soesaseru/soesasu	添えさせる/添えさす
59	change-of-state	-/e-	trans	no_simple_intr	subomu	C	become narrow	すぼむ	subomaseru/subomasu	すぼませる/すぼます	subomeru	V	make narrow	すぼめる	subomesaseru/subomesasu	すぼめさせる/すぼめさす
60	manner-of-motion	-/e-	trans	suppletive	sukumu	C	crouch	すくむ	sukumaseru/sukumasu	すくませる/すくます	sukumeru	V	duck (ones head)	すくめる	sukumesaseru/sukumesasu	すくめさせる/すくめさす
61	inherently-directed	-/e-	trans	causative	susumu	C	advance	進む	susumaseru/susumasu	進ませる/進ます	susumeru	V	advance	進める	susumesaseru/susumesasu	進めさせる/進めさす
62	stative	-/e-	trans	suppletive	tagau	C	differ	たがう	tagaaseru/tagaasu	たがわせる/たがわす	tagaeru	V	break (ones word)	たがえる	tagaesaseru/tagaesasu	たがえさせる/たがえさす
63	manner-of-motion	-/e-	trans	causative	tatu	C	stand	立つ	tataseru/tatasu	立たせる/立たす	tateru	V	stand	立てる	tatesaseru/tatesasu	立てさせる/立てさす
64	mental state	-/e-	trans	no_simple_intr	aradatu	C	become aggravated	荒立つ	aradataseru/aradatasu	荒立たせる/荒立たす	aradateru	V	aggravate	荒立てる	aradatesaseru/aradatesasu	荒立てさせる/荒立てさす
65	mental state	-/e-	trans	no_simple_intr	iradatu	C	become irritated	いら立つ	iradataseru/iradatasu	いら立たせる/いら立たす	iradateru	V	irritate	いら立てる	iradatesaseru/iradatesasu	いら立てさせる/いら立てさす
66	change-of-location	-/e-	trans	suppletive	sakadatu	C	stand on end	逆立つ	sakadataseru/sakadatasu	逆立たせる/逆立たす	sakadateru	V	ruffle up	逆立てる	sakadatesaseru/sakadatesas	逆立てさせる/逆立てさす
67	change-of-state	-/e-	trans	causative	tawamu	C	bend	たわむ	tawamaseru/tawamasu	たわませる/たわます	tawameru	V	bend	たわめる	tawamesaseru/tawamesasu	たわめさせる/たわめさす
68	stative	-/e-	trans	suppletive	tigau	C	differ	違う	tigaaseru/tigaasu	違わせる/違わす	tigaeru	V	change	違える	tigaesaseru/tigaesasu	違えさせる/違えさす
69	mental state	-/e-	trans	no_simple_intr	matigau	C	become mistaken	間違う	matigaaseru/matigaasu	間違わせる/間違わす	matigaeru	V	mistake	間違える	matigaesaseru/matigaesasu	間違えさせる/間違えさす
70	change-of-state	-/e-	trans	suppletive	tizimu	C	shrink	縮む	tizimaseru/tizimasu	縮ませる/縮ます	tizimeru	V	reduce	縮める	tizimesaseru/tizimesasu	縮めさせる/縮めさす
71	inherently-directed	-/e-	trans	no_simple_intr	todoku	C	be delivered	届く	todokaseru/todokasu	届かせる/届かす	todokeru	V	deliver	届ける	todokesaseru/todokesasu	届けさせる/届けさす
72	manner-of-motion	-/e-	trans	causative	tugau	C	mate with	つがう	tugaaseru/tugaasu	つがわせる/つがわす	tugaeru	V	mate with	つがえる	tugaesaseru/tugaesasu	つがえさせる/つがえさす
73	change-of-location	-/e-	trans	no_simple_intr	tuku	C	adhere to	付く	tukaseru/tukasu	付かせる/付かす	tukeru	V	attach	付ける	tukesaseru/tukesasu	付けさせる/付けさす
74	stative	-/e-	trans	no_simple_intr	katazuku	C	become tidy	片付く	katazukaseru/katazukasu	片付かせる/片付かす	katazukeru	V	tidy up	片付ける	katazukesaseru/katazukesasu	片付けさせる/片付けさす
75	change-of-state	-/e-	trans	no_simple_intr	kizutuku	C	become damaged	傷付く	kizutukaseru/kizutukasu	傷付かせる/傷付かす	kizutukeru	V	damage	傷付ける	kizutukesaseru/kizutukesasu	傷付けさせる/傷付けさす
76	mental state	-/e-	trans	no_simple_intr	natuku	C	become attached to	なつく	natukaseru/natukasu	なつかせる/なつかす	natukeru	V	win over	なつける	natukesaseru/natukesasu	なつけさせる/なつけさす
77	inherently-directed	-/e-	trans	no_simple_tran	tikazuku	C	approach	近付く	tikazukaseru/tikazukasu	近付かせる/近付かす	tikazukeru	V	allow to approach	近付ける	tikazukesaseru/tikazukesasu	近付けさせる/近付けさす
78	stative	-/e-	trans	no_simple_intr	tumu	C	become packed	積む	tumaseru/tumasu	積ませる/積ます	tumeru	V	pack	詰める	tumesaseru/tumesasu	詰めさせる/詰めさす
79	transaction	-/e-	trans	no_simple_tran	tutau	C	go along	伝う	tutaaseru/tutaasu	伝わせる/伝わす	tutaeru	V	transmit	伝える	tutaesaseru/tutaesasu	伝えさせる/伝えさす
80	stative	-/e-	trans	causative	tuzuku	C	continue	続く	tuzukaseru/tuzukasu	続かせる/続かす	tuzukeru	V	continue	続ける	tuzukesaseru/tuzukesasu	続けさせる/続けさす
81	manner-of-motion	-/e-	trans	causative	ukabu	C	float	浮かぶ	ukabaseru/ukabasu	浮かばせる/浮かばす	ukaberu	V	float	浮かべる	ukabesaseru/ukabesasu	浮かべさせる/浮かべさす
82	verbs of appearing/	-/e-	trans	causative	yamu	C	stop	止む	yamaseru/yamasu	止ませる/止ます	yameru	V	stop	止める	yamesaseru/yamesasu	止めさせる/止めさす
83	manner-of-motion	-/e-	trans	causative	yasumu	C	rest	休む	yasumaseru/yasumasu	休ませる/休ます	yasumeru	V	rest	休める	yasumesaseru/yasumesasu	休めさせる/休めさす
84	mental state	-/e-	trans	no_simple_intr	yawaragu	C	become softened	和らぐ	yawaragaseru/yawaragasu	和らがせる/和らがす	yawarageru	V	soften	和らげる	yawaragesaseru/yawaragesa	和らげさせる/和らげさす
85	change-of-state	-/e-	trans	no_simple_intr	yurumu	C	become loose	緩む	yurumaseru/yurumasu	緩ませる/緩ます	yurumeru	V	loosen	緩める	yurumesaseru/yurumesasu	緩めさせる/緩めさす
86	change-of-state	-/e-	trans	no_simple_intr	yugamu	C	become crooked	歪む	yugamaseru/yugamasu	歪ませる/歪ます	yugameru	V	bend	歪める	yugamesaseru/yugamesasu	歪めさせる/歪めさす
87	manner-of-motion	-/e-	trans	causative	yureru	V	shake	揺れる	yuresaseru/yuresasu	揺れさせる/揺れさす	yuru	C	shake	揺る	yuraseru/yurasu	揺らせる/揺らす
88	inherently-directed	-ar-/-e	both	suppletive	agaru	C	rise	上がる	agaraseru/agarasu	上がらせる/上がらす	ageru	V	raise	上げる	agesaseru/agesasu	上げさせる/上げさす
89	stative	-ar-/-e	both	no_simple_intr	aratamaru	C	become improved	改まる	aratamaraseru/aratamarasu	改まらせる/改まらす	aratameru	V	improve	改める	aratamesaseru/aratamesasu	改めさせる/改めさす
90	touch verbs	-ar-/-e	both	no_simple_tran	ataru	C	touch	当たる	ataraseru/atarasu	当たらせる/当たらす	ateru	V	cause to touch	当てる	atesaseru/atesasu	当てさせる/当てさす
91	change-of-state	-ar-/-e	both	no_simple_intr	atatamaru	C	become warm	暖まる	atatamaraseru/atatamarasu	暖まらせる/暖まらす	atatameru	V	warm up	暖める	atatamesaseru/atatamesasu	暖めさせる/暖めさす
92	change-of-location	-ar-/-e	both	causative	atumaru	C	gather	集まる	atumaraseru/atumarasu	集まらせる/集まらす	atumeru	V	gather	集める	atumesaseru/atumesasu	集めさせる/集めさす
93	transaction	-ar-/-e	both	suppletive	azukaru	C	keep	預かる	azukaraseru/azukarasu	預からせる/預からす	azukeru	V	entrust to	預ける	azukesaseru/azukesasu	預けさせる/預けさす
94	inherently-directed	-ar-/-e	both	suppletive	butukaru	C	bump into	ぶつかる	butukaraseru/butukarasu	ぶつからせる/ぶつからす	butukeru	V	strike against	ぶつける	butukesaseru/butukesasu	ぶつけさせる/ぶつけさす
95	change-of-state	-ar-/-e	both	no_simple_intr	hamaru	C	fittn into	はまる	hamaraseru/hamarasu	はまらせる/はまらす	hameru	V	fit into	はめる	hamesaseru/hamesasu	はめさせる/はめさす
96	manner-of-motion	-ar-/-e	both	no_simple_intr	hayamaru	C	become hasty	早まる	hayamaraseru/hayamarasu	早まらせる/早まらす	hayameru	V	hasten	早める	hayamesaseru/hayamesasu	早めさせる/早めさす
97	change-of-state	-ar-/-e	both	causative	hazimaru	C	begin	始まる	hazimaraseru/hazimarasu	始まらせる/始まらす	hazimeru	V	begin	始める	hazimesaseru/hazimesasu	始めさせる/始めさす
98	inherently-directed	-ar-/-e	both	no_simple_intr	hedataru	C	become separated	隔たる	hedataraseru/hedatarasu	隔たらせる/隔たらす	hedateru	V	separate	隔てる	hedatesaseru/hedatesasu	隔てさせる/隔てさす
99	inherently-directed	-ar-/-e	both	no_simple_intr	hikumaru	C	become lower	低まる	hikumaraseru/hikumarasu	低まらせる/低まらす	hikumeru	V	lower	低める	hikumesaseru/hikumesasu	低めさせる/低めさす
100	inherently-directed	-ar-/-e	both	causative	hirogaru	C	spread out	広がる	hirogaraseru/hirogarasu	広がらせる/広がらす	hirogeru	V	spread out	広げる	hirogesaseru/hirogesasu	広げさせる/広げさす
101	manner-of-motion	-ar-/-e	both	causative	hiromaru	C	spread	広まる	hiromaraseru/hiromarasu	広まらせる/広まらす	hiromeru	V	spread	広める	hiromesaseru/hiromesasu	広めさせる/広めさす
102	inherently-directed	-ar-/-e	both	causative	hukamaru	C	deepen	深まる	hukamaraseru/hukamarasu	深まらせる/深まらす	hukameru	V	deepen	深める	hukamesaseru/hukamesasu	深めさせる/深めさす
103	stative	-ar-/-e	both	no_simple_intr	kabusaru	C	become covered	かぶさる	kabusaraseru/kabusarasu	かぶさらせる/かぶさらす	kabuseru	V	cover	かぶせる	kabusesaseru/kabusesasu	かぶせさせる/かぶせさす
104	stative	-ar-/-e	both	causative	kakaru	C	hang	掛かる	kakaraseru/kakarasu	掛からせる/掛からす	kakeru	V	hang	掛ける	kakesaseru/kakesasu	掛けさせる/掛けさす
105	change-of-state	-ar-/-e	both	no_simple_intr	karamaru	C	become connected	絡まる	karamaraseru/karamarasu	絡まらせる/絡まらす	karameru	V	connect	絡める	karamesaseru/karamesasu	絡めさせる/絡めさす
106	change-of-location	-ar-/-e	both	causative	kasanaru	C	pile up	重なる	kasanaraseru/kasanarasu	重ならせる/重ならす	kasaneru	V	pile up	重ねる	kasanesaseru/kasanesasu	重ねさせる/重ねさす

From Jacobsen, W. (1992). The Transitive Structure of Events in Japanese. Kuroshio Publishers, Tokyo, Japan.
Semantic class and Class of English conterpart verbs were added to the original list. Also, Japanese kanji transcripts and some homographic words (kiru = 切る、着る etc.) were also added
morphological causative: Consotnant-ending: [a]seru / [a]su; Verb-ending: saseru/sasu

Num	Semantic class	Type	Marked	English class	Kana (intra)	V o	English (intra)	Kanji (intra)	Morphological causative	Morphologcal causative Kanji	kana (trans)	V o	English (trans)	Kanji (trans)	Morphological causative	Morphological causative kanji
107	change-of-state	-ar-/-e	both	causative	katamaru	C	harden	固まる	katamaraseru/katamarasu	固まらせる/固まらす	katameru	V	harden	固める	katamesaseru/katamesasu	固めさせる/固めさす
108	change-of-state	-ar-/-e	both	causative	kawaru	C	change	変わる	kawaraseru/kawarasu	変わらせる/変わらす	kaeru	V	change	変える	kaesaseru/kaesasu	変えさせる/変えさす
109	mental state	-ar-/-e	both	no_simple_intr	kimaru	C	become decided	決まる	kimaraseru/kimarasu	決まらせる/決まらす	kimeru	V	decide	決める	kimesaseru/kimesasu	決めさせる/決めさす
110	mental state	-ar-/-e	both	suppletive	kiwamaru	C	reach an extreme	極まる	kiwamaraseru/kiwamarasu	極まらせる/極まらす	kiwameru	V	carry to an extreme	極める	kiwamesaseru/kiwamesasu	極めさせる/極めさす
111	stative	-ar-/-e	both	no_simple_intr	kiyomaru	C	become pure	清まる	kiyomaraseru/kiyomarasu	清まらせる/清まらす	kiyomeru	V	purify	清める	kiyomesaseru/kiyomesasu	清めさせる/清めさす
112	manner-of-motion	-ar-/-e	both	no_simple_intr	kurumaru	C	become wrapped up in	くるまる	kurumaraseru/kurumarasu	くるまらせる/くるまらす	kurumeru	V	lump together with	くるめる	kurumesaseru/kurumesasu	くるめさせる/くるめさす
113	change-of-state	-ar-/-e	both	suppletive	kuwawaru	C	join	加わる	kuwawaraseru/kuwawarasu	加わらせる/加わらす	kuwaeru	V	add	加える	kuwaesaseru/kuwaesasu	加えさせる/加えさす
114	change-of-state	-ar-/-e	both	causative	magaru	C	bend	曲がる	magaraseru/magarasu	曲がらせる/曲がらす	mageru	V	bend	曲げる	magesaseru/magesasu	曲げさせる/曲げさす
115	change-of-state	-ar-/-e	both	no_simple_intr	marumaru	C	become round	丸まる	marumaraseru/marumarasu	丸まらせる/丸まらす	marumeru	V	make round	丸める	marumesaseru/marumesasu	丸めさせる/丸めさす
116	change-of-location	-ar-/-e	both	suppletive	matomaru	C	take shape	まとまる	matomaraseru/matomarasu	まとまらせる/まとまらす	matomeru	V	put into order	まとめる	matomesaseru/matomesasu	まとめさせる/まとめさす
117	change-of-state	-ar-/-e	both	no_simple_intr	mazaru	C	become mixed with	混ざる	mazaraseru/mazarasu	混ざらせる/混ざらす	mazeru	V	mix with	混ぜる	mazesaseru/mazesasu	混ぜさせる/混ぜさす
118	change-of-state	-ar-/-e	both	suppletive	maziwaru	C	mingle with	交わる	maziwaraseru/maziwarasu	交わらせる/交わらす	mazieru	V	mix with	交える	maziesaseru/maziesasu	交えさせる/交えさす
119	mental state	-ar-/-e	both	no_simple_intr	mitukaru	C	be found	見つかる	mitukaraseru/mitukarasu	見つからせる/見つからす	mitukeru	V	find	見つける	mitukesaseru/mitukesasu	見つけさせる/見つけさす
120	change-of-state	-ar-/-e	both	no_simple_intr	mookaru	C	be earned	儲かる	mookaraseru/mookarasu	儲からせる/儲からす	mookeru	V	earn	儲ける	mookesaseru/mookesasu	儲けさせる/儲けさす
121	change-of-state	-ar-/-e	both	no_simple_intr	nukumaru	C	become warm	ぬくまる	nukumaraseru/nukumarasu	ぬくまらせる/ぬくまらす	nukumeru	V	warm up	温める	nukumesaseru/nukumesasu	温めさせる/温めさす
122	verbs of appearing/	-ar-/-e	both	suppletive	osamaru	C	subside	治まる	osamaraseru/osamarasu	治まらせる/治まらす	osameru	V	pacify	治める	osamesaseru/osamesasu	治めさせる/治めさす
123	mental state	-ar-/-e	both	suppletive	osowaru	C	learn	教わる	osowaraseru/osowarasu	教わらせる/教わらす	osieru	V	teach	教える	osiesaseru/osiesasu	教えさせる/教えさす
124	verbs of appearing/	-ar-/-e	both	causative	owaru	C	end	終わる	owaraseru/owarasu	終わらせる/終わらす	oeru	V	end	終える	oesaseru/oesasu	終えさせる/終えさす
125	change-of-location	-ar-/-e	both	no_simple_intr	sadamaru	C	be decided	定まる	sadamaraseru/sadamarasu	定まらせる/定まらす	sadameru	V	decide	定める	sadamesaseru/sadamesasu	定めさせる/定めさす
126	inherently-directed	-ar-/-e	both	no_simple_intr	sagaru	C	become lower	下がる	sagaraseru/sagarasu	下がらせる/下がらす	sageru	V	lower	下げる	sagesaseru/sagesasu	下げさせる/下げさす
127	stative	-ar-/-e	both	causative	burasagaru	C	hang down	ぶら下がる	burasagaraseru/burasagarasu	ぶら下がらせる/ぶら下がらす	burasageru	V	hang down	ぶら下げる	burasagesaseru/burasagesas	ぶら下げさせる/ぶら下げさす
128	transaction	-ar-/-e	both	suppletive	sazukaru	C	receive	授かる	sazukaraseru/sazukarasu	授からせる/授からす	sazukeru	V	grant	授ける	sazukesaseru/sazukesasu	授けさせる/授けさす
129	manner-of-motion	-ar-/-e	both	no_simple_intr	sebamaru	C	become narrow	狭まる	sebamaraseru/sebamarasu	狭まらせる/狭まらす	sebameru	V	make narrow	狭める	sebamesaseru/sebamesasu	狭めさせる/狭めさす
130	change-of-state	-ar-/-e	both	causative	simaru	C	close	閉まる	simaraseru/simarasu	閉まらせる/閉まらす	simeru	V	close	閉める	simesaseru/simesasu	閉めさせる/閉めさす
131	change-of-state	-ar-/-e	both	suppletive	sizumaru	C	become quiet	鎮まる	sizumaraseru/sizumarasu	鎮まらせる/鎮まらす	sizumeru	V	make quiet	鎮める	sizumesaseru/sizumesasu	鎮めさせる/鎮めさす
132	change-of-state	-ar-/-e	both	no_simple_intr	somaru	C	be dyed	染まる	somaraseru/somarasu	染まらせる/染まらす	someru	V	dye	染める	somesaseru/somesasu	染めさせる/染めさす
133	change-of-state	-ar-/-e	both	no_simple_intr	sonawaru	C	be provided	備わる	sonawaraseru/sonawarasu	備わらせる/備わらす	sonaeru	V	provide with	備える	sonaesaseru/sonaesasu	備えさせる/備えさす
134	change-of-state	-ar-/-e	both	suppletive	subomaru (tsu	C	become narrow	すぼまる	subomaraseru/subomarasu	すぼまらせる/すぼまらす	subomeru	V	make narrow	すぼめる	subomesaseru/subomesasu	すぼめさせる/すぼめさす
135	verbs of appearing/	-ar-/-e	both	suppletive	sutaru	C	fall into disuse	廃る	sutaraseru/sutarasu	廃らせる/廃らす	suteru	V	throw away	捨てる	sutesaseru/sutesasu	捨てさせる/捨てさす
136	manner-of-motion	-ar-/-e	both	suppletive	suwaru	C	sit	座る	suwaraseru/suwarasu	座らせる/座らす	sueru	V	set	据える	suesaseru/suesasu	据えさせる/据えさす
137	inherently-directed	-ar-/-e	both	suppletive	takamaru	C	rise	高まる	takamaraseru/takamarasu	高まらせる/高まらす	takameru	V	raise	高める	takamesaseru/takamesasu	高めさせる/高めさす
138	change-of-state	-ar-/-e	both	causative	tamaru	C	collect	貯まる	tamaraseru/tamarasu	貯まらせる/貯まらす	tameru	V	collect	貯める	tamesaseru/tamesasu	貯めさせる/貯めさす
139	change-of-state	-ar-/-e	both	no_simple_intr	tasukaru	C	be helped	助かる	tasukaraseru/tasukarasu	助からせる/助からす	tasukeru	V	help	助ける	tasukesaseru/tasukesasu	助けさせる/助けさす
140	change-of-state	-ar-/-e	both	suppletive	tazusawaru	C	participate in	携わる	tazusawaraseru/tazusawaras	携わらせる/携わらす	tazusaeru	V	carry on ones person	携える	tazusaesaseru/tazusaesasu	携えさせる/携えさす
141	change-of-state	-ar-/-e	both	suppletive	tizimaru	C	shrink	縮まる	tizimaraseru/tizimarasu	縮まらせる/縮まらす	tizimeru	V	reduce	縮める	tizimesaseru/tizimesasu	縮めさせる/縮めさす
142	stative	-ar-/-e	both	causative	todomaru	C	stop	とどまる	todomaraseru/todomarasu	とどまらせる/とどまらす	todomeru	V	stop	とどめる	todomesaseru/todomesasu	とどめさせる/とどめさす
143	verbs of appearing/	-ar-/-e	both	causative	tomaru	C	stop	止まる	tomaraseru/tomarasu	止まらせる/止まらす	tomeru	V	stop	止める	tomesaseru/tomesasu	止めさせる/止めさす
144	inherently-directed	-ar-/-e	both	suppletive	toozakaru	C	move away	遠ざかる	toozakaraseru/toozakarasu	遠ざからせる/遠ざからす	toozakeru	V	keep at a distance	遠ざける	toozakesaseru/toozakesasu	遠ざけさせる/遠ざけさす
145	change-of-state	-ar-/-e	both	causative	tukaru	C	soak in	浸かる	tukaraseru/tukarasu	浸からせる/浸からす	tukeru	V	soak in	浸ける	tukesaseru/tukesasu	浸けさせる/浸けさす
146	stative	-ar-/-e	both	no_simple_intr	tumaru	C	become packed	詰まる	tumaraseru/tumarasu	詰まらせる/詰まらす	tumeru	V	pack	詰める	tumesaseru/tumesasu	詰めさせる/詰めさす
147	stative	-ar-/-e	both	causative	turanaru	C	line up	連なる	turanaraseru/turanarasu	連ならせる/連ならす	turaneru	V	line up	連ねる	turanesaseru/turanesasu	連ねさせる/連ねさす
148	transaction	-ar-/-e	both	no_simple_intr	tutawaru	C	be handed down	伝わる	tutawaraseru/tutawarasu	伝わらせる/伝わらす	tutaeru	V	transmit	伝える	tutaesaseru/tutaesasu	伝えさせる/伝えさす
149	stative	-ar-/-e	both	no_simple_intr	tutomaru	C	be fit for the role of	勤まる	tutomaraseru/tutomarasu	勤まらせる/勤まらす	tutomeru	V	play the role of	勤める	tutomesaseru/tutomesasu	勤めさせる/勤めさす
150	change-of-state	-ar-/-e	both	no_simple_intr	tuyomaru	C	become song	強まる	tuyomaraseru/tuyomarasu	強まらせる/強まらす	tuyomeru	V	strengten	強める	tuyomesaseru/tuyomesasu	強めさせる/強めさす
151	change-of-state	-ar-/-e	both	suppletive	ukaru	C	pass (an exam)	受かる	ukaraseru/ukarasu	受からせる/受からす	ukeru	V	take (an exam)	受ける	ukesaseru/ukesasu	受けさせる/受けさす
152	verbs of appearing/	-ar-/-e	both	no_simple_intr	umaru	C	be buried	埋まる	umaraseru/umarasu	埋まらせる/埋まらす	umeru	V	bury	埋める	umesaseru/umesasu	埋めさせる/埋めさす
153	change-of-state	-ar-/-e	both	suppletive	usumaru	C	become thin	薄まる	usumaraseru/usumarasu	薄まらせる/薄まらす	usumeru	V	make thin	薄める	usumesaseru/usumesasu	薄めさせる/薄めさす
154	manner-of-motion	-ar-/-e	both	no_simple_intr	uwaru	C	be planted	植わる	uwaraseru/uwarasu	植わらせる/植わらす	ueru	V	plant	植える	uesaseru/uesasu	植えさせる/植えさす
155	change-of-state	-ar-/-e	both	no_simple_intr	yasumaru	C	become rested	休まる	yasumaraseru/yasumarasu	休まらせる/休まらす	yasumeru	V	rest	休める	yasumesaseru/yasumesasu	休めさせる/休めさす
156	change-of-location	-ar-/-e	both	suppletive	yokotawaru	C	lie down	横たわる	yokotawaraseru/yokotawara	横たわらせる/横たわらす	yokotaeru	V	lay down	横たえる	yokotaesaseru/yokotaesasu	横たえさせる/横たえさす
157	mental state	-ar-/-e	both	causative	yowamaru	C	weaken	弱まる	yowamaraseru/yowamarasu	弱まらせる/弱まらす	yowameru	V	weaken	弱める	yowamesaseru/yowamesasu	弱めさせる/弱めさす
158	change-of-state	-ar-/-e	both	no_simple_intr	yudaru	C	be boiled	ゆだる	yudaraseru/yudarasu	ゆだらせる/ゆだらす	yuderu	V	boil	ゆでる	yudesaseru/yudesasu	ゆでさせる/ゆでさす
159	change-of-state	-ar/-	intra	no_simple_intr	hasamaru	C	become caught betwee	挟まる	hasamaraseru/hasamarasu	挟まらせる/挟まらす	hasamu	C	put between	挟む	hasamaseru/hasamasu	挟ませる/挟ます

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Semantic class and Class of English conterpart verbs were added to the original list. Also, Japanese kanji transcripts and some homographic words (kiru = 切る、着る etc.) were also added
morphological causative: Consotnant-ending: [a]seru/[a]su; Verb-ending: saseru/sasu

Num	Semantic class	Type	Marked	English class	Kana (intra)	V	o English (intra)	Kanji (intra)	Morphological causative	Morphologcal causative Kanji	kana (trans)	V	o English (trans)	Kanji (trans)	Morphological causative	Morphological causative kanji
160	change-of-state	-ar-/-	intra	no_simple_intr	husagaru	C	become obsucted	塞がる	husagaraseru/husagarasu	塞がらせる/塞がらす	husagu	C	obsuct	塞ぐ	husagaseru/husagasu	塞がせる/塞がす
161	change-of-state	-ar-/-	intra	no_simple_intr	kurumaru	C	become wrapped up ir	包まる	kurumaraseru/kurumarasu	包まらせる/包まらす	kurumu	C	wrap up in	包む	kurumaseru/kurumasu	包ませる/包ます
162	manner-of-motion	-ar-/-	intra	no_simple_tran	matagaru	C	sit aside	またがる	matagaraseru/matagarasu	またがらせる/またがらす	matagu	C	saddle	またぐ	matagaseru/matagasu	またがせる/またがす
163	transaction	-ar-/-	intra	no_simple_intr	tamawaru	C	be granted	賜る	tamawaraseru/tamawarasu	賜らせる/賜らす	tamau	C	grant	賜う	tamaaseru/tamaasu	賜わせる/賜わす
164	change-of-state	-ar-/-	intra	no_simple_intr	togaru	C	become sharp	とがる	togaraseru/togarasu	とがらせる/とがらす	togu	C	sharpen	研ぐ	togaseru/togasu	研がせる/研がす
165	change-of-state	-ar-/-	intra	no_simple_intr	tukamaru	C	be caught	捕まる	tukamaraseru/tukamarasu	捕まらせる/捕まらす	tukamu	C	catch	つかむ	tukamaseru/tukamasu	つかませる/つかます
166	change-of-location	-ar-/-	intra	no_simple_intr	tunagaru	C	become connected	繋がる	tunagaraseru/tunagarasu	繋がらせる/繋がらす	tunagu	C	connect	繋ぐ	tunagaseru/tunagasu	繋がせる/繋がす
167	stative	-r-/-s-	both	no_simple_tran	amaru	C	remain	余る	amaraseru/amarasu	余らせる/余らす	amasu	C	let remain	余す	amasaseru/amasasu	余させる/余さす
168	manner-of-motion	-r-/-s-	both	causative	hitaru	C	soak in	浸る	hitaraseru/hitarasu	浸らせる/浸らす	hitasu	C	soak in	浸す	hitasaseru/hitasasu	浸させる/浸さす
169	manner-of-motion	-r-/-s-	both	suppletive	iburu	C	smoke	いぶる	iburaseru/iburasu	いぶらせる/いぶらす	ibusu	C	fumigate	いぶす	ibusaseru/ibusasu	いぶさせる/いぶさす
170	inherently-directed	-r-/-s-	both	causative	kaeru	C	return	帰る	kaeraseru/kaerasu	帰らせる/帰らす	kaesu	C	return	返す	kaesaseru/kaesasu	返させる/返さす
171	manner-of-motion	-r-/-s-	both	causative	hirugaeru	C	wave	翻る	hirugaeraseru/hirugaerasu	翻らせる/翻らす	hirugaesu	C	wave	翻す	hirugaesaseru/hirugaesasu	翻させる/翻さす
172	manner-of-motion	-r-/-s-	both	causative	kutugaeru	C	tip over	覆る	kutugaeraseru/kutugaerasu	覆らせる/覆らす	kutugaesu	C	tip over	覆す	kutugaesaseru/kutugaesasu	覆させる/覆さす
173	change-of-state	-r-/-s-	both	causative	kaeru	C	hatch	孵る	kaeraseru/kaerasu	孵らせる/孵らす	kaesu	C	hatch	孵す	kaesaseru/kaesasu	孵させる/孵さす
174	verbs of appearing/	-r-/-s-	both	no_simple_tran	kieru	V	go out	消える	kiesaseru/kiesasu	消えさせる/消えさす	kesu	C	extinguish	消す	kesaseru/kesasu	消させる/消さす
175	inherently-directed	-r-/-s-	both	no_simple_tran	kitaru	C	come	きたる	kitaraseru/kitarasu	きたらせる/きたらす	kitasu	C	bring about	きたす	kitasaseru/kitasasu	きたさせる/きたさす
176	manner-of-motion	-r-/-s-	both	causative	korogaru	C	roll	転がる	korogaraseru/korogarasu	転がらせる/転がらす	korogasu	C	roll	転がす	korogasaseru/korogasasu	転がさせる/転がさす
177	inherently-directed	-r-/-s-	both	no_simple_tran	kudaru	C	go down	下る	kudaraseru/kudarasu	下らせる/下らす	kudasu	C	lower	下す	kudasaseru/kudasasu	下させる/下さす
178	manner-of-motion	-r-/-s-	both	causative	mawaru	C	turn	回る	mawaraseru/mawarasu	回らせる/回らす	mawasu	C	turn	回す	mawasaseru/mawasasu	回させる/回さす
179	inherently-directed	-r-/-s-	both	causative	modoru	C	return	戻る	modoraseru/modorasu	戻らせる/戻らす	modosu	C	return	戻す	modosaseru/modosasu	戻させる/戻さす
180	mental state	-r-/-s-	both	no_simple_intr	naoru	C	become better	治る	naoraseru/naorasu	治らせる/治らす	naosu	C	fix	治す	naosaseru/naosasu	治させる/治さす
181	change-of-state	-r-/-s-	both	suppletive	naru	C	become	なる	naraseru/narasu	ならせる/ならす	nasu	C	make	なす	nasaseru/nasasu	なさせる/なさす
182	verbs of appearing/	-r-/-s-	both	no_simple_intr	nakunaru	C	become lost, die	無くなる	nakunaraseru/nakunarasu	無くならせる/無くならす	nakunasu	C	lose	無くなす	nakunasaseru/nakunasasu	無くなさせる/無くなさす
183	change-of-state	-r-/-s-	both	no_simple_intr	nigoru	C	become muddy	濁る	nigoraseru/nigorasu	濁らせる/濁らす	nigosu	C	muddy	濁す	nigosaseru/nigosasu	濁させる/濁さす
184	inherently-directed	-r-/-s-	both	no_simple_tran	noboru	C	rise	登る	noboraseru/noborasu	登らせる/登らす	nobosu	C	bring up, serve	のぼす	nobosaseru/nobosasu	のぼさせる/のぼさす
185	stative	-r-/-s-	both	suppletive	nokoru	C	remain	残る	nokoraseru/nokorasu	残らせる/残らす	nokosu	C	leave	残す	nokosaseru/nokosasu	残させる/残さす
186	change-of-state	-r-/-s-	both	suppletive	okoru	C	happen	起こる	okoraseru/okorasu	起こらせる/起こらす	okosu	C	cause	起こす	okosaseru/okosasu	起こさせる/起こさす
187	mental state	-r-/-s-	both	no_simple_tran	satoru	C	realize	悟る	satoraseru/satorasu	悟らせる/悟らす	satosu	C	make realize	論す	satosaseru/satosasu	論させる/論さす
188	change-of-state	-r-/-s-	both	no_simple_intr	simeru	C	become wet	湿る	simeraseru/simerasu	湿らせる/湿らす	simesu	C	wet	示す	simesaseru/simesasu	示させる/示さす
189	stative	-r-/-s-	both	suppletive	taru	C	suffice	足る	taraseru/tarasu	足らせる/足らす	tasu	C	add, supplement	足す	tasaseru/tasasu	足させる/足さす
190	change-of-state	-r-/-s-	both	no_simple_intr	tirakaru	C	become scattered	散らかる	tirakaraseru/tirakarasu	散らからせる/散らからす	tirakasu	C	scatter	散らかす	tirakasaseru/tirakasasu	散らかさせる/散らかさす
191	change-of-state	-r-/-s-	both	no_simple_intr	tomoru	C	become lit	灯る	tomoraseru/tomorasu	灯らせる/灯らす	tomosu	C	light	灯す	tomosaseru/tomosasu	灯させる/灯さす
192	inherently-directed	-r-/-s-	both	no_simple_tran	tooru	C	pass through	通る	tooraseru/toorasu	通らせる/通らす	toosu	C	let pass through	通す	toosaseru/toosasu	通させる/通さす
193	change-of-state	-r-/-s-	both	suppletive	uturu	C	appear, become reflect	写る	uturaseru/uturasu	写らせる/写らす	utusu	C	capture (an image), ref	写す	utusaseru/utusasu	写させる/写さす
194	change-of-location	-r-/-s-	both	causative	uturu	C	move	移る	uturaseru/uturasu	移らせる/移らす	utusu	C	move	移る	utusaseru/utusasu	移らせる/移らす
195	transaction	-r-/-s-	both	suppletive	wataru	C	cross over	渡る	wataraseru/watarasu	渡らせる/渡らす	watasu	C	hand over	渡す	watasaseru/watasasu	渡させる/渡さす
196	change-of-location	-r-/-s-	both	no_simple_tran	yadoru	C	lodge at	宿る	yadoraseru/yadorasu	宿らせる/宿らす	yadosu	C	give lodging to	宿す	yadosaseru/yadosasu	宿させる/宿さす
197	verbs of appearing/	-re-/-s	both	suppletive	arawareru	V	appear	現れる	arawaresaseru/arawaresasu	現れさせる/現れさす	arawasu	C	show	現す	arawasaseru/arawasasu	現させる/現さす
198	inherently-directed	-re-/-s	both	suppletive	hanareru	V	move away from	離れる	hanaresaseru/hanaresasu	離れさせる/離れさす	hanasu	C	aeparate from	離す	hanasaseru/hanasasu	離させる/離さす
199	inherently-directed	-re-/-s	both	suppletive	hazureru	V	come off	外れる	hazuresaseru/hazuresasu	外れさせる/外れさす	hazusu	C	take off	外す	hazusaseru/hazusasu	外させる/外さす
200	manner-of-motion	-re-/-s	both	causative	kakureru	V	hide	隠れる	kakuresaseru/kakuresasu	隠れさせる/隠れさす	kakusu	C	hide	隠す	kakusaseru/kakusasu	隠させる/隠さす
201	change-of-state	-re-/-s	both	suppletive	kegareru	V	become unclean	汚れる	kegaresaseru/kegaresasu	汚れさせる/汚れさす	kegasu	C	make unclean	汚す	kegasaseru/kegasasu	汚させる/汚さす
202	change-of-state	-re-/-s	both	causative	koboreru	V	spill	こぼれる	koboresaseru/koboresasu	こぼれさせる/こぼれさす	kobosu	C	spill	こぼす	kobosaseru/kobosasu	こぼさせる/こぼさす
203	change-of-state	-re-/-s	both	no_simple_intr	kogareru	V	burn with passion for	焦がれる	kogaresaseru/kogaresasu	焦がれさせる/焦がれさす	kogasu	C	scorch	焦がす	kogasaseru/kogasasu	焦がさせる/焦がさす
204	change-of-state	-re-/-s	both	no_simple_intr	konareru	V	become digested	こなれる	konaresaseru/konaresasu	こなれさせる/こなれさす	konasu	C	digest	こなす	konasaseru/konasasu	こなさせる/こなさす
205	verbs of appearing/	-re-/-s	both	causative	kowareru	V	break	壊れる	kowaresaseru/kowaresasu	壊れさせる/壊れさす	kowasu	C	break	壊す	kowasaseru/kowasasu	壊させる/壊さす
206	verbs of appearing/	-re-/-s	both	suppletive	kuzureru	V	collapse	崩れる	kuzuresaseru/kuzuresasu	崩れさせる/崩れさす	kuzusu	C	demolish	崩す	kuzusaseru/kuzusasu	崩させる/崩さす
207	change-of-state	-re-/-s	both	no_simple_intr	mabureru	V	become smeared	まぶれる	maburesaseru/maburesasu	まぶれさせる/まぶれさす	mabusu	C	smear	まぶす	mabusaseru/mabusasu	まぶさせる/まぶさす
208	change-of-state	-re-/-s	both	suppletive	midareru	V	become disordered	乱れる	midaresaseru/midaresasu	乱れさせる/乱れさす	midasu	C	put into disorder	乱す	midasaseru/midasasu	乱させる/乱さす
209	change-of-state	-re-/-s	both	no_simple_intr	mureru	V	become steamed	蒸れる	muresaseru/muresasu	蒸れさせる/蒸れさす	musu	C	steam	蒸す	musaseru/musasu	蒸させる/蒸さす
210	manner-of-motion	-re-/-s	both	causative	nagareru	V	flow	流れる	nagaresaseru/nagaresasu	流れさせる/流れさす	nagasu	C	flow	流す	nagasaseru/nagasasu	流させる/流さす
211	inherently-directed	-re-/-s	both	no_simple_tran	nogareru	V	escape	逃れる	nogaresaseru/nogaresasu	逃れさせる/逃れさす	nogasu	C	let escape	逃す	nogasaseru/nogasasu	逃させる/逃さす
212	inherently-directed	-re-/-s	both	no_simple_tran	taoreru	V	fall	倒れる	taoresaseru/taoresasu	倒れさせる/倒れさす	taosu	C	bring down	倒す	taosaseru/taosasu	倒させる/倒さす

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morphological causative: Consotnant-ending: [a]seru/[a]su; Verb-ending: saseru/sasu

Num	Semantic class	Type	Marked	English class	Kana (intra)	V o	English (intra)	Kanji (intra)	Morphological causative	Morphologcal causative Kanji	kana (trans)	V o	English (trans)	Kanji (trans)	Morphological causative	Morphological causative kanji
213	change-of-state	-re-/-s	both	no_simple_intr	tubureru	V	become crushed	つぶれる	tuburesaseru/tuburesasu	つぶれさせる/つぶれさす	tubusu	C	crush	つぶす	tubusaseru/tubusasu	つぶさせる/つぶさす
214	change-of-state	-re-/-s	both	no_simple_intr	yogoreru	V	become dirty	汚れる	yogoresaseru/yogoresasu	汚れさせる/汚れさす	yogosu	C	soil	汚す	yogosaseru/yogosasu	汚させる/汚さす
215	transaction	-ri-/-s-	both	suppletive	kariru	V	borrow	借りる	karisaseru/karisasu	借りさせる/借りさす	kasu	C	lend	貸す	kasaseru/kasasu	貸させる/貸さす
216	stative	-ri-/-s-	both	suppletive	tariru	V	suffice	足りる	tarisaseru/tarisasu	足りさせる/足りさす	tasu	C	add, supplement	足す	tasaseru/tasasu	足させる/足さす
217	change-of-state	-/-as-	trans	suppletive	aku	C	open	開く	akaseru/akasu	開かせる/開かす	akasu	C	reveal	開かす	akasaseru/akasasu	開かさせる/開かさす
218	NA	-/-as-	trans	suppletive	au	C	get together	会う	aaseru/aasu	会わせる/会わす	awasu	C	bring together	会わす	awasaseru/awasasu	会わさせる/会わさす
219	mental state	-/-as-	trans	no_simple_intr	hagemu	C	be diligent in	励む	hagemaseru/hagemasu	励ませる/励ます	hagemasu	C	encourage	励ます	hagemasaseru/hagemasasu	励まさせる/励ますす
220	change-of-state	-/-as-	trans	no_simple_intr	hekomu	C	become dented	へこむ	hekomaseru/hekomasu	へこませる/へこます	hekomasu	C	dent	へこます	hekomasaseru/hekomasasu	へこまさせる/へこまさす
221	change-of-state	-/-as-	trans	causative	heru	C	decrease	減る	heraseru/herasu	減らせる/減らす	herasu	C	decrease	減らす	herasaseru/herasasu	減らさせる/減らさす
222	verbs that emit ligh	-/-as-	trans	no_simple_trar	hikaru	C	shine	光る	hikaraseru/hikarasu	光らせる/光らす	hikarasu	C	cause to shine	光らす	hikarasaseru/hikarasasu	光らさせる/光らさす
223	inherently-directed	-/-as-	trans	suppletive	hikkomu	C	draw back	引っ込む	hikkomaseru/hikkomasu	引っ込ませる/引っ込ます	hikkomasu	C	pull back	引っ込ます	hikkomasaseru/hikkomasasu	引っ込まさせる/引っ込まさす
224	manner-of-motion	-/-as-	trans	suppletive	huku	C	blow	吹く	hukaseru/hukasu	吹かせる/吹かす	hukasu	C	puff, smoke	吹かす	hukasaseru/hukasasu	吹かさせる/吹かさす
225	manner-of-motion	-/-as-	trans	no_simple_trar	hukuramu	C	swell	膨らむ	hukuramaseru/hukuramasu	膨らませる/膨らます	hukuramasu	C	cause to swell	膨らます	hukuramasaseru/hukuramas	膨らまさせる/膨らまさす
226	NA	-/-as-	trans	no_simple_trar	furu	C	rain	降る	furaseru/furasu	降らせる/降らす	hurasu	C	cause to rain	降らす	hurasaseru/hurasasu	降らさせる/降らさす
227	verbs that emit ligh	-/-as-	trans	no_simple_trar	kagayaku	C	shine	輝く	kagayakaseru/kagayakasu	輝かせる/輝かす	kagayakasu	C	cause to shine	輝かす	kagayakasaseru/kagayakasas	輝かさせる/輝かさす
228	change-of-state	-/-as-	trans	causative	kawaku	C	dry	乾く	kawakaseru/kawakasu	乾かせる/乾かす	kawakasu	C	dry	乾かす	kawakasaseru/kawakasasu	乾かさせる/乾かさす
229	mental state	-/-as-	trans	no_simple_intr	kiku	C	take effect	効く	kikaseru/kikasu	効かせる/効かす	kikasu	C	use	効かす	kikasaseru/kikasasu	効かさせる/効かさす
230	change-of-state	-/-as-	trans	causative	kooru	C	freeze	凍る	kooraseru/koorasu	凍らせる/凍らす	koorasu	C	freeze	凍らす	koorasaseru/koorasasu	凍らさせる/凍らさす
231	change-of-state	-/-as-	trans	no_simple_intr	koru	C	become absorbed in	凝る	koraseru/korasu	凝らせる/凝らす	korasu	C	concentrate on	凝らす	korasaseru/korasasu	凝らさせる/凝らさす
232	change-of-state	-/-as-	trans	causative	kusaru	C	spoil	腐る	kusaraseru/kusarasu	腐らせる/腐らす	kusarasu	C	spoil	腐らす	kusarasaseru/kusarasasu	腐らさせる/腐らさす
233	mental state	-/-as-	trans	no_simple_intr	mayou	C	become perplexed	迷う	mayoaseru/mayoasu	迷わせる/迷わす	mayowasu	C	perplex	迷わす	mayowasaseru/mayowasasu	迷わさせる/迷わさす
234	manner-of-motion	-/-as-	trans	suppletive	meguru	C	come around	巡る	meguraseru/megurasu	巡らせる/巡らす	megurasu	C	turn around	巡らす	megurasaseru/megurasasu	巡らさせる/巡らさす
235	manner-of-motion	-/-as-	trans	causative	moru	C	leak	洩る	moraseru/morasu	盛らせる/盛らす	morasu	C	leak	漏らす	morasaseru/morasasu	漏らさせる/漏らさす
236	verbs of laughing	-/-as-	trans	no_simple_trar	naku	C	cry	泣く	nakaseru/nakasu	泣かせる/泣かす	nakasu	C	cause to cry	泣かす	nakasaseru/nakasasu	泣かさせる/泣かさす
237	verbs that emit ligh	-/-as-	trans	causative	naru	C	ring	鳴る	naraseru/narasu	鳴らせる/鳴らす	narasu	C	ring	鳴らす	narasaseru/narasasu	鳴らさせる/鳴らさす
238	mental state	-/-as-	trans	no_simple_intr	nayamu	C	be troubled	悩む	nayamaseru/nayamasu	悩ませる/悩ます	nayamasu	C	trouble	悩ます	nayamasaseru/nayamasasu	悩まさせる/悩ますす
239	mental state	-/-as-	trans	no_simple_intr	odoroku	C	be surprized	驚く	odorokaseru/odorokasu	驚かせる/驚かす	odorokasu	C	surprise	驚かす	odorokasaseru/odorokasasu	驚かさせる/驚かさす
240	mental state	-/-as-	trans	no_simple_intr	sawagu	C	become excited	騒ぐ	sawagaseru/sawagasu	騒がせる/騒がす	sawagasu	C	excite	騒がす	sawagasaseru/sawagasasu	騒がさせる/騒がさす
241	change-of-state	-/-as-	trans	causative	soru	C	bend	反る	soraseru/sorasu	反らせる/反らす	sorasu	C	bend	反らす	sorasaseru/sorasasu	反らさせる/反らさす
242	inherently-directed	-/-as-	trans	no_simple_trar	suberu	C	slip	滑る	suberaseru/suberasu	滑らせる/滑らす	suberasu	C	let slip	滑らす	suberasaseru/suberasasu	滑らさせる/滑らさす
243	change-of-state	-/-as-	trans	suppletive	suku	C	become transparent	すく	sukaseru/sukasu	すかせる/すかす	sukasu	C	make tranparent	すかす	sukasaseru/sukasasu	すかさせる/すかさす
244	change-of-state	-/-as-	trans	suppletive	sumu	C	become clear	澄む	sumaseru/sumasu	澄ませる/澄ます	sumasu	C	make clear	澄ます	sumasaseru/sumasasu	澄まさせる/澄ますす
245	verbs of appearing/	-/-as-	trans	causative	sumu	C	end	済む	sumaseru/sumasu	済ませる/済ます	sumasu	C	end	済ます	sumasaseru/sumasasu	済まさせる/済ますす
246	verbs that emit ligh	-/-as-	trans	causative	teru	C	shine	照る	teraseru/terasu	照らせる/照らす	terasu	C	shine	照らす	terasaseru/terasasu	照らさせる/照らさす
247	manner-of-motion	-/-as-	trans	causative	tiru	C	scatter	散る	tiraseru/tirasu	散らせる/散らす	tirasu	C	scatter	散らす	tirasaseru/tirasasu	散らさせる/散らさす
248	manner-of-motion	-/-as-	trans	causative	tobu	C	fly	飛ぶ	tobaseru/tobasu	飛ばせる/飛ばす	tobasu	C	fly	飛ばす	tobasaseru/tobasasu	飛ばさせる/飛ばさす
249	change-of-state	-/-as-	trans	no_simple_intr	togaru	C	become sharp	尖る	togaraseru/togarasu	尖らせる/尖らす	togarasu	C	sharpen	尖らす	togarasaseru/togarasasu	尖らさせる/尖らさす
250	change-of-state	-/-as-	trans	suppletive	tomu	C	become rich	富む	tomaseru/tomasu	富ませる/富ます	tomasu	C	make rich	富ます	tomasaseru/tomasasu	富ませる/富ますす
251	manner-of-motion	-/-as-	trans	causative	ugoku	C	move	動く	ugokaseru/ugokasu	動かせる/動かす	ugokasu	C	move	動かす	ugokasaseru/ugokasasu	動かさせる/動かさす
252	change-of-state	-/-as-	trans	causative	waku	C	boil	沸く	wakaseru/wakasu	沸かせる/沸かす	wakasu	C	boil	沸かす	wakasaseru/wakasasu	沸かさせる/沸かさす
253	mental state	-/-as-	trans	no_simple_intr	wazurau	C	be troubled	煩う	wazuraaseru/wazuraasu	煩わせる/煩わす	wazurawasu	C	trouble	煩わす	wazurawasaseru/wazurawas	煩わさせる/煩わさす
254	mental state	-/-as-	trans	no_simple_intr	yorokobu	C	be happy	喜ぶ	yorokobaseru/yorokobasu	喜ばせる/喜ばす	yorokobasu	C	please	喜ばす	yorokobasaseru/yorokobasa	喜ばさせる/喜ばさす
255	change-of-state	-e-/-as	both	suppletive	akeru	V	dawn	開ける	akesaseru/akesasu	開けさせる/開けさす	akasu	C	spend (the night)	開かす	akasaseru/akasasu	開かさせる/開かさす
256	change-of-state	-e-/-as	both	no_simple_intr	areru	V	become ravaged	荒れる	aresaseru/aresasu	荒れさせる/荒れさす	arasu	C	ravage	荒らす	arasaseru/arasasu	荒らさせる/荒らさす
257	change-of-state	-e-/-as	both	suppletive	bakeru	V	turn into	化ける	bakesaseru/bakesasu	化けさせる/化けさす	bakasu	C	bewitch	化かす	bakasaseru/bakasasu	化かさせる/化かさす
258	change-of-state	-e-/-as	both	no_simple_intr	bareru	V	come to light	ばれる	baresaseru/baresasu	ばれさせる/ばれさす	barasu	C	expose	ばらす	barasaseru/barasasu	ばらさせる/ばらさす
259	change-of-state	-e-/-as	both	suppletive	bokeru	V	become unclear	ぼける	bokesaseru/bokesasu	ぼけさせる/ぼけさす	bokasu	C	make unclear	ぼかす	bokasaseru/bokasasu	ぼかさせる/ぼかさす
260	inherently-directed	-e-/-as	both	suppletive	deru	V	come out	出る	desaseru/desasu	出させる/出さす	dasu	C	take out	出す	dasaseru/dasasu	出させる/出さす
261	change-of-state	-e-/-as	both	causative	haeru	V	grow	生える	haesaseru/haesasu	生えさせる/生えさす	hayasu	C	grow	生やす	hayasaseru/hayasasu	生やさせる/生やさす
262	change-of-state	-e-/-as	both	causative	hageru	V	peel off	剥げる	hagesaseru/hagesasu	剥げさせる/剥げさす	hagasu	C	peel off	剥がす	hagasaseru/hagasasu	剥がさせる/剥がさす
263	change-of-state	-e-/-as	both	causative	hareru	V	clear up	晴れる	haresaseru/haresasu	晴れさせる/晴れさす	harasu	C	clear up	晴らす	harasaseru/harasasu	晴らさせる/晴らさす
264	verbs of appearing/	-e-/-as	both	suppletive	hateru	V	come to an end	果てる	hatesaseru/hatesasu	果てさせる/果てさす	hatasu	C	carry out	果たす	hatasaseru/hatasasu	果たさせる/果たさす
265	change-of-state	-e-/-as	both	no_simple_intr	hieru	V	become cool	冷える	hiesaseru/hiesasu	冷えさせる/冷えさす	hiyasu	C	cool	冷やす	hiyasaseru/hiyasasu	冷やさせる/冷やさす

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Semantic class and Class of English conterpart verbs were added to the original list. Also, Japanese kanji transcripts and some homographic words (kiru = 切る、着る etc.) were also added
morphological causative: Consotnant-ending: [a]seru / [a]su; Verb-ending: saseru / sasu

Num	Semantic class	Type	Marked	English class	Kana (intra)	V	o English (intra)	Kanji (intra)	Morphological causative	Morphologcal causative Kanji	kana (trans)	V	o English (trans)	Kanji (trans)	Morphological causative	Morphological causative kanji
266	change-of-state	-e-/-as	both	causative	hueru	V	increase	増える	huesaseru/huesasu	増えさせる/増えさす	huyasu	C	increase	増やす	huyasaseru/huyasasu	増やさせる/増やさす
267	change-of-state	-e-/-as	both	suppletive	hukeru	V	grow late	更ける	hukesaseru/hukesasu	更けさせる/更けさす	hukasu	C	stay up late at (night)	更かす	hukasaseru/hukasasu	更かさせる/更かさす
268	change-of-state	-e-/-as	both	no_simple_intr	huyakeru	V	become soaked	ふやける	huyakesaseru/huyakesasu	ふやけさせる/ふやけさす	huyakasu	C	soak	ふやかす	huyakasaseru/huyakasasu	ふやかさせる/ふやかさす
269	mental state	-e-/-as	both	causative	ieru	V	heal	癒える	iesaseru/iesasu	癒えさせる/癒えさす	iyasu	C	heal	癒す	iyasaseru/iyasasu	癒させる/癒さす
270	stative	-e-/-as	both	no_simple_intr	kakeru	V	become lacking	欠ける	kakesaseru/kakesasu	欠けさせる/欠けさす	kakasu	C	miss (a meeting)	欠かす	kakasaseru/kakasasu	欠かさせる/欠かさす
271	verbs of appearing/	-e-/-as	both	no_simple_trar	kareru	V	wither; dry out	枯れる	karesaseru/karesasu	枯れさせる/枯れさす	karasu	C	let wither; dry out	枯らす	karasaseru/karasasu	枯らさせる/枯らさす
272	verbs of appearing/	-e-/-as	both	causative	kireru	V	ran out	切れる	kiresaseru/kiresasu	切れさせる/切れさす	kirasu	C	run out	切らす	kirasaseru/kirasasu	切らさせる/切らさす
273	change-of-state	-e-/-as	both	no_simple_intr	koeru	V	become fat, fertile	肥える	koesaseru/koesasu	肥えさせる/肥えさす	koyasu	C	fatten, fertilize	肥やす	koyasaseru/koyasasu	肥やさせる/肥やさす
274	change-of-state	-e-/-as	both	no_simple_intr	kogeru	V	become scorched	焦げる	kogesaseru/kogesasu	焦げさせる/焦げさす	kogasu	C	scorch	焦がす	kogasaseru/kogasasu	焦がさせる/焦がさす
275	manner-of-motion	-e-/-as	both	causative	korogeru	V	roll	転げる	korogesaseru/korogesasu	転げさせる/転げさす	korogasu	C	roll	転がす	korogasaseru/korogasasu	転がさせる/転がさす
276	change-of-state	-e-/-as	both	no_simple_intr	kozireru	V	become worse	こじれる	koziresaseru/koziresasu	こじれさせる/こじれさす	kozirasu	C	make worse	こじらす	kozirasaseru/kozirasasu	こじらさせる/こじらさす
277	stative	-e-/-as	both	no_simple_intr	kureru	V	(day, year) comes to an	暮れる	kuresaseru/kuresasu	暮れさせる/暮れさす	kurasu	C	pass (time)	暮らす	kurasaseru/kurasasu	暮らさせる/暮らさす
278	mental state	-e-/-as	both	no_simple_intr	magireru	V	become confused with	紛れる	magiresaseru/magiresasu	紛れさせる/紛れさす	magirasu	C	conceal in; distract	紛らす	magirasaseru/magirasasu	紛らさせる/紛らさす
279	stative	-e-/-as	both	no_simple_intr	makeru	V	be defeated	負ける	makesaseru/makesasu	負けさせる/負けさす	makasu	C	defeat	負かす	makasaseru/makasasu	負かさせる/負かさす
280	change-of-state	-e-/-as	both	causative	moeru	V	burn	燃える	moesaseru/moesasu	燃えさせる/燃えさす	moyasu	C	burn	燃やす	moyasaseru/moyasasu	燃やさせる/燃やさす
281	verbs that emit ligh	-e-/-as	both	causative	moreru	V	leak	漏れる	moresaseru/moresasu	漏れさせる/漏れさす	morasu	C	leak	漏らす	morasaseru/morasasu	漏らさせる/漏らさす
282	change-of-state	-e-/-as	both	no_simple_intr	mureru	V	become steamed	蒸れる	muresaseru/muresasu	蒸れさせる/蒸れさす	murasu	C	steam	蒸らす	murasaseru/murasasu	蒸らさせる/蒸らさす
283	mental state	-e-/-as	both	no_simple_intr	nareru	V	become accustomed to	慣れる	naresaseru/naresasu	慣れさせる/慣れさす	narasu	C	accustom, tame	慣らす	narasaseru/narasasu	慣らさせる/慣らさす
284	inherently-directed	-e-/-as	both	no_simple_trar	nigeru	V	escape	逃げる	nigesaseru/nigesasu	逃げさせる/逃げさす	nigasu	C	let escape	逃がす	nigasaseru/nigasasu	逃がさせる/逃がさす
285	change-of-location	-e-/-as	both	no_simple_intr	nukeru	V	be left out	抜ける	nukesaseru/nukesasu	抜けさせる/抜けさす	nukasu	C	leave out	抜かす	nukasaseru/nukasasu	抜かさせる/抜かさす
286	change-of-state	-e-/-as	both	no_simple_intr	nureru	V	become wet	濡れる	nuresaseru/nuresasu	濡れさせる/濡れさす	nurasu	C	make wet	濡らす	nurasaseru/nurasasu	濡らさせる/濡らさす
287	stative	-e-/-as	both	no_simple_intr	okureru	V	be late for	遅れる	okuresaseru/okuresasu	遅れさせる/遅れさす	okurasu	C	delay	遅らす	okurasaseru/okurasasu	遅らさせる/遅らさす
288	mental state	-e-/-as	both	no_simple_intr	sameru	V	become awake	覚める	samesaseru/samesasu	覚めさせる/覚めさす	samasu	C	wake up	覚ます	samasaseru/samasasu	覚まさせる/覚ますす
289	change-of-state	-e-/-as	both	no_simple_intr	sameru	V	become cool	冷める	samesaseru/samesasu	冷めさせる/冷めさす	samasu	C	cool	冷ます	samasaseru/samasasu	冷まさせる/冷まさす
290	change-of-location	-e-/-as	both	suppletive	soreru	V	deviate	逸れる	soresaseru/soresasu	逸れさせる/逸れさす	sorasu	C	divert	逸らす	sorasaseru/sorasasu	逸らさせる/逸らさす
291	verbs of appearing/	-e-/-as	both	suppletive	taeru	V	die out	絶える	taesaseru/taesasu	絶えさせる/絶えさす	tayasu	C	exterminate	絶やす	tayasaseru/tayasasu	絶やさせる/絶やさす
292	manner-of-motion	-e-/-as	both	no_simple_trar	tareru	V	drop	垂れる	taresaseru/taresasu	垂れさせる/垂れさす	tarasu	C	let drop	垂らす	tarasaseru/tarasasu	垂らさせる/垂らさす
293	change-of-state	-e-/-as	both	no_simple_intr	tizireru	V	become curly	縮れる	tiziresaseru/tiziresasu	縮れさせる/縮れさす	tizirasu	C	curl	縮らす	tizirasaseru/tizirasasu	縮らさせる/縮らさす
294	change-of-state	-e-/-as	both	causative	tokeru	V	melt	溶ける	tokesaseru/tokesasu	溶けさせる/溶けさす	tokasu	C	melt	溶かす	tokasaseru/tokasasu	溶かさせる/溶かさす
295	change-of-state	-e-/-as	both	causative	torokeru	V	melt	とろける	torokesaseru/torokesasu	とろけさせる/とろけさす	torokasu	C	melt	とろかす	torokasaseru/torokasasu	とろかさせる/とろかさす
296	verbs of appearing/	-e-/-as	both	no_simple_intr	tuieru	V	be wasted	費える	tuiesaseru/tuiesasu	費えさせる/費えさす	tuiyasu	C	consume	費やす	tuiyasaseru/tuiyasasu	費やさせる/費やさす
297	mental state	-e-/-as	both	no_simple_intr	zireru	V	be impatient	じれる	ziresaseru/ziresasu	じれさせる/じれさす	zirasu	C	irritate	じらす	zirasaseru/zirasasu	じらさせる/じらさす
298	change-of-state	-e-/-as	both	no_simple_intr	zureru	V	become out of line	ずれる	zuresaseru/zuresasu	ずれさせる/ずれさす	zurasu	C	shift out of line	ずらす	zurasaseru/zurasasu	ずらさせる/ずらさす
299	mental state	-e-/-as	both	no_simple_intr	zyareru	V	be playful	じゃれる	zyaresaseru/zyaresasu	じゃれさせる/じゃれさす	zyarasu	C	play with	じゃらす	zyarasaseru/zyarasasu	じゃらさせる/じゃらさす
300	mental state	-i-/-as-	both	suppletive	akiru	V	grow tired of	飽きる	akisaseru/akisasu	飽きさせる/飽きさす	akasu	C	make (one) tired of	飽かす	akasaseru/akasasu	飽かさせる/飽かさす
301	verbs of appearing/	-i-/-as-	both	suppletive	dekiru	V	come into existence	できる	dekisaseru/dekisasu	できさせる/できさす	dekasu	C	bring about	でかす	dekasaseru/dekasasu	でかさせる/でかさす
302	stative	-i-/-as-	both	no_simple_trar	ikiru	V	live	生きる	ikisaseru/ikisasu	生きさせる/生きさす	ikasu	C	bring to life	生かす	ikasaseru/ikasasu	生かさせる/生かさす
303	mental state	-i-/-as-	both	no_simple_trar	koriru	V	learn (from experience	懲りる	korisaseru/korisasu	懲りさせる/懲りさす	korasu	C	give (one) a lesson	凝らす	korasaseru/korasasu	凝らさせる/凝らさす
304	change-of-state	-i-/-as-	both	no_simple_trar	mitiru	V	become full	満ちる	mitisaseru/mitisasu	満ちさせる/満ちさす	mitasu	C	fill	満たす	mitasaseru/mitasasu	満たさせる/満たさす
305	change-of-state	-i-/-as-	both	no_simple_intr	nobiru	V	become extended	伸びる	nobisaseru/nobisasu	伸びさせる/伸びさす	nobasu	C	extend	伸ばす	nobasaseru/nobasasu	伸ばさせる/伸ばさす
306	change-of-state	-i-/-as-	both	causative	toziru	V	close	閉じる	tozisaseru/tozisasu	閉じさせる/閉じさす	tozasu	C	close	閉ざす	tozasaseru/tozasasu	閉ざさせる/閉ざさす
307	change-of-state	-i-/-os	both	no_simple_intr	hiru	C	become dry	干る	hiraseru/hirasu	干らせる/干らす	hosu	C	dry	干す	hosaseru/hosasu	干させる/干さす
308	verbs of appearing/	-i-/-os	both	no_simple_intr	horobiru	V	go to ruin	滅びる	horobisaseru/horobisasu	滅びさせる/滅びさす	horobosu	C	destroy	滅ぼす	horobosaseru/horobosasu	滅ぼさせる/滅ぼさす
309	change-of-state	-i-/-os	both	causative	okiru	V	get up	起きる	okisaseru/okisasu	起きさせる/起きさす	okosu	C	get up	起こす	okosaseru/okosasu	起こさせる/起こさす
310	inherently-directed	-i-/-os	both	suppletive	oriru	V	get off	降りる	orisaseru/orisasu	降りさせる/降りさす	orosu	C	let off	降ろす	orosaseru/orosasu	降ろさせる/降ろさす
311	inherently-directed	-i-/-os	both	suppletive	otiru	V	fall	落ちる	otisaseru/otisasu	落ちさせる/落ちさす	otosu	C	drop	落とす	otosaseru/otosasu	落とさせる/落とさす
312	change-of-location	-i-/-os	both	no_simple_intr	sugiru	V	go past	過ぎる	sugisaseru/sugisasu	過ぎさせる/過ぎさす	sugosu	C	pass (time)	過ごす	sugosaseru/sugosasu	過ごさせる/過ごさす
313	stative	-/-se-	trans	causative	abiru	V	pour	浴びる	abisaseru/abisasu	浴びさせる/浴びさす	abiseru	V	pour	浴びせる	abisesaseru/abisesasu	浴びせさせる/浴びせさす
314	change-of-state	-/-se-	trans	no_simple_intr	kaburu	C	become covered (with)	かぶる	kaburaseru/kaburasu	かぶらせる/かぶらす	kabuseru	V	cover (with), put on (a	かぶせる	kabusesaseru/kabusesasu	かぶせさせる/かぶせさす
315	change-of-state	-/-se-	trans	causative	kiru	V	put on	着る	kisaseru/kisasu	着させる/着さす	kiseru	V	put on	着せる	kisesaseru/kisesasu	着せさせる/着せさす
316	stative	-/-se-	trans	no_simple_trar	niru	V	resemble	似る	nisaseru/nisasu	似させる/似さす	niseru	V	model after	似せる	nisesaseru/nisesasu	似せさせる/似せさす
317	change-of-location	-/-se-	trans	suppletive	noru	C	get on	乗る	noraseru/norasu	乗らせる/乗らす	noseru	V	put on, give a ride to	乗せる	nosesaseru/nosesasu	乗せさせる/乗せさす
318	inherently-directed	-/-se-	trans	no_simple_trar	yoru	C	approach	寄る	yoraseru/yorasu	寄らせる/寄らす	yoseru	V	allow to approach	寄せる	yosesaseru/yosesasu	寄せさせる/寄せさす

From Jacobsen, W. (1992). The Transitive Structure of Events in Japanese. Kuroshio Publishers, Tokyo, Japan.
Semantic class and Class of English conterpart verbs were added to the original list. Also, Japanese kanji transcripts and some homographic words (kiru = 切る、着る etc.) were also added
morphological causative: Consotnant-ending: [a]seru / [a]su; Verb-ending: saseru / sasu

Num	Semantic class	Type	Marked	English class	Kana (intra)	V o	English (intra)	Kanji (intra)	Morphological causative	Morphologcal causative Kanji	kana (trans)	V o	English (trans)	Kanji (trans)	Morphological causative	Morphological causative kanji
319	mental state	-/-se-	trans	suppletive	miru	V	see	見る	misaseru/misasu	見させる/見さす	miseru	V	show	見せる	misesaseru/misesasu	見せさせる/見せさす
320	mental state	-e-/-ak	both	no_simple_intr	amaeru	V	act dependent (on)	甘える	amaesaseru/amaesasu	甘えさせる/甘えさす	amayakasu	C	spoil	甘やかす	amayakasaseru/amayakasasu	甘やかさせる/甘やかさす
321	inherently-directed	-e-/-ak	both	suppletive	hagureru	V	stray from	はぐれる	haguresaseru/haguresasu	はぐれさせる/はぐれさす	hagurakasu	C	put off, evade	はぐらかす	hagurakasaseru/hagurakasasu	はぐらかさせる/はぐらかさす
322	mental state	-e-/-ak	both	no_simple_intr	obieru	V	become frightened at	怯える	obiesaseru/obiesasu	怯えさせる/怯えさす	obiyakasu	C	frighten, threaten	脅かす	obiyakasaseru/obiyakasasu	脅かさせる/脅かさす
323	stative	-e-/-ak	both	suppletive	sobieru	V	rise high	そびえる	sobiesaseru/sobiesasu	そびえさせる/そびえさす	sobiyakasu	C	hold (shoulders) high	そびやかす	sobiyakasaseru/sobiyakasasu	そびやかさせる/そびやかさす
324	change-of-state	-e-/-ak	both	suppletive	neru	V	go to bed	寝る	nesaseru/nesasu	寝させる/寝さす	nekaseru	V	put to bed	寝かせる	nekasaseru/nekasasu	寝かせさせる/寝かさす
325	stative	-or-/-e	both	no_simple_intr	komoru	C	be fully present	籠る	komoraseru/komorasu	籠らせる/籠らす	komeru	V	fill with	籠める	komesaseru/komesasu	籠めさせる/籠めさす
326	change-of-state	-or-/-e	both	no_simple_intr	nukumoru	C	become warm	温もる	nukumoraseru/nukumorasu	温もらせる/温もらす	nukumeru	V	warm up	温める	nukumesaseru/nukumesasu	温めさせる/温めさす
327	verbs of appearing/	-are-/-	both	suppletive	sutareru	V	fall into disuse	廃れる	sutaresaseru/sutaresasu	廃れさせる/廃れさす	suteru	V	throw away	捨てる	sutesaseru/sutesasu	捨てさせる/捨てさす
328	change-of-state	-are-/-	both	no_simple_intr	torawareru	V	be seized with, caught	捕われる	torawaresaseru/torawaresas	捕われさせる/捕われさす	toraeru	V	seize, catch	捕らえる	toraesaseru/toraesasu	捕らえさせる/捕らえさす
329	change-of-state	-are-/-	both	no_simple_intr	wakareru	V	become divided	分かれる	wakaresaseru/wakaresasu	分かれさせる/分かれさす	wakeru	V	divide	分ける	wakesaseru/wakesasu	分けさせる/分けさす
330	manner-of-motion	misc	both	causative	hagareru	V	peel off	剥がれる	hagaresaseru/hagaresasu	剥がれさせる/剥がれさす	hagu	C	peel off	剥ぐ	hagaseru/hagasu	剥がせる/剥がす
331	change-of-state	misc	both	no_simple_intr	hogureru	V	become untied	ほぐれる	hoguresaseru/hoguresasu	ほぐれさせる/ほぐれさす	hogusu	C	untie	ほぐす	hogusaseru/hogusasu	ほぐさせる/ほぐさす
332	change-of-state	misc	both	suppletive	hosoru	C	become thin	細る	hosoraseru/hosorasu	細らせる/細らす	hosomeru	V	make narrow	細める	hosomesaseru/hosomesasu	細めさせる/細めさす
333	manner-of-motion	misc	both	no_simple_tra	hukureru	V	swell	膨れる	hukuresaseru/hukuresasu	膨れさせる/膨れさす	hukuramasu	C	cause to swell	膨らます	hukuramasaseru/hukuramas	膨らまさせる/膨らまさす
334	manner-of-motion	misc	both	suppletive	kakeru	V	run	駆ける	kakesaseru/kakesasu	駆けさせる/駆けさす	karu	C	drive, spur	駆る	karaseru/karasu	駆らせる/駆らす
335	change-of-location	misc	both	suppletive	kasureru	V	become hoarse	かすれる	kasuresaseru/kasuresasu	かすれさせる/かすれさす	karasu	C	make hoarse	からす	karasaseru/karasasu	からさせる/からさす
336	mental state	misc	both	no_simple_intr	kikoeru	V	become audible	聞こえる	kikoesaseru/kikoesasu	聞こえさせる/聞こえさす	kiku	C	hear	聞く	kikaseru/kikasu	聞かせる/聞かす
337	change-of-location	misc	both	causative	koeru	V	go over	越える	koesaseru/koesasu	越えさせる/越えさす	kosu	C	go over	越す	kosaseru/kosasu	越させる/越さす
338	transaction	misc	both	no_simple_intr	kudaru	C	go down	下る	kudaraseru/kudarasu	下らせる/下らす	kudasaru	C	bestow	下さる	kudasaraseru/kudasarasu	下さらせる/下さらす
339	stative	misc	both	suppletive	kusuburu	C	smoke	くすぶる	kusuburaseru/kusuburasu	くすぶらせる/くすぶらす	kusuberu	C	fumigate	くすべる	kusuberaseru/kusuberasu	くすべらせる/くすべらす
340	change-of-location	misc	both	no_simple_intr	maziru	C	become mixed with	混じる	maziraseru/mazirasu	混じらせる/混じらす	mazeru	V	mix with	混ぜる	mazesaseru/mazesasu	混ぜさせる/混ぜさす
341	verbs of appearing/	misc	both	no_simple_intr	nakunaru	C	become lost, die	無くなる	nakunaraseru/nakunarasu	無くならせる/無くならす	nakusu	C	lose	無くす	nakusaseru/nakusasu	無くさせる/無くさす
342	stative	misc	both	suppletive	nigiwau	C	become prosperous	にぎわう	nigiwaaseru/nigiwaasu	にぎわわせる/にぎわわす	nigiwasu	C	make prosperous	にぎわす	nigiwasaseru/nigiwasasu	にぎわさせる/にぎわさす
343	inherently-directed	misc	both	no_simple_intr	nobiru	V	become extended	伸びる	nobisaseru/nobisasu	伸びさせる/伸びさす	noberu	V	extend	伸べる	nobesaseru/nobesasu	伸べさせる/伸べさす
344	stative	misc	both	suppletive	obusaru	C	get on (someones back	おぶさる	obusaraseru/obusarasu	おぶさらせる/おぶさらす	obuu	C	carry on (ones back)	おぶう	obuaseru/obuasu	おぶわせる/おぶわす
345	inherently-directed	misc	both	suppletive	oyobu	C	reach	及ぶ	oyobaseru/oyobasu	及ばせる/及ばす	oyobosu	C	extend (influence) to	及ぼす	oyobosaseru/oyobosasu	及ぼさせる/及ぼさす
346	change-of-location	misc	both	no_simple_intr	sasaru	C	become stuck in	刺さる	sasaraseru/sasarasu	刺さらせる/刺さらす	sasu	C	stick, trust into	刺す	sasaseru/sasasu	刺させる/刺さす
347	change-of-state	misc	both	no_simple_intr	tukamaru	C	become caught	捕まる	tukamaraseru/tukamarasu	捕まらせる/捕まらす	tukamaeru	V	catch	捕まえる	tukamaesaseru/tukamaesasu	捕まえさせる/捕まえさす
348	verbs of appearing/	misc	both	suppletive	tukiru	V	run out	尽きる	tukisaseru/tukisasu	尽きさせる/尽きさす	tukusu	C	use up	尽くす	tukusaseru/tukusasu	尽くさせる/尽くさす
349	stative	misc	both	no_simple_intr	tumoru	C	become accumulated	積もる	tumoraseru/tumorasu	積もらせる/積もらす	tumu	C	accumulate	積む	tumaseru/tumasu	積ませる/積ます
350	verbs of appearing/	misc	both	no_simple_intr	umareru	V	be born	生まれる	umaresaseru/umaresasu	生まれさせる/生まれさす	umu	C	give birth to	生む	umaseru/umasu	生ませる/生ます
351	stative	misc	both	no_simple_intr	uruou	C	become moistened	潤う	uruoaseru/uruoasu	潤わせる/潤わす	uruosu	C	moisten	潤す	uruosaseru/uruosasu	潤させる/潤さす
352	verbs of appearing/	misc	both	suppletive	useru	V	disappear	失せる	usesaseru/usesasu	失せさせる/失せさす	usinau	C	lose	失う	usinaaseru/usinaasu	失わせる/失わす
353	change-of-state	misc	both	no_simple_intr	uzumoreru	V	become buried	埋もれる	uzumoresaseru/uzumoresas	埋もれさせる/埋もれさす	uzumeru	C	bury	埋める	uzumeraseru/uzumerasu	埋めらせる/埋めらす
354	manner-of-motion	misc	both	no_simple_tra	yureru	V	sway	揺れる	yuresaseru/yuresasu	揺れさせる/揺れさす	yurugasu	C	cause to sway	揺るがす	yurugasaseru/yurugasasu	揺るがさせる/揺るがさす

APPENDIX E

THE $\mathcal{R}$ AND SPSS SCRIPTS AND THE FORMULAE OF THE STATISTICAL ANALYSES

Listing E.1: R code for the full mixed-design model

```
fit <- ezANOVA(data=data,
  dv=.(gramPrefSum), # DV is Summed Gram Preference scores
  wid=.(subjectID),  # Subject is identified by subjectID
  within=.(verbFreq, # Verb Freq is a within-subject
    verbClass_lg),   # Verb Class is a within-subject
  between=.(englishLevel) # English Level is a between-subj
)
print(fit)           # print out the results
```

Listing E.2: SPSS code for the full mixed-design model

```
GLM hitTouchV_high objDropV_high bodyPartV_high laughV_high \
    causative_exceptV_high causativeV_high hitTouchV_mid \
    objDropV_mid bodyPartV_mid laughV_mid \
    causative_exceptV_mid causativeV_mid hitTouchV_low \
    objDropV_low bodyPartV_low laughV_low
causative_exceptV_low causativeV_low BY englishLevel
  /WSFACTOR=verbFreq 3 Polynomial verbClass 6 Polynomial
  /METHOD=SSTYPE(3)
  /CRITERIA=ALPHA(.05)
  /WSDESIGN=verbFreq verbClass verbFreq*verbClass
  /DESIGN=englishLevel.
```

Listing E.3: R code for the three-way mixed-design ANOVA

```
for (i in 1:length(levels(data$verbClass_lg))) {
  # extract a subset of the data (for each level of Verb Class)
  temp <- subset(data,
    (verbClass_lg==levels(data$verbClass_lg)[i]))
```

```
  temp <- drop.levels(temp,reorder=FALSE)
  fit <- ezANOVA(data=temp,
    dv=.(gramPrefSum), # DV is Summed Gram Preference scores
    wid=.(subjectID),  # Subject is identified by subjectID
    within=.(verbFreq),# Verb Freq is a within-subject
    between=.(englishLevel) # English Level is a between-subj
  )
  print(fit)
}
```

Listing E.4: SPSS code for the three-way mixed-design ANOVA (Hit-touch verb only)

```
/* Hit-Touch verbs */
GLM hitTouchV_high hitTouchV_mid hitTouchV_low BY \
   englishLevel /WSFACTOR=verbFreq 3 Polynomial
/METHOD=SSTYPE(1)
/CRITERIA=ALPHA(.05)
  /WSDESIGN=verbFreq
  /DESIGN=englishLevel.
```

Listing E.5: R code for the mixed-effect linear model

```
fit = lmer(gramPrefSum~        # Summed Gram Preference is DV
  as.numeric(verbClass_lg)*    # Verb Class as a fixed effect
  as.numeric(verbLogFreq)*     # Verb Freq as a fixed effect
  michigan       # English Lvl as a fixed effect
  +1             # with intercept for the fixed-effects
  +(1|verb)+(1|subjectID),     # Verb and Subj are random
  data=data)
print(pvals.fnc(fit,addPlot=FALSE)) # MCMC estimate
```

Listing E.6: SPSS code for the mixed-effect linear model

```
MIXED grmPrfSm WITH subjctID vrbClss_ michigan verb vrbLgFrq
   /FIXED = INTERCEPT vrbClss_ michigan vrbLgFrq \
      vrbClss_*michigan vrbClss_*vrbLgFrq michigan*vrbLgFrq \
      vrbClss_*michigan*vrbLgFrq | SSTYPE(3)
   /METHOD = ML
   /PRINT = SOLUTION TESTCOV
   /RANDOM = INTERCEPT | SUBJECT(subjctID) COVTYPE(VC)
   /RANDOM = INTERCEPT | SUBJECT(verb) COVTYPE(VC).
```

Listing E.7: R code for the mixed-effect linear model (for each level of Verb Semantic Class)

```r
for (i in 1:length(levels(data$verbClass_lg))) {
  # extract data (for each level of Verb Class)
  temp <- subset(data,
    (verbClass_lg==levels(data$verbClass_lg)[i]))
  temp <- drop.levels(temp,reorder=FALSE)
  fit = lmer(gramPrefSum~    # Summed Gram Preference is DV
    verbLogFreq*             # Verb Freq as a fixed effect
    michigan       # English Lvl as a fixed effect
    +1+            # with intercept for the fixed-effects
    (1|verb)+                # Verb is a random effect
    (1|subjectID),           # Subject is a random effect
    data=temp)
  print(pvals.fnc(fit,addPlot=FALSE)) # MCMC estimate
}
```

Listing E.8: SPSS syntax code for the mixed-effect linear model (for each level of Verb Semantic Class)

```
/* Hit-touch verb */
USE ALL.
COMPUTE filter_$=(vrbClss_ = 1).
VARIABLE LABELS filter_$ 'vrbClss_ = 1 (FILTER)'.
VALUE LABELS filter_$ 0 'Not Selected' 1 'Selected'.
FORMATS filter_$ (f1.0).
FILTER BY filter_$.
EXECUTE.

MIXED grmPrfSm WITH subjctID michigan verb vrbLgFrq
   /FIXED = INTERCEPT michigan vrbLgFrq michigan*vrbLgFrq | \
      SSTYPE(3)
   /METHOD = REML
   /PRINT = SOLUTION TESTCOV
   /RANDOM = INTERCEPT | SUBJECT(subjctID) COVTYPE(VC)
   /RANDOM = INTERCEPT | SUBJECT(verb) COVTYPE(VC).
```

APPENDIX F

MIXED-EFFECT LINEAR MODEL

Pinheiro and Bates (2000) present Formula F.1 as the general model for the mixed-effect linear model.

$$\begin{aligned} \mathbf{y}_i &= \mathbf{X}_i\boldsymbol{\beta} + \mathbf{Z}_i b_i + \epsilon_i \\ \text{or equivalently,} \quad y_{ij} &= \beta_j + b_i + \epsilon_{ij} \end{aligned} \tag{F.1}$$

where i represents the level of each random-effect factor, j represents the level of each fixed-effect factor, $\mathbf{y}_i$ is a vector of outcomes, $\mathbf{X}_i$ is the fixed-effect matrix (also known as *cell means*), $\boldsymbol{\beta}$ is a vector of fixed-effect β, $\mathbf{Z}_i b_i$ (or simply b_i) is a vector of random effects, and ϵ_i is a vector of errors.

For the current analysis, the covariance structure of the random-effect factors is assumed to be independent and, therefore, Variance Component (VC) is used (i.e., $\mathbf{Z}$ is a vector of 1). The full model with all the fixed-effect factors and their interaction terms is shown as Formula F.2 and their $\mathcal{R}$ code and SPSS syntax code are presented in Listings E.5 and E.6.

$$\begin{aligned} y_i \;=\; & \beta_{\text{English Proficiency}_i} + b_{\text{English Proficiency}_i} + \epsilon_{\text{English Proficiency}_i} + \\ & \beta_{\text{Verb Frequency}_i} + b_{\text{Verb Frequency}_i} + \epsilon_{\text{Verb Frequency}_i} + \\ & \beta_{\text{Verb Class}_i} + b_{\text{Verb Class}_i} + \epsilon_{\text{Verb Class}_i} + \\ & \beta_{\text{Proficiency*Frequency}_i} + b_{\text{Proficiency*Frequency}_i} + \epsilon_{\text{Proficiency*Frequency}_i} + \\ & \beta_{\text{Proficiency*Class}_i} + b_{\text{Proficiency*Class}_i} + \epsilon_{\text{Proficiency*Class}_i} + \\ & \beta_{\text{Class*Frequency}_i} + b_{\text{Class*Frequency}_i} + \epsilon_{\text{Class*Frequency}_i} + \\ & \beta_{\text{Prof*Class*Freq}_i} + b_{\text{Prof*Class*Freq}_i} + \epsilon_{\text{Prof*Class*Freq}_i} \end{aligned} \tag{F.2}$$

Since the error terms, ϵ's, are computed as the intercept of the entire model, Formula F.2 can be simplified to Formula F.3.

$$\begin{aligned} y_i \quad = \quad & \beta_{\text{English Proficiency}_i} + b_{\text{English Proficiency}_i} + \\ & \beta_{\text{Verb Frequency}_i} + b_{\text{Verb Frequency}_i} + \\ & \beta_{\text{Verb Class}_i} + b_{\text{Verb Class}_i} + \\ & \beta_{\text{Proficiency*Frequency}_i} + b_{\text{Proficiency*Frequency}_i} + \\ & \beta_{\text{Proficiency*Class}_i} + b_{\text{Proficiency*Class}_i} + \\ & \beta_{\text{Class*Frequency}_i} + b_{\text{Class*Frequency}_i} + \\ & \beta_{\text{Prof*Class*Freq}_i} + b_{\text{Prof*Class*Freq}_i} \\ & \epsilon_{\text{all levels}_i} \end{aligned} \tag{F.3}$$

β in $\beta_{\text{English Proficiency}}$ is similar to a coefficient in a basic linear model except that it is allowed to vary for each level of the random variable. By the same token, b in $b_{\text{English Proficiency}_i}$ is similar to an intercept with the variability for each level of the random effect. Thus, in the traditional linear model terms, $\beta_{\text{English Proficiency}}$ can be translated into $bx_{\text{English Proficiency}} + u_{\text{English Proficiency}}$ (where u is the variability of coefficients around the model) and $b_{\text{English Proficiency}_i}$ is $a_{\text{English Proficiency}} + u_{\text{English Proficiency}}$ (where u is the variability of intercepts, a_i, around the model). Finally, Participant and Verb are entered as the random effects in the current model, so the subscript i represents each level of these two variables.

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