THE CORRESPONDENCE BETWEEN VOWEL QUALITY AND VERBAL TELICITY IN YAMATO-JAPANESE

by

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ABSTRACT

The main goal of this thesis is to report a sound meaning correspondence in Japanese verbs which have thus far not been recognized. In particular, I show that the non-low vowels mark verbal telicity, which defines an inherent endpoint of an eventuality. This correspondence holds in verbs of the native lexical stratum, Yamato-Japanese. I further show that the correspondence is synchronically part of the grammar, by showing that fluent speakers of Japanese are sensitive to the correspondence in nonce verbs. These facts cast doubt on the standard assumption that such verbs are morphologically simplex. Thus, another goal of this thesis is to develop a morphosyntactic analysis for the correspondence associates with the syntactic category for telicity, inner Aspect. Language-internally, this argument implies that seemingly simplex verbs are the result of morpho-syntactic processing. Cross-linguistically, the argument contributes to the understanding that languages differ as to whether inner Aspect has an overt marker. Such differences strongly support the notion that inner Aspect is not only a category in lexical semantics but also a category in syntax.

PREFACE

The experiments reported in Chapter 3 involved human subjects and were approved by the UBC Research Ethics Board in advance (Project Title: Determining Event Structure in Communicative Interaction, Principal Investigator: Eric A. Vatikiotis-Bateson, Certificate Number: H04-80558).

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LIST OF ABBREVIATIONS

ACC	accusative case
ASP	aspect
С	consonant
CAUS	causative
CL	classifier
COMP	complementizer
DAT	dative case
DECAUS	decausative
GEN	genitive case
HON	honorific
NEG	negative
NOM	nominative case
OBJ	object
OP	operator
POL	politeness
PRES	present tense
PST	past tense
Q	interrogative mood
SG	singular
Т	tense
ТОР	topic

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CHAPTER 1

Introduction

1.1. The problem: the non-low vowels correspond to verbal telicity

In this thesis, I am concerned with the correspondence between sound and meaning in Japanese verbs. A monosyllabic verb containing the vowel /e/ or /u/ denotes a verb with an inherent endpoint. For example, in (1), the verb *ket*- 'kick' denotes an event where the action of kicking comes to end when the object *kan* 'can' comes to be kicked. Such verbs are telic.

- (1) Meari-ga kan-o k<u>e</u>t-ta M.-NOM can-ACC kick-PST 'Mary kicked the can.'
- Takashi-ga sakana-o t<u>u</u>t-ta
 T.-NOM fish-ACC pull.up-PST
 'Takashi pulled up the fish.'

By contrast, a monosyllabic verb containing the vowel /i/ or /o/ denotes an event with no inherent endpoint. For example, in (3), the verb *kit*- 'cut' denotes an event such that the action of cutting the object *kami* 'paper' continues. Such verbs are atelic.

- (3) Hanako-ga kami-o k<u>i</u>t-ta M.-NOM paper-ACC cut-PST 'Mary cut the paper.'
- (4) Taro-ga seki-o t<u>o</u>t-ta T.-NOM seat-ACC take-PST 'Taro took the seat.'

The goal of this thesis is three-fold:

- i) to show that Japanese non-low vowels mark verbal telicity (i.e., whether or not the verb denotes an inherent endpoint of an event),
- ii) to show that the correspondence between the non-low vowels and verbal telicity is synchronically part of the grammar, and
- iii) to discuss phonological and morpho-syntactic implications of this correspondence.

1

1.2. Japanese has markers for verbal telicity

Even though in some verbs, vowel quality corresponds to verbal telicity, one might wonder whether this correspondence is strict. This is because the semantic notion of telicity and its relevant notions are compositional and because the sound-meaning correspondence varies across Japanese lexical strata. Therefore, to identify the correspondence in question, we have to carefully control for the compositionality of telicity and the lexical strata of Japanese.

First, I briefly show how verbal telicity interacts with other notions. Verbal telicity is an intrinsic aspectual property of verbs. It interacts with viewpoint aspect, which determines how an event is viewed: one can either consider the event as a whole or else focus on a particular subevent within the event (Smith 1991). Viewpoint aspect often gives rise to seemingly contradictory interpretations of the verb (Kenny 1963). For example, if a telic verb is used in its imperfective form, then the focus is on a sub-event of the telic event. However, this interpretation does not distinguish from an atelic verb in the simple past tense. In both cases, the event does not come to an inherent endpoint, as in (5). I will therefore control for viewpoint aspect and examine verbs in the simple past tense.

- (5) a. Meari-ga kan-o <u>ket-te-i-ta</u> M.-NOM can-ACC kick-and-be-PST 'Mary was kicking the can.'
 - b. Meari-ga kami-o <u>kit-ta</u> M.-NOM paper-ACC cut-PST 'Mary cut the paper.'

Moreover, the notion of telicity itself is compositional. That is, verbal telicity interacts with other components in the predicate such as the direct object and adverbs. This often conceals the telicity inherent to the verb itself. For example, the quantity of the direct object contributes to the telicity of the predicate (Verkuyl 1972, 1993; Krifka 1992, 1998; Tenny 1994; Borer 1994, 2005; Ramchand 2008; among others). When a telic verb co-occurs with a quantized object, the predicate remains telic, as in (6a). In contrast, when the object is non-quantized the predicate becomes atelic, as in (6b).

(6) a. Meari-ga <u>hitotu-no</u> kan-o ket-ta (telic) M.-NOM one.CL-GEN can-ACC kick-PST 'Mary kicked a can.'

> b. Meari-ga kan-o ket-ta (atelic) M.-NOM can-ACC kick-PST 'Mary kicked cans.'

Similarly, certain adjuncts may trigger a repetitive interpretation for the event, which also conceals verbal telicity, as in (7) (cf. Dowty 1979; Lasersohn 1995, 1998; Van Geenhoven 2004).

(7)	a.	Meari-ga MNOM	hitotu-no one.CL-GEN	kan-o can-ACC	ket-ta kick-PST		(telic)
		'Mary kicked	a can.'				
	b.	Meari-ga MNOM	<u>nandomo</u> again.and.agai	hitotu-no n one.CL-0	kan-o GEN can-ACC	ket-ta kick-PST	(atelic)

'Mary kicked a can again and again.'

Throughout the thesis, I will control for the context of the predicate such that verbal telicity is clearly observed. In particular, I focus on transitive structures which yield only a single event reading. Verbal telicity is diagnosed with Japanese-specific tests. For instance, a durative adverb *gohunnoaida* 'for 5 minutes' is compatible with an atelic verb, but not with a telic verb, as in (8). In contrast, a time-span adverb *gohunde* 'in 5 minutes' is compatible with a telic verb, but not with an atelic verb, as in (9).

- (8) a. *Meari-ga <u>gohunnoaida</u> itido hitotu-no kan-o ket-ta
 M.-NOM for.5.min. one.time one.CL-GEN can-ACC kick-PST
 *'Mary kicked a can once for five minutes.'
 - b. Meari-ga **gohunnoaida** itido itimai-no kami-o kit-ta M.-NOM for.5.min. one.time one.CL-GEN can-ACC kick-PST 'Mary cut a piece of paper once for five minutes.'
- a. Meari-ga <u>gohunde</u> itido hitotu-no kan-o ket-ta
 M.-NOM in.5.min. one.time one.CL-GEN can-ACC kick-PST
 'Mary kicked a can once in five minutes.'

b. *Meari-ga **gohunde** itido itimai-no kami-o kit-ta M.-NOM in.5.min. one.time one.CL-GEN can-ACC kick-PST *'Mary cut a piece of paper once in five minutes.'

The empirical domain is constrained by the class partition of the Japanese lexicon. In particular, the Japanese lexicon consists of lexical strata which originate from different languages: the native lexical stratum (Yamato-Japanese), loanwords borrowed from Chinese (Sino-Japanese) and from other languages such as English, German and Portuguese (foreign words). It is within Yamato-Japanese verb stems that vowel quality corresponds to verbal telicity. I will show that the restriction of this phenomenon to Yamato-Japanese is not an accident. In particular, it follows from the way verbs are formed. While in Yamato-Japanese verb stems are inherently verbal, loanword verb stems are derived from nouns. This derivational difference accompanies phonological and morphological properties which are specific to Yamato-Japanese verb stems. These phonological and morphological properties add to classical diagnostics for Yamato-Japanese. The classical diagnostics are based on morpho-phonological properties in nouns and verbs (Martin 1952; McCawley 1968; Harada 1976; Ito and Mester 1995, 1999, 2003; Kubozono 1995; Rosen 2001, 2003). However, the classical diagnostics have exceptions (Takayama 1999; Ito and Mester 2003).

Controlling for the contexts of meanings and sounds, respectively, I will show that the non-low vowels correspond to verbal telicity in existing transitive verbs. Namely, /e, u/ corresponds to a telic interpretation while /i, o/ corresponds to an atelic interpretation. This correspondence is sensitive to the vowel position; it is observed in monosyllabic verbs and at the second vowel of bisyllabic verbs (i.e., at the rightmost vowel). The four non-low vowels /e, u, i, o/ contrast with the low vowel /a/, for which one does not observe any fixed telicity value in existing verbs. This is summarized in (10) and (11).

(10) Monosyllabic transitive verbs

Vowel quality	Verbal telicity	
/e, u/	telic	
/i, o/	atelic	
/a/	telic or atelic	

First vowel	Verbal telicity	Second vowel	Verbal telicity
/e, u/	telic or atelic	/e, u/	telic
/i, o/	telic or atelic	/i, o/	atelic
/a/	telic or atelic	/a/	telic or atelic

(11) Bisyllabic transitive verbs

1.3. The synchronic nature of the correspondence

Once we have identified the correspondence between the non-low vowels and verbal telicity, another question arises: What is the nature of this sound-meaning correspondence? In fact, there are two potential hypotheses: i) the correspondence could be accidental or ii) the correspondence could be part of the grammar. The first hypothesis predicts that Japanese speakers will not be sensitive to the correspondence in nonce verbs. In contrast, the second hypothesis predicts that Japanese speakers will be sensitive to the correspondence even in nonce verbs. The different predictions of the two hypotheses are summarized in (12).

	The correspondence holds in		
The synchronic nature	existing verbs	nonce verbs	
ACCIDENT	Yes	No	
PART OF THE GRAMMAR	Yes	Yes	

(12) Two potential hypothesis for the sound-meaning correspondence

With nonce verbs, I will show that the correspondence between the non-low vowels and verbal telicity is synchronically part of the grammar. Moreover, I will show that the correspondence is also sensitive to the vowel position in nonce verbs such as the vowel of monosyllabic verbs and the second vowel of bisyllabic verbs (i.e., the rightmost vowel). Furthermore, I will show that the low vowel /a/, which does not mark verbal telicity in existing verbs, does correspond to verbal telicity in the rightmost vowel of nonce verbs.

1.4. Implications of the vowel telicity correspondence

Acknowledging that the hitherto unrecognized correspondence between the non-low vowels and verbal telicity is synchronically part of the grammar has implications for phonology and morpho-

syntax. As (13) shows, in phonology, two vowels each encode telicity and atelicity, respectively, although they do not form a natural class in standard distinctive features.



I propose that these two pairs of vowels are classified in how far the tongue is removed from the tongue rest position, in the course of articulation. Namely, $\{/e/, /u/\}$ associated with [+telic] are close to the tongue rest position ([central]) while $\{/i/, /o/\}$ associated with [-telic] are at the edges of the vocal tract ([peripheral]), as shown in (14).

Telicity value	Phonological feature	Actual vowel
[+telic]	[central]	/e/, /u/
[-telic]	[peripheral]	/i/, /o/

(14) The correspondence between verbal telicity and phonological feature

The vowel-telicity correspondence also casts doubt on the assumption that the verbs in question are morphologically simplex. I develop a morpho-syntactic analysis for the correspondence. I adopt Chomsky's generative grammar, in particular, the Principles and Parameters framework and its minimalist incarnations (Chomsky 1981, 1995, 2001). In particular, I assume that:

- i) event structure is represented in syntax (e.g., Travis 1991, 2000; Borer 1994, 2005),
- ii) inner Aspect (inner Asp) is the category responsible for verbal telicity (e.g., Travis 1991, 1994, 2000, 2010).

I argue that in Japanese, the rightmost vowel associates with inner Asp (i.e., one-to-one association of sound with meaning). This is represented in (15). This one-to-one association of

vowel quality and inner Asp implies that seemingly simplex verbs are the result of morphosyntactic processing. As such, Japanese resembles other telicity-marking languages such as Malagasy (Phillips 1996; Travis 2000) and Arabic (Er-Rayyan 1986; Fassi Fehri 1993; Bahloul 1994).



This one-to-one association between vowel quality and inner Asp contrasts with languages which do not mark telicity, such as English and Russian. In these languages, a simplex verb form associates with inner Asp and the verbal root (i.e., one-to-many association of sound with meaning). Therefore, the present analysis has consequences for the typology of sound-meaning correspondences; the difference between telicity-marking languages and non-telicity-marking languages is reduced to the number of meanings which associate with a given sound pattern.

1.5. Organization of the thesis

In Chapter 2, I show that the non-low vowels strictly correspond to verbal telicity in Japanese existing verbs. I first introduce the notion of verbal telicity and show how to find minimal pairs. I also restrict the empirical domain. Then, I demonstrate that in the empirical domain the strict correspondence between the non-low vowels and verbal telicity is observed.

In Chapter 3, I show that fluent speakers of Japanese are sensitive to the correspondence between vowel quality and verbal telicity in nonce verbs. I first explain the design of the experiments which I have conducted. Then, I show the results of the experiments.

In Chapter 4, I develop a phonologycial analysis and a morpho-syntactic analysis for the correspondence between vowel quality and verbal telicity. I further discuss the typology of how inner Aspect is encoded.

In Chapter 5, I conclude the thesis. For future research, I also dicuss more consequences of the present morpho-syntactic analysis.

CHAPTER 2

The correspondence between the non-low vowels and verbal telicity

in Yamato-Japanese verbs

In this chapter, I show that the non-low vowels mark verbal telicity in Yamato-Japanese. In section 2.1, I introduce the notion of telicity and show how verbs contrast with each other according to whether they denote a telic or an atelic eventuality. In section 2.2, I restrict the empirical domain to Yamato-Japanese verbs, the native lexical stratum. In section 2.3, I demonstrate that within the Yamato-Japanese lexical stratum, the non-low vowels have a fixed telicity value.

2.1. The telicity of verbs

In this section, we define verbal telicity and show how to diagnose it.

2.1.1. What is verbal telicity?

Verbs denote actions and states; following Bach (1986), I use the term 'eventuality' as a cover term for actions and states. Eventualities occur at a particular time (this corresponds to tense-marking) and are associated with an internal temporal structure (this corresponds to aspect-marking). Following Smith (1991), two types of aspect-marking are distinguished. While outer aspect (Smith's 'viewpoint aspect') indicates whether the speaker views the eventuality as a whole (perfective) or focuses on a particular sub-event within the eventuality (imperfective); inner aspect (aktionsarten; Smith's 'lexical aspect') indicates whether the eventuality described by a verb has an inherent endpoint. Eventualities that have an inherent endpoint are called telic eventualities while eventualities that have no inherent endpoint are called atelic eventualities. As we shall see, the distinction between telic and atelic eventualities has a special status in the grammar of Japanese.

I briefly illustrate telicity with examples from English, where it is a well-studied phenomenon (Vendler 1967; Verkuyl 1972, 1993; Dowty 1979; Tenny 1987, 1994; van Voorst 1988; Parsons 1990; Moltmann 1991; Pustejovsky 1991; Krifka 1992, 1998; Landman 1992, 2000; Filip 1993, 1996, 2000; Borer 1994, 2005; Ritter and Rosen 1998; Hay et al. 1999;

Higginbotham 2000, 2009; Larson 2001; Zucchi and White 2001; Rothstein 2004; Thompson 2005, 2006; MacDonald 2006, 2008; Ramchand 2008; among many). Consider the telic verb in (16a). The verb *fix* denotes an eventuality where the action of fixing comes to end when the object *a cart* comes to be repaired. In other words, the eventuality of fixing something has an inherent endpoint. Telicity so defined is illustrated in (16b). On the temporal line, a dot represents the inherent endpoint of the eventuality. The eventuality does not continue beyond this point in time.



In (17a), in contrast, the verb *push* denotes an atelic eventuality such that the action of pushing the object (*a cart*) continues. That is, the eventuality of pushing something has no necessary endpoint. The atelicity is illustrated in (17b). There is no dot on the time line. This indicates that there is no inherent endpoint of the eventuality. The eventuality could in principle continue indefinitely.



2.1.2. How to find minimal pairs

To find minimal pairs of verbs which differ in telicity, we need to control for the structural context of the clause. In other words, everything in the clause is the same except for the verb, which differs in telicity. Of particular concern here are two potentially confounding factors: i) the effect of the *direct object* and ii) the possibility to repeat the eventuality (*repetitiveness*). We now briefly show how these potential confounds are controlled for.

The effect of the direct object

In this thesis, we mainly look at transitive predicates which involve direct objects (see Chapter 5 for the telicity of intransitive verbs). It is well known that in some languages the telicity of a verb partly depends on properties of the direct object. This is true for English (Tenny 1994), Scottish Gaelic (Ramchand 1997), Finnish (Kiparsky 1998), German (Kratzer 2004) and Korean (Lee 2007). Examples of English are given in (18). In sentence (a), the Theme receives accusative case and the telic verb is interpreted as such. In contrast, in the sentence in (b) the Theme is introduced by a preposition and the interpretation is atelic. This is known as the conative construction, which merely asserts that there was an attempt to shoot the cow. As a result, the adverb *in an hour* is infelicitous, since it is only compatible with a telic interpretation.

- (18) a. John shot a cow (<u>in an hour</u>).
 - b. John shot \underline{at} a cow (*<u>in an hour</u>). (cf. Tenny 1994: 46 ex.81)

Moreover, to distinguish telic from atelic verbs, I use objects whose number or quantity is specified (quantized). This is because the quantity of objects affects the calculation of phrase-level telicity (cf. Verkuyl 1972; Dowty 1979; van Voorst 1988; Tenny 1994; among many). (See also Chapters 4 and 5 for calculation of telicity.) Objects are quantized with numerals (e.g., 'one', 'two', 'three') and quantifiers (e.g., 'all', 'many', 'some'), as in (19).

- (19) a. John shot <u>two</u> cows.
 - b. John shot <u>many</u> cows.

In contrast, objects are non-quantized with bare plurals or bare nouns (i.e., with no numerals and quantifiers), as in (20).

- (20) a. John shot <u>cows</u>.
 - b. John drank <u>water</u>.

For simplicity, I use singular nouns such as (18a) throughout the thesis, unless otherwise mentioned.

Repetitiveness

The telicity of verbs we have considered thus far involved a single occurrence of the eventuality. There is, however, the possibility for a repetitive interpretation of the eventuality. That is, if the number of occurrences is not overtly specified by an adverb, the verb phrase is compatible with either a single occurrence reading or a repetitive reading, as shown in (21) (Binnick 1969; Dowty 1979: 82; Lasersohn 1995, 1998; Van Geenhoven 2004).

- (21) John fixed a cart.
 - i) John fixed a cart <u>once</u> (a single occurrence).
 - ii) John fixed a cart <u>repeatedly</u>.

With the repetitive reading, the repeated eventuality has no endpoint, even though the single eventuality has an inherent endpoint. The repetitive telic eventuality is compatible with a durative adverb 'for an hour' which is meant to test the atelicity of verbs.

(22) John fixed a cart repeatedly for an hour.

Thus, repetitiveness needs to be controlled for. In this thesis I am only concerned with the single occurrence reading.

2.1.3. How to diagnose telicity

The telicity of verbs is diagnosed with language-specific tests. In this subsection, I introduce the telicity tests that work for English.

We first look at the telicity test which involves a time span adverb such as 'in x time' (cf. Dowty 1979). A time-span adverb locates the entire eventuality within the time-span denoted by the adverb. In particular, the endpoint of the telic eventuality corresponds to the temporal endpoint denoted by the time-span adverb, as illustrated in (23).



Thus, telic verbs are compatible with a time-span adverb, as illustrated in (24).

(24) John fixed a cup <u>in an hour</u>.

In contrast, atelic verbs denote an eventuality without an inherent endpoint. Consequently, an atelic eventuality cannot be located within the time-span denoted by the adverb, as illustrated in (25).



Thus, atelic verbs are NOT compatible with a time-span adverb, as shown in (26). '*' marks ungrammaticality throughout this thesis.

(26) *John **push**ed a cart <u>in an hour</u>.

Note that although (26) sounds odd, the sentence is still acceptable to some speakers (Binnick 1969; Dowty 1979: 56, 334). The sentence is interpreted as 'it took John an hour to start pushing a cart'. On this inceptive reading, the transitive verb denotes the eventuality initiated by the causer *John* (see also Chapters 3 and 4 for relevant discussion). The transitive verb implies (but does not assert) that there is a preceding eventuality before the initial point (I refer to this as the 'precondition'). Furthermore, it implies that this precondition reaches its endpoint when the eventuality in question starts. Thus, the endpoint of the precondition is compatible with the time-span adverb, as illustrated in (27). I avoid the above interpretation, as the time-span adverb does not target the endpoint of the eventuality denoted by the verb in question.



We have now established the diagnostic criteria for telic verbs. Next we turn to those tests that diagnose atelic verbs: i) durative adverbs, ii) punctual adverbs, and iii) past entailments in the progressive aspect. We consider each in turn.

Durative adverbs such as 'for an hour' are only compatible with atelic predicates (cf. Dowty 1979). This is because durative adverbs denote an interval t which itself consists of a set of subintervals (t'). As such, durative adverbs are sensitive to the relation between the eventuality e and its sub-events (cf. Krifka 1989, 1992, 1998). With the atelic verb *push*, the sentence *John pushed a cart* is true at any sub-event e' of the eventuality e. This amounts to saying that with an atelic verb, a sub-event e' is homogeneous to the entire eventuality e. Thus, the atelic verb is felicitous with a durative adverb. This is shown in (28).

(28) John pushed a cart for an hour.



In contrast, with the telic verb *fix*, the sentence *John fixed a cup* is true only at the endpoint of the eventuality. This amounts to saying that with a telic verb, a sub-event *e'* is heterogeneous to the entire eventuality *e*. Thus, the telic verb is infelicitous with a durative adverb, as shown in (30).

(30) *John fixed a cup for an hour.



The second diagnostic for atelicity involves punctual adverbs such as 'at x time' (cf. Dowty 1979). A punctual adverb picks out a particular point in time that occurs during the course of the eventuality. Which point of this eventuality is targeted by the adverb depends on the telicity of the verb and therefore serves as a diagnostic for telicity. With the atelic verb *push*, a sub-event e' is homogeneous to the entire eventuality e and the sentence *John pushed a cart* is true at any sub-event e' of the entire eventuality e. Thus, the temporal point denoted by the punctual adverb at 5 p.m. can in principle correspond to any sub-event e', and the eventuality

continues after the temporal point (cf. Bar-el 2005; Bar-el, Davis and Matthewson 2005). This is exemplified in (32).

(32) John pushed a cart at 5 p.m. and in fact, he is still pushing a cart.



In contrast, with the telic verb fix, a sub-event e' is heterogeneous to the entire eventuality e and the sentence *John fixed a cart* is true only at the endpoint, but not at any other point in time of the eventuality. Hence, the point in time denoted by the punctual adverb necessarily picks out the endpoint of the eventuality only. Thus, the eventuality is non-cancellable and it does not continue after the point in time denoted by the punctual adverb. This is exemplified in (34).

(34) *John fixed a cart at 5 p.m. and in fact, he is still fixing a cart.

(35)



The third diagnostic for atelicity is whether or not there is a past entailment in the progressive aspect (Kenny 1963). This test is also known as the *imperfective paradox*. A verb in the progressive form picks out a sub-event e' of the eventuality e. With the atelic verb *push*, the sentence *John pushed a cart* is true at any sub-event e' of the eventuality e. Thus, in the context of the present progressive in English, the atelic verb *push* gives rise to a past entailment (*John has pushed a cart*), as shown in (36).

(36) John is pushing a cart.
 → John (has) pushed a cart.



In contrast, with a telic verb, a sub-event *e*' of the eventuality *e* is true only at the endpoint of the eventuality. Thus, in the context of the present progressive, the telic verb *fix* does not give rise to a past entailment. That is, *John is fixing a cart* does not imply *John has fixed a cart*. This is illustrated in (38).



In this subsection, we have discussed four diagnostics for the (a)telicity of verbs. Telic verbs are felicitous with time-span adverbs but they are infelicitous with durative adverbs and punctual adverbs. Moreover, telic verbs do not give rise to a past entailment in the progressive aspect. In contrast, atelic verbs are infelicitous with time-span adverbs but they are felicitous with durative adverbs and with punctual adverbs. Finally, atelic verbs give rise to a past entailment in the progressive aspect. The diagnostics are summarized in (40).

(40)

Diagnostic tests in English	telic verbs	atelic verbs
Telicity test		
i) felicitous with time-span adverb	YES	NO
Atelicity tests		
ii) felicitous with durative adverb	NO	YES
iii) felicitous with punctual adverb	NO	YES
iv) past entailment in the progressive	l NO	YES

2.1.4. Diagnosing telicity in Japanese

In this subsection, I first show how to control for two potential confounds: i) the contribution of the direct object, and ii) the possibility of repeating the event (*repetitiveness*). I then show that the four diagnostics we have discussed for English also diagnose telicity in Japanese.

2.1.4.1. Controlling for two potential confounds

As mentioned in section 2.1.2, the contribution of the verb towards the telicity of the entire verb phrase can be determined by keeping the direct object constant. In Japanese, accusative case on the direct object is marked by the suffix -o, as in (41a). In this case, a telic interpretation arises, as evidenced by the possibility for a time span adverb. If, on the other hand, the object is not *o*-marked, as in (41b), the verb phrase is not interpreted as telic, as evidenced by the impossibility of the time span adverb. Note that the verb phrase is atelic in this case even if the verb itself is otherwise telic.

(41)	a.	John-ga	(gohunde)	ittoo-no	kuma <u>-o</u>	ut-ta
		JNOM	in.five.minute	one.CL-GEN	bear-ACC	shoot-PST
		'John shot one	bear in five mi	inutes.'		
	b.	John-ga JNOM	(*gohunde) in.five.minute	ittoo-no one.CL-GEN	kuma <u>-ni</u> bear-DAT	ut-ta shoot-PST
		*'John shot at	one bear in five	e minutes.'		

To control for the contribution of the object I use verb phrases containing an *o*-marked object throughout.

The contribution of the verb towards the telicity of the entire verb phrase also becomes apparent by keeping the direct object quantized, as shown in (42).

(42)	a.	John-ga JNOM 'John shot one	(gohunde) five.minute-at bear in five mi	ittoo-no one.CL-GEN inutes.'	kuma-o bear-ACC	ut-ta shoot-PST
	b.	John-ga JNOM *'John pushed	(*gohunde) five.minute-at one bear in fiv	ittoo-no one.CL-GEN e minutes.'	kuma-o bear-ACC	osi-ta push-PST

The quantity of the direct object is optionally realized with overt classifiers, as shown in (43) (cf. Watanabe 2008).

(43) (it-tou-no) kuma one-CL.head-GEN bear 'one bear'

An object without an overt classifier (i.e., a bare noun) gives rise to ambiguity: the noun denotes either a quantized entity or a non-quantized entity, as shown in (44).¹

(44) kuma 'bear' i) 'a bear' ii) 'bears'

Therefore, with a telic verb, the non-quantized reading of the bare noun can give rise to an atelic interpretation, as shown in (45).

(45)	John-ga	(gohunde)	kuma-o	ut-ta		
	JNOM	in.five.minute	bear-ACC	hit-PST		
i) 'John shot a bear in five minutes.'						
ii) *'John shot bears (one after another) in five minutes.'						

To avoid the ambiguity in quantity, I consistently use quantized objects throughout the thesis.

The second potential confound in determining the telicity of the predicate is the potential for *repetitiveness*. Thus, in investigating the contribution of the verb towards the telicity of the entire verb phrase, we need to control for repetitiveness. If the number of occurrences of the eventuality is not overtly specified by an adverb, the verb phrase may have a single occurrence reading or a repetitive reading.

(46)	Hirosi-wa	hitotu-no	booru-o	ket-ta		
	HTOP	one.CL-GEN	ball-ACC	kick-PST		
	= 'Hiroshi kicked one ball once.'					
	= 'Hiroshi k					

¹ Strictly speaking, a noun without an overt classifier can denote a countable object but its specific value is undetermined (general number) (see also Krifka 1995; Cheng and Sybesma 1998; Corbett 2000; Rullmann and You 2006; Chierchia 2010; among others).

To rule out the repetitive reading I therefore use the frequentative adverb *itido* 'once/one time', which unambiguously yields the single occurrence reading, as shown in (47).

(47) Hiroshi-wa <u>itido</u> hitotu-no booru-o ket-ta H.-TOP once 1.CL-GEN ball-ACC kick-PST 'Hiroshi kicked one ball once.'

2.1.4.2. Testing telicity in Japanese

In this subsection, I show that the four diagnostics we have discussed in section 2.1.3 also apply to Japanese. Some of the tests are discussed in the many studies on verbal aspect in Japanese, dating back to Kindaichi (1950) (see also Fujii 1966; Suzuki 1976; Takahashi 1976; Yoshikawa 1976; Okuda 1977; Okutsu 1978; Ando 1982; Moriyama 1988; Kudo 1995; McClure 1996; Kitahara 1998; Ogihara 1998; Shirai 1998, 2000; Mihara 2004; Urushibara 2005; Kiyota 2007; Nishiyama 2006; Tanaka 2008; among others).

Test 1: Time span adverbs

With the use of time-span adverbs we can uniquely identify telic verbs (Ando 1982; Kageyama and Yumoto 1997; Kitahara 1998; Ueno and Kageyama 2001; Mihara 2004; among many). In (48), the time span adverbial *gohunde* 'in five minutes' is felicitous with the telic verb *naosi*-'fix', but not with the atelic verb *osi*- 'push'.

(48)	a.	Taro-ga	(gohunde)	itido	itidai-no	kaato-o	<u>naosi</u> -ta
		TNOM	in.five.min	once	one.CL-GEN	cart-ACC	fix-PST
		'Taro fixe	ed one cart or	nce (in	five minutes).'		
	b.	Taro-ga	(*gohunde)	itido	itidai-no	kaato-o	<u>osi</u> -ta
		TNOM	in.five.min	once	one.CL-GEN	cart-ACC	push-PST
		'Taro pus	shed one cart	once ('	*in five minute	s).'	-

Test 2: Durative adverbs

With the use of durative adverbs, we can identify atelic verbs (Ando 1982; Kageyama and Yumoto 1997; Kitahara 1998; Ueno and Kageyama 2001; Mihara 2004; among many). Atelic verbs, but not telic verbs, are felicitous with the durative adverbial *gohunnoaida* 'for five minutes'.

- (49) a. Taro-ga (**gohunnoaida**) itido itidai-no kaato-o <u>osi</u>-ta T.-NOM for.five.minute once one.CL-GEN cart-ACC push-PST 'Taro pushed one cart once (for five minutes).'
 - b. Taro-ga (*gohunnoaida) itido itidai-no kaato-o <u>naosi</u>-ta T.-NOM for.five.minute once one.CL-GEN cart-ACC fix-PST 'Taro fixed one cart once (*for five minutes).'

Test 3: Punctual adverbs

The use of punctual adverbs such as 'at x time' identifies atelic verbs. Unlike the other tests for (a)telicity introduced above, punctual adverbs have not been used as a diagnostic for telicity in Japanese. In an atelic eventuality, the punctual adverbial *gozi-ni* 'at five (o'clock)' can pick out any point in the event, not just the endpoint. Thus, the eventuality can continue after the point in time denoted by the adverbial. This continuation is exemplified in the following example. In the first sentence of (50), the atelic verb occurs with the punctual adverbial. This sentence can be continued with an assertion that the same event continues even after the specified time.

(50)	Hanako-wa	gozi-ni	itidai-no	kuruma-o	<u>osi</u> -ta	
	HTOP	five.o'clock-at	one.CL-GEN	car-ACC	push-PST	
	'Hanako pushed one car at five (sharp).'					

zissai Hanako-wa gozi-gohun-ni mada so-no kuruma-o <u>osi</u>-teita in.fact H.-TOP five.o'clock-five.min-at still that-GEN car-ACC push-teita 'in fact, Hanako was still pushing that car at five after five (as a continuity of the single eventuality).'

In contrast, if the verb is telic, the punctual adverbial picks out the endpoint of the eventuality. Consequently, the eventuality cannot continue after the point in time specified by the punctual adverb. That the eventuality is interpreted as ending can be seen in (51). In the first sentence, the telic verb is modified by the punctual adverb. Since the punctual adverb picks out the endpoint of the eventuality, it is implied that the eventuality does not continue. Consequently, the utterance cannot be continued by asserting that the eventuality did in fact continue.

(51) Hanako-wa gozi-tyoodo-ni hitotu-no ringo-o <u>tabe</u>-ta apple-ACC eat-PST 'Hanako ate one apple at five sharp.'
= 'Hanako finished eating one apple at five sharp.'

*zissai Hanako-wa gozi-gohun-ni mada so-no ringo-o <u>tabe</u>-teita in.fact H.-TOP five.o'clock-five.minute-at still that-GEN apple-ACC eat-teita *'in fact, Hanako was still eating that apple at five after five.'

Test 4: The imperfective paradox

A verb in its progressive form entails that the eventuality took place in the past. But this is true only if the verb is atelic. No such entailment arises in the context of a telic verb. In Japanese the progressive aspect is formed by suffixing *-te-i-ru* to the verb root, as in (52).

(52) osi-te-i-ru push-OP-be-PRES '(he) is pushing (something).'

Note that the progressive form *-te-i-ru* is morphologically complex. In particular, Nishiyama (2006) argues that *-te* is an imperfective operator which picks out a sub-event of the eventuality denoted by the verb, while *-i-ru* is analyzable as a stative verb which takes as its argument the sub-event derived by *-te*. Thus, the verb in the progressive yields an on-going process reading. I follow Nishiyama and take the progressive form as a telicity test. An atelic verb in the progressive entails that the eventuality took place in the past, as exemplified in (53).

(53) Hanako-ga ima itido itidai-no kaato-o [osi-te-i]-ru H.-NOM now once one.CL-GEN cart-ACC push-OP-be-PRES 'Hanako is now pushing one cart once.'
→ 'Hanako has pushed one cart once.'

In contrast, a telic verb in the progressive does not give rise to a past entailment, as illustrated in (54).

(54) Hanako-ga ima itido itidai-no kaato-o [<u>naosi</u>-te-i]-ru
 H.-NOM now once one.CL-GEN cart-ACC fix-OP-be-PRES
 'Hanako is now fixing one cart once.'
 → 'Hanako has fixed one cart once.'

We have now established that the four diagnostics for (a)telicity – namely time span, durativity, punctuality, and past entailment – are also applicable to Japanese. This is summarized in (55).

(55)		Diagnostic tests in Japanese	Telic verbs	Atelic verbs
		Telicity tests		
	i)	felicitous with time-span adverb	YES	NO
		Atelicity tests		
	ii)	felicitous with durative adverb	NO	YES
	iii)	felicitous with punctual adverb	NO	YES
	iv)	past entailment in the progressive	NO	YES

2.2. Restricting the empirical domain

The main goal of this thesis is to show that there is a correspondence between the quality of the vowel and the telicity of the verb this vowel occurs in. This correspondence, however, holds only across one of the lexical strata found in Japanese, namely, the Yamato-Japanese lexical stratum. In this section I show that the lexical strata of Japanese, which in addition to the Yamato-Japanese stratum also include a Sino-Japanese stratum and a more recent loanword stratum, differ in several respects. In particular, Yamato-Japanese verb stems are inherently verbal, while all loanword verb stems are derived from nouns. I show that the derivational difference of verb stems between Yamato-Japanese and loanwords has consequences for their phonology and for their morphology.

2.2.1. Restricting the lexical strata

The history of lexical strata in Japanese is summarized in Shibatani (1990). Of the lexical strata, Yamato-Japanese is the native stratum of Japanese. In contrast, the Sino-Japanese stratum contains loan words from Chinese. Sino-Japanese words date back to about 400 CE. Those words were borrowed with the introduction of elements of Chinese culture and economy. Another major flow of Sino-Japanese words came after the Meiji Restoration (1867). To assist in adopting Western culture, people invented new words by combining existing Sino-Japanese words. Yamato-Japanese words thus are considered "the modern descendants of morphemes that were part of the Japanese vocabulary before heavy borrowing from Chinese occurred" (Vance 1987: 2). In addition to loan words from Chinese, Japanese has another set of loan words: 'foreign words'. These are defined as relatively new loan words mainly from Western languages

(Shibatani 1990). The first contact with the Western world was in the sixteenth century, when words were borrowed from Portuguese, Spanish, and Dutch. In the second half of the nineteenth century, words were borrowed from English and French, due to these languages' dominance in technology and the economy. More precisely, foreign words contain loan words from languages other than Chinese, i.e., the source languages include not only Western languages but also Asian languages such as Korean and Vietnamese (e.g. kimuchi 'kimchi' and fo 'pho') (cf. Komatsu 2001). Thus, both foreign words and Sino-Japanese words are types of loan words, which constitute separate strata that contrast with native Yamato-Japanese words. In addition to these three strata, McCawley (1968), Shibatani (1990) and Ito and Mester (1995) identify another stratum, namely, that of onomatopoeia. This stratum consists of conventionalized mimetic expressions of natural sounds and motions (see also chapter 4). Onomatopoeic adverbs are frequently used in Japanese, denoting the manner of motion (Hirose 1981; Hamano 1986, 1998; Tamori and Scoulap 1999). Onomatopoeic expressions and Yamato-Japanese words have long been developed in the history of Japanese. Thus, I assume that onomatopoeic expressions are part of native words (see also Chater 5 for the relation of Yamato-Japanese and Onomatopoeia). We have now identified four distinct lexical strata of Japanese, as summarized in (56).

(56)



2.2.2. How to diagnose Yamato-Japanese verb stems

Yamato-Japanese verb stems differ from loanword verb stems in the way they are formed. We begin with loanword verb stems for explanatory purposes. All loanword verb stems are derived from nouns. There are two types of derived verbs. The first type derives verbs from nouns by suffixing the Yamato-Japanese light verb *-su* 'do', as shown in (57a) (Grimshaw and Mester 1988; Uchida and Nakayama 1993; Miyamoto 1999; Poser 2002)². The other type derives verbs from nouns by suffixing the verbalizer *-r*, as shown in (57b) (Sato 1975, 1985; Tsujimura and Davis 2008).

(57) a.
$$[stem [N ...(C)V] - su]$$
- (Loanword verb stems)
b. $[stem [N ...(C)V(C)V] - r]$ -

In contrast, Yamato-Japanese verb stems are inherently verbal and they cannot be decomposed into verbalizers and nouns, as schematized in (58).

In what follows I show that the differences between Yamato-Japanese and loanword verb stems manifest themselves both morphologically and phonologically. In particular, we can identify the following differences: i) prosodic differences (number of syllables), ii) melodic differences (the type of the right most consonant) and iii) differences in the patterns of nominalization. Since these are all categorial differences between Yamato-Japanese and loanword verb stems, we can use them as diagnostics to identify Yamato-Japanese verb stems in the first place. To the best of my knowledge, these diagnostics have not been fully discussed before.

2.2.2.1. Prosodic properties: the number of syllables

Yamato-Japanese verb stems differ from loanword verb stems in the number of syllables. Yamato-Japanese verb stems can be monosyllabic, bisyllabic, trisyllabic, or quadrisyllabic (cf. Kubozono 1995). Thus, as (59) shows, there is no restriction on the number of syllabus for a well-formed Yamato-Japanese verb stem.

 $^{^{2}}$ How the noun is attached to the light verb is controversial: the noun might be incorporated (Grimshaw and Mester 1988), it might be an adjunct to the verb, or it might be an argument of the light verb (cf. Poser 2002).

(59) Yamato-Japanese verb stems

Monosyllabic	Bisyllabic	Trisyllabic	<u>Quadrisyllabic</u>
tor-	nobor-	nagamer-	sakanobor-
'take'	'clime'	'view'	'track back'

This contrasts with loanword verb stems. Since all loanword verb stems are derived, there cannot be any monosyllabic loanword verb stems. They minimally consist of a monosyllabic noun and the light verb -su, as shown in (60).

(60) [stem [N ...CV]-su]

Monosyllabic	Bisyllabic	<u>Trisyllabic</u>	Quadrisyllabic
n/a	ka-su-	kakin-su-	zyogingu-su-
	charge-do-	charge.money-do-	jogging-do-
	'charge'	'charge money'	ʻjog'

Loanword verb stems with the verbalizer -r do not allow for monosyllabic forms, either. The verb stems with -r often take a truncated noun, as shown in (61).

(61)		Original form	Truncated form	Verb form	<u>Gloss</u>
	a.	sabotaazyu	sabo	sabo-r-	ʻplay hooky'
	b.	sutaabakkusu	sutaba	sutaba-r-	'Starbucks'
	C.	guuguru	gugu	gugu-r-	'Google'
	d.	makudonarudo	makku	maku-r-	'McDonald'

However, the noun contained in the verb stem cannot be monosyllabic (Ito 1990), as in (62).

(62)	*kyou	<u>su-r</u> -(u)-no?
	today	Starbucks-V-NONPST
	intended 'Are you going to Starbucks?'	

Such verb stems are larger than a syllable and they do not allow for monosyllabic forms.
(63) [stem [N ...CVCV]-r]

Monosyllabic	Bisyllabic	Trisyllabic	Quadrisyllabic
n/a	sabo-r-	sutaba-r-	mizerabu-r-
	sabotage-V-	Starbacks-V-	Les Miserables-V-
	ʻplay hookyʻ	'go to Starbacks'	'confort oneself'

In conclusion, Yamato-Japanese verb stems differ from loanword verb stems in that only the former but not the latter may be monosyllabic. This is a byproduct of the fact that all loanword verb stems are derived. This leaves us with the question as to how to distinguish between Yamato-Japanese verb stems and loanword verb stems in the bisyllabic (or larger) form. In the following few subsections, I show that Yamato-Japanese verb stems and loanword verb stems

2.2.2.2. Moraicity of the rightmost syllable

As seen above, loanword verb stems are derived by suffixing either the light verb -su or the verbalizer -r. These two types of loanword verb stems are also characterized by the moraicity of the rightmost syllable. In loanword verb stems ending with the light verb -su, the rightmost syllable is monomoraic, as in (64). In the verb stems ending with the verbalizer -r, the rightmost syllable is bimoraic.

(64) Moraicity of the rightmost syllable in loanword verb stems

Monomoraic form:	CV.su	([stem $\dots_{\sigma}[\mu]$])
Bimoraic form:	CV.CVr	([stem, $[\mu \mu]$])

Of these two types of loanword verb stems, the loanword verb stems with -su are more productive than those with -r. Any loanword nouns are compatible with -su, as in (65).

- (65) Loanword verb stems with -su
 - a. makudonarudo-su-McDonald-do-
 - b. sutaabakkusu-su-Starbucks-do-

c. mizeraburu-su-Les Miserable-do-

In contrast, many loan words cannot be verbalized with the suffix -r, as shown in (66).

- (66) <u>Loanword verb stems with -r</u>
 - a. *makudonarudo-r-McDonald-V-
 - b. *sutaabakkusu-r-Starbucks-V-
 - c. *kakin-rcharging-Vintended 'charge money'
 - d. *insatu-rcopying-Vintended 'copy'

Here the question arises as to whither the productivity of verb stems is attributed to the moraicity of the loanword verb stems or to the verbalizers. Yamato-Japanese verb stems indicate that the productivity of loanword verb stems is attributed to the verbalizers. Yamato-Japanese verb stems also have monomoraic and bimoraic forms, as schematized in (67).

(67) <u>Yamato-Japanese verb stems</u>

Monomoraic form	n: CV. <u>C</u> V	([stem $\dots_{\sigma}[\mu]$])
Bimoraic form:	CV.CV <u>C</u>	([stem $\dots_{\sigma} [\mu \mu]$)

However, Yamato-Japanese verb stems differ from the loanword verb stems in type frequency of the rightmost syllable. 156 bisyllabic transitive Yamato-Japanese verb stems are either monomoraic or bimoraic in the second syllable. However, Yamato-Japanese verb stems differ from loanword verb stems in the distribution of moraicity. 77% of the bisyllabic Yamato-Japanese verb stems are bimoraic (see also Appendix A for lists of the verbs). This is summarized in (68).

	Monomoraic form (n=36) 23%		Bimoraic form (n=120) 77%	
Syllable type	V	CV	VC	CVC
Number of verb stems	25	11	5	115
Example	ki.i- 'listen'	mu.si- 'steam'	se.ow- 'shoulder'	o.kur- 'send'

(68) Moraicity of the second syllable in bisyllabic transitive Yamato-Japanese verb stems (n=156)

This dominance of bimoraicity over monomoraicity also holds in monosyllabic transitive verb stems. Out of 54 monosyllabic transitive Yamato-Japanese verb stems, 89% are bimoraic. This is summarized in (69).³

(69)	Moraicity in monosyllab	ic transitive Yamato-Japanese verb stems (n=	=54)
()			- /

	Monomoraic (n=6) 11%		Bimoraic (n=48) 89%	
Syllable type	V	CV	VC	CVC
Number of verb stems	1	5	7	41
Example	e- 'get'	ki- 'wear'	ir- 'fry'	kir- 'cut'

2.2.2.3. Melodic properties of the rightmost syllable

Yamato-Japanese verb stems and loanword verb stems also differ in melodic properties of the rightmost consonant. As seen above, loanword verb stems are derived by suffixing either the light verb *-su* or the verbalizer *-r*. In such loanword verb stems the consonant contained within the verbalizing suffixes is the only option for the melody of the rightmost consonant, as shown in (70). In the verb stems with the light verb *-su*, the rightmost consonant is the onset of the second syllable, namely, /s/. In the verb stems with the verbalizer *-r*, the rightmost consonant is the coda of the second syllable, namely, /r/.

³ This type frequency correlates with the sensitivity to the vowel telicity correspondence in nonce verbs (see Chapter 3).

(70) Loanword verb stems

Monomoraic form:	CV. <u>s</u> u	([stem $\dots_{\sigma} [\mu]$])
Bimoraic form:	CV.CV <u>r</u>	([stem $_{\sigma}$ [$\mu \mu$]])

In contrast to loanword verb stems Yamato-Japanese verb stems vary in the type of the rightmost consonant. As (71) shows, the rightmost consonant is either /b/, /m/, /w/, /t/, /s/, /z/, /r/, or /k/. This variation in possible consonants contrasts with the fact that /s/ and /r/ are the only options in the rightmost consonant of the loanword verb stems.

	Rightmost consonant	Yamato-Japanese verb stem	Loanword verb stem
a.	/b/	a <u>b</u> i- 'bathe'	n/a
		mana <u>b</u> - 'learn'	
b.	/m/	niko <u>m</u> - 'stew'	n/a
c.	/w/	kako <u>w</u> - 'gage'	n/a
d.	/t/	tamo <u>t</u> - 'maintain'	n/a
e.	/s/	ka <u>s</u> - 'lend'	ka- <u>s</u> - 'charge'
f.	/z/	hazi- 'shame'	n/a
g.	/r/	ka <u>r</u> i- 'borrow'	
		meku <u>r</u> - 'leaf'	maku- <u>r</u> - 'go to McDonald'
h.	/k/	sak- 'tear'	n/a

(71) The type of rightmost consonants in Yamato-Japanese and loanword verb stems

2.2.2.4. Nominalization

The last property which distinguishes Yamato-Japanese verb stems from loanword verb stems is the patterns of nominalizations. Loanword verb stems are derived by suffixing the verbalizer *-su* or *-r*. Thus, the root itself (without the verbalizing suffix) functions as noun. Such nominal expressions are inflected for case, as shown in (72) and (73).

(72) Verb stem: *kan-zi-* 'feel'

kan-ga taisetu-da feeling-NOM important-COP 'feeling is important.' (73) Verb stem: *sutaba-r-* 'go to a Starbucks'

watasi-wa <u>sutaba</u>-ga suki 1sg-TOP Starbucks-NOM like.NONPAST 'I like Starbucks.'

In contrast, the Yamato-Japanese verb stems cannot be nominalized by subtracting the last consonant. In the monomoraic and the bimoraic Yamato-Japanese verb stems, the residue after subtracting the last consonant is ill-formed and it cannot be inflected for case.

(74) Verb stem: *kas*- 'lend'

*<u>ka</u>-ga hituyou-da lend-NOM necessary-COP intended 'lending is necessary.'

(75) Verb stem: *idom-* 'challenge'

*<u>ido</u>-ga hituyou-da challenge-NOM necessary-COP intended 'challenge is necessary.'

Well-formed nouns are derived from the Yamato-Japanese verb stems by suffixing the nominalizing vowel /i/. As shown in (76) and (77), the verb stem with /i/ can be inflected for case.

(76) Verb stem: *kas*- 'lend'

kas-i-ga hituyou-da lend-N-NOM necessary-COP 'lending is necessary.'

(77) Verb stem: *idom-* 'challenge'

*<u>idom-i</u>-ga hituyou-da challenge-N-NOM necessary-COP 'challenge is necessary.'

2.2.2.5. Classic diagnostics for Yamato-Japanese expressions

The diagnostics for Yamato-Japanese verb stems that we have seen above are consequences of the fact that loanword verb stems are derived from nouns. In fact this difference is the most reliable diagnostic to distinguish between the two types of verb stems. In what follows I discuss those diagnostics that are traditionally used: i) sequential voicing in compounds (*Rendaku*) and ii) modification by an honorific prefix *o*-. I show that these are not fully reliable diagnostics.

2.2.2.5.1. Rendaku

Rendaku is the process of sequential voicing by which the initial voiceless obstruent of the second part in a compound is voiced (Martin 1952; McCawley 1968; Ito and Mester 1995, 1999, 2003; Kubozono 1995; Rose 2001, 2003). Examples of Rendaku are shown in (78).

(78)	a.	$\frac{\text{independent noun}}{\text{ma } + \underline{k}\text{okoro}} \rightarrow \text{true} \text{heart}$	<u>compound</u> ma-gokoro 'naked heart'	(Yamato-Japanese)
	b.	ko + <u>k</u> ir-u → small cut-NONPAST	ko-gir-u 'cut into pieces'	

In the context of an endocentric compound, the first part (X) modifies the head (Y), which can be a verb or a noun. In such compounds, voicing functions as a 'linking morpheme' (Ito and Mester 2003).



Crucially, any noun or verb which functions as the head of a compound will undergo *Rendaku*. This is often found in coinages, as shown in (80) (e.g. Takayama 1999).

(80)	Independent	t nouns	Compound		
	zidousya +	<u>k</u> aisya →	zidousya-gaisya	(Sino-Japanese)	
	car	company	'car company'		

2.2.2.5.2. Honorific o-

The honorific prefix *o*- typically modifies a Yamato-Japanese noun (cf. Harada 1976; Hasegawa 2005), as in (81).



As (82) shows, again, this morphological processing applies not only to Yamato-Japanese nouns but also to loanwords.

(82)	a.	[N o- [N benkyou]] HON-study	(Sino-Japanese)
	b.	[N o- [N kagen]] HON-adjustment	(Sino-Japanese)

To sum up, Yamato-Japanese verb stems and loanword verb stems differ in derivation. Yamato-Japanese verb stems are inherently verbal while loanword verb stems are derived from nouns.⁴ This derivational difference of verb stems gives rise to the four properties specific to Yamato-Japanese verb stems: (i) monosyllabicity, (ii) variation of the rightmost consonant, (iii) type frequency in bimoraicity and (iv) nominalization. These four properties are in turn used as the diagnostics for Yamato-Japanese verb stems. These are summarized in (83). We also showed that the classic diagnostics such as *Rendaku* and modification by honorific *o*- are not sufficient conditions to identify Yamato-Japanese verb stems.

⁴ The absence of encoding telicity in loanword verb stems follows from the inherent nounhood of the loanwords (see section 2.3.3).

(83) Diagnostics for Yamato-Japanese verb stems

		Y-J verb stems	Loanword verb stems
Prosody	1. [stem σ]	YES	NO
	2. [$_{stem} \sigma 1 \sigma 2$]	YES	YES
	2'. $\sigma 2[\mu] < \sigma 2[\mu\mu]$	YES	NO
Melody	2". [stemCx (V)]	YES	NO
Nominalization	3. truncation	NO	YES
Modification	4. $[_{Y} [_{X}] [_{Y} C]]$ [+voice]	YES	YES
	5. [_Y [_X o-] [_Y C]] HON-	YES	YES

2.2.3. Restricting the domain to verbs in the past tense form

There is one more empirical restriction necessary to unveil the correspondence between vowels and verbal telicity in Japanese. We have to investigate Yamato-Japanese verbs in their past tense form. This restriction is necessary because part of the verb stems – including the quality of the vowel – changes with inflection. Only verb stems in the past contain the same vowel as verb stems in the progressive (McCawley 1968; Maeda 1979; Tabata 1983; Yoshida 1983; Poser 1986; Davis and Tsujimura 1991; among others). Given that progressive forms are used as one of the diagnostics for atelicity, we would not be able to identify the correspondence between verbal telicity and a particular sound pattern without using verb stems identical to those in the progressive. In this subsection, I demonstrate that verb stems in the past but not verb stems in the progressive.

As mentioned before, in the present tense, verb stems are suffixed by -(r)u. In the past tense, verb stems are suffixed by -ta. In the progressive aspect, verb stems also change and are suffixed by -te-*i*-*ru*. This is shown in (84).

(84)		Present	Past	Progressive
	a.	tabe- <u>ru</u> eat-PRES	tabe- <u>ta</u> eat-PST	tabe- <u>te-i-ru</u> eat-and-be-PRES
	b.	mi- <u>ru</u> see-PRES	mi- <u>ta</u> see-PST	mi- <u>te-i-ru</u> see-and-be-PRES

There are five patterns of changes associated with the stem-final vowel or consonant. In the first pattern (Pattern 1), the vowel /u/ of the verb stem in the present changes to /i/ in the past and in the progressive. This pattern is observed in a limited number of verb stems such as ku-/ki-'come' and su-/si- 'do', as schematized in (85). This is exemplified in (86).

(85)	Pattern 1 <u>Present</u> [stem <u>u</u>]-ru		Past/Progressive [stem i]-t	
(86)	a.	<u>Present</u> k <u>u</u> -ru come-PRES	<u>Past</u> k <u>i</u> -ta come-PST	<u>Progressive</u> k <u>i</u> -te-i-ru come-and-be-PRES
	b.	s <u>u</u> -ru do-PRES	s <u>i</u> -ta do-PST	s <u>i</u> -te-i-ru do-and-be-PRES

The other four patterns affect the stem-final consonant, which would otherwise "result in a phonologically impermissible sequence of consonants" (Davis and Tsujimura 1991: 119) (see also section 2.2.4. for Japanese syllable structure). Pattern 2 shows that the root-final consonants /m/, /b/ and /n/ in the non-past forms are assimilated in place of articulation to the initial alveolar consonant /t/ of the past tense suffix -ta. The same place assimilation takes place with the progressive suffix -te-i-ru. Also, the alveolar consonant of the past tense suffix and of the gerund suffix -te-i-ru is assimilated in voicing to the root-final voiced consonant, as schematized in (87). This pattern is exemplified in (88).

(87)	Patte <u>Prese</u> [stem	ern 2 <u>ent</u> <u>m/n/b</u>]-u	Past/Progressive	
(88)	a.	<u>Present</u> yo <u>m</u> -u read-PRES	<u>Past</u> yo <u>n-d</u> a read-PST	<u>Progressive</u> yo <u>n-d</u> e-i-ru read-and-be-PRES
	b.	to <u>b</u> -u fly-PRES	to <u>n-da</u> fly-PST	to <u>n-d</u> e-i-ru fly-and-be-PRES
	c.	si <u>n</u> -u die-PRES	si <u>n-da</u> die-PST	si <u>n</u> - <u>d</u> e-i-ru die-and-be-PRES

In Pattern 3 root-final (non-nasal) sonorants /r/ and /w/ in the present are geminated to the initial alveolar stop of the past tense suffix -ta. A similar gemination also takes place if the progressive suffix -te-*i*-*ru* is attached to the verb root, as schematized in (89). This pattern is exemplified in (90).

(89) Pattern 3
<u>Present</u> <u>Past/Progressive</u>
[stem...C]-u [stem ...t]-t...
where C is non-nasal and non-coronal

(90)	a.	<u>Present</u> to <u>r</u> -u take-PRES	<u>Past</u> to <u>t</u> -ta take-PST	<u>Progressive</u> to <u>t</u> -te-i-ru take-and-be-PRES
	b.	ka <u>w</u> -u buy-PRES	ka <u>t</u> -ta buy-PST	ka <u>t</u> -te-i-ru buy-and-be-PRES

Pattern 4 affects stems with a final alveolar fricative /s/ in the present. In this context, a high front vowel /i/ is inserted after this consonant in the past and in the gerund, as schematized in (91). This pattern is exemplified in (92).

- (91) Pattern 4 <u>Present</u> <u>[stem...s]-u</u> <u>Past/Progressive</u> <u>[stem...si]-t...</u>
- (92)Present
kag-uPast
kasi-taProgressive
kasi-te-i-ru
rent-PRESrent-PRESrent-PSTrent-and-be-PRES

Pattern 5 affects stems with final velar stops /k/ and /g/ in the present. In this context, a high front vowel /i/ is inserted in the past tense. In addition, the velar consonants delete after *i*-epenthesis, as schematized in (93). The *i*-epenthesis and the velar consonant deletion also take place in the progressive. This pattern is exemplified in (94).

(93) Pattern 5 <u>Present</u> <u>past/gerund</u> [stem...k/g]-u [stem...i]-t...

(94)	a.	<u>Present</u> ka <u>k</u> -u write-PRES	<u>Past</u> ka <u>i</u> -ta write-PST	<u>Progressive</u> ka <u>i</u> -te-i-ru write-and-be-PRES
	b.	ka g -u sniff-PRES	ka <u>i</u> -da sniff-PST	ka <u>i</u> -de-i-ru sniff-and-be-PRES

2.2.4. How to construct minimal pairs

Having restricted the empirical domain to Yamato-Japanese verbs, we now list all actual verbs that fall into this domain. To make sure that we cover all the existing verbs in this domain, we first pay attention to the phonological constraints on possible verbs in the language. The phonological constraints include constraints on syllable structure, the phonemic inventory, phonotactics, and suprasegmental properties.

Let us begin with constraints on syllable structure. In contemporary Japanese, syllables are CVC with both onset and coda consonants being optional (Kubozono 1999).⁵ Thus, consonant clusters in onset and coda positions are prohibited. The coda consonant is restricted to either a nasal or the first consonant in a geminate. As seen in the last subsection, gemination results from assimilating a root-final (non-nasal) sonorant to the initial consonant of the past tense particle *-ta*. Thus, monosyllabic verb stems can be either V, CV, VC or CVC. This is exemplified in (95).

(95)	Monosyllabic verb stems				
		Syllable structure	Past	(cf. Present)	
	a.	V	e-ta	er-u/e-ru	
			get-PST	get-PRES	
	b.	CV	n i -ta	nir-u/ni-ru	
			simmer-PST	simmer-PRES	
	c.	VC	a n-da	am-u	
			knit-PST	knit-PRES	
	d.	CVC	k u t-ta	ku(w)-u	
			eat-PST	eat-PRES	

⁵ Compare this to Old Japanese which had an open syllable structure CV (Shibatani 1990; Kubozono 1999).

Bisyllabic verb stems take one of the forms V.V, CV.V, V.CV, V.VC, CV.CV, V.CVC, or CV.CVC, where a dot '.' between segments represents a syllable boundary.⁶ This is exemplified in (96).

(96)	Bisyll	abic verb stems		
	a.	<u>Syllable structure</u> V.V	<u>Past</u> ui-ta	(cf. <u>Present</u>) uk-u
			float-PST	float-PRES
	b.	CV.V	kai-ta write-PST	kak-u write-PRES
	c.	V.CV	age-ta raise-PST	ager-u/age-ru raise-PRES
	d.	V.VC	aot-ta agitate-PST	aor-u agitate-PRES
	e.	CV.CV	musi-ta steam-PST	mus-u steam-PRES
	f.	VC.VC	iwat-ta celebrate-PST	iwa(w)-u celebrate-PRES
	g.	CV.CVC	kasut-ta graze-PST	kasur-u graze-PRES

We now turn to constraints on the phonemic inventories. Contemporary Japanese has five vowels, /i/, /e/, /u/, /o/ and /a/ (Shibatani 1990), as in (97).

⁶ There are many verb stems which contain two vowels adjacent to each other. They look like diphthongal vowels in a single syllable, but I assume here that such diphthongal vowels are in two different syllables. This is partly motivated by the fact that if the verb stem ends in a velar consonant /k/ or /g/, the consonant drops in the past tense form but remains in polite speech, as shown in (i) (cf. Kindaichi 1976). Therefore, the second vowel /i/ is in the second syllable, separate from the first vowel in the first syllable.

(i)	Bisyl	Bisyllabic verb stems				
	-	Past	Polite language	(cf. <u>non-past</u>)		
	a.	ka.i-ta (diphthong) write-PAST	ka.k i -masu write-POL	kak-u write-PRES		
	b.	ki. i- ta (diphthong) listen-PAST	ki.k i -masu listen-POL	kik-u listen-PRES		

(97) <u>vower inventory of Tokyo dialect</u>
--

	Front		back
high	i		u
mid	e		0
low		a	

The inventory of Japanese consonant phonemes is listed in (98) (adopted from Shibatani 1990).

	Bilabial	alveolar	coronal	glottal
stop fricative liquid nasal glide	p b m w	t d s z r n j	k g	h

(98) <u>Consonant phoneme inventory</u>

(i)

(Shibatani 1990: 159 Tables 8.1 and 8.2 with slight modification)

We now turn to phonotactic constraints. In onset position, there are three constraints. First, /p/ never occurs in verb-initial onset position in Yamato-Japanese. This contrasts with loan words where /p/ in verb-initial onset position is attested.⁸

⁸ In Yamato-Japanese (as well as Sino-Japanese) [p] is in complementary distribution with [h] (Shibatani 1990). While [p] does not occur in word-initial position, [h] does, as in **poo/hoo* 'law'. In contrast, [p] may occur in word-internal position, but [h] does not, as in *ken-pou/*ken-hou* 'constitution'. These are exemplified in (i). The examples are from Sino-Japanese.

<u>Word-initial</u> hin 'goods'	*pin	<u>word-internal</u> zep- p in 'great goods'	*zeh-hin/*zetsu-hin
hen 'side'	*pen	ip- p en 'a side'	*ih-hin/*itsu-hin
h un 'minute'	*pun	dʒip- p un 'ten minutes'	*dʒih-hin
h oo 'law'	*poo	ken-poo 'constitution'	*ken-hoo
han 'group'	*pan	ip- p an 'a group'	*ih-han/*itsu-han

Thus, one of the consonants can be treated as the underlying form. It has been claimed that /h/ historically developed from /p/ (McCawley 1968), though I leave this as an open issue. For our purpose, it is enough to know what consonants can appear in word-initial position.

(99) <u>Foreign words</u> pikunikku-suru picnic-do 'picnic (V)'

The second phonotactic constraint in onset position is that the flap consonant /r/ never occurs in verb-initial onset position in Yamato-Japanese. The other strata allow for word-initial /r/.

(101) <u>Foreign words</u> rirei-suru relay-do 'relay (V)'

The third phonotactic (or phonological) constraint affects glides. The bilabial glide /w/ occurs in onset only if it is followed by the low back vowel /a/, as shown in (102). The palatal glide /j/ occurs in onset only if it is followed by a back vowel /u/, /o/ or /a/.

(102) The distribution of glides $\frac{/i/ /e/ /u/ /o/ /a/}{/w/ *[wi] *[we] *[wu] *[wo] [wa]}$ /j/ *[ji] *[je] [ju] [jo] [ja]

With respect to the surface form of a given phoneme (i.e., its allophones), alveolar stops and fricatives need attention. These alveolar consonant phonemes are realized differently with high vowels and with the other non-high vowels. If the high front vowel /i/ follows an alveolar fricative in onset position, the consonant is palatalized ([fi] and [d3i]), as seen in (103). If /i/ follows an alveolar stop in onset position, the consonant is also palatalized ([fi] and [d3i]). If the high back vowel /u/ follows an alveolar stop /t, d/ in onset position, the consonant is affricated ([tsu] and [dzu]). If /u/ follows the voiced alveolar fricative /z/, the consonant has the affricate [dzu]⁹. With the other non-high vowels, the alveolar consonants are realized as they are.

/a/

(103) Alveolar obstruents with vowels Onset/Nucleus

/d/

/i/ /u/ /e/ /0/ [se] [so] [sa] /s/[∫i] [su] [tfi] [tsu] [te] [to] [ta] /t/ [dʒi] [dzu] [ze] [zo] [za] $|\mathbf{Z}|$

[dʒi] [dzu] [de] [do] [da]

A coda consonant is either part of a geminate or a nasal. As seen in the last sub-section, gemination results from assimilating a root-final (non-nasal) sonorant to the initial consonant of the past tense particle -ta. This is again illustrated in (104) and (105).

(104) a. /ker-ta/ \rightarrow [ket-ta] kick-PST b. /a(w)-ta/ \rightarrow [at-ta] meet-PST \rightarrow [ka**n-d**a] (105) a. /ka**m-t**a/ bite-PST b. /u**m-t**a/ \rightarrow [u**n-d**a] bear-PST

If the verb root ends in a bilabial consonant /m/ or /b/, the consonant assimilates in place of articulation to the alveolar consonant /t/ of the past tense particle -ta. In addition, the initial consonant of the past tense particle is voiceless and it assimilates in voicing to the preceding voiced consonant /m/ or /b/.

We now turn to the phonotactic constraints on the nucleus. The front vowels /i/ and /e/ can occur not only in closed syllable verb stems but also in open syllable verb stems. In contrast, the back vowels /u/, /o/ and /a/ occur only in closed syllable verb stems. The contrast between

⁹ As seen in (103), the contrast between $\frac{z}{and}\frac{d}{is}$ lost in the Tokyo dialect. This is due to the historical development of Japanese (Shibatani 1990: 165-166).

front vowels and back vowels is illustrated with monosyllabic verb stems below. To the best of my knowledge, the phonotactic constraint on back vowels has never been recognized.¹⁰

(106)		Syllab	le structure	<u>Verb root in the past tense</u>		
	a.	VC	(closed)	it-ta fry-PST		
	b.	CVC	(closed)	kit-ta cut-PST		
	c.	V	(open)	i-ta exist-PST		
	d.	CV	(open)	mi-ta see-PST		
(107)		Syllable structure		Verb root in the past tense		
	a.	VC	(closed)	ut-ta sell-PST		
	b.	CVC	(closed)	kut-ta eat-PST		
	C.	V	(open)	*u-ta		
	d.	CV	(open)	*m u- ta		

Lastly, we turn to pitch accent (e.g. Kindaichi 1974; Tanaka 2008). Pitch accent in Japanese is contrastive in that it distinguishes the meanings of some verbs. This is shown in (108). In (a), the superscript " ′" on a vowel represents a high pitch, while a vowel without the

- (i) a. **u**ta(w)-u sing-PRES
 - b. kutakutana worn.out

It is worth investigating if gemination corresponds to a semantic feature.

¹⁰ The fact that back vowels cannot occur in open syllable verb stems might be due to the following alveolar stop /t/ which is part of the past tense particle *-ta*. It is often said that back vowels are dorsal while front vowels are coronal (cf. Harshman et al. 1977). Given that alveolar consonants are also coronal, it takes back vowels longer to reach the target coronal position of the following consonant compared with front vowels. Gemination fills in the temporal gap between the back vowels and the alveolar consonant in articulation. However, this purely phonetic account cannot explain the fact that back vowels followed by the alveolar stop /t/ do not require gemination in other environments, as shown below.

superscript represents a low pitch in (b). However, no systematic correspondence between the pitch accent and meanings has been identified.

(108) a. mát-ta wait-PST
b. mat-ta dance-PST
(109) a. yút-ta do.up.one's.hair-past
b. yut-ta

utter-PST

There are a few remarks in order on the syllable type. The CV template of the rightmost syllable of verb stems allow for the front vowels, /i/ and /e/, but not for the back vowels, /u/, /o/, and /a/. To the best of my knowledge, this phonotactic constraint on back vowels has never been recognized. The CV template is given in (110).

(110) CV template of the rightmost syllable

C (onset)	V (nucleus)
	high or low pitch
$\{m, b, w, t, d, s, z, n, j, k, g, h, no onset\}$	{i, e}

The CVC template of the rightmost syllable of verb stems allow for all the five vowels in the nucleus. As seen in the previous section, the coda of the CVC verb stems is reduced to either /n/ or /t/ in the past tense. The template of CVC verb stems is given in (111).

(111) CVC template of the rightmost syllable

C (onset)	V (nucleus)	C (coda)
	high or low pitch	
$\{m, b, w, t, d, s, z, n, j, k, g, h, no onset\}$	$\{i, u, e, o, a\}$	{n, t}

I list all logically possible monosyllabic and bisyllabic verb stems which fall into the defined domain (see the lists of existing verbs in Appendix B). These verbs are transitive; the direct object is *o*-marked in transitive structures, as shown in (112) (see also section 2.1.4).

(112) Taro-ga booru-<u>o</u> ket-ta T.-NOM ball-ACC kick-PST 'Taro kicked a ball.'

I have checked all the logical possible words for their existence in two Japanese dictionaries, *Daijirin* (3^{rd}) (Sanseido) and *Shin Meikyo Jiten* (Taishukan). We can therefore be sure that we have an exhaustive list of existing transivive verb stems in the past tense.¹² I have also checked the accent-pitch of these words in *Shin Meikai Nihongo Akusento Jiten* (Sanseido).

2.3. The non-low vowels correspond to verbal telicity

In this section, I demonstrate that the non-low vowels of the rightmost vowel correspond to verbal telicity. In monosyllabic verb stems, the quality of the single vowel corresponds to verbal telicity, as schematized in (113). In bisyllabic verb stems, the second vowel (Vowel 2) corresponds to verbal telicity, as schematized in (114).

(113) Monosyllabic verb stem

(114) Bisyllabic verb stem

```
[verb stem (C) Vowel1 (C) Vowel2 (C)]
|
non-low vowel
```

verbal telicity

¹² In the list of verbs in Appendix B, 'n/a' stands for impermissible syllables in Yamato-Japanese: such syllables are ruled out by the phonotactic constraints just discussed. Given that the list contains only transitive verbs, however, there are lots of possibilities for the gaps if intransitive verbs are introduced (see Chapter 5 for discussion of intransitive verbs).

In the rightmost vowel position, /e/ and /u/ are associated with a telic interpretation while /i/ and /o/ are associated with an atelic interpretation. Verbs with /a/ as their rightmost vowel do not pattern the same: some are interpreted as telic, while others are interpreted as atelic.

(115) /e, u/ - telic /i, o/ - atelic /a/ - telic or atelic

I discuss each of these correspondences in turn. Note that the above vowel-telicity correspondence was checked with 10 adult fluent speakers of Japanese. Out of these consultants, 5 were in their 20's, and 5 in their 30's. 7 consultants spoke Eastern dialects including Tokyo dialect, while 3 spoke Western dialects. 5 consultants were male the other 5 were female. The background of the consultants is summarized in (116).

	AGE	20's - 5, 30's - 5		
DIALECT	Eastern (n=7)	Kanto - 4, Koshinetsu -1, Tohoku/Hokkai		
	Western (n=3)	Kansai - 2, Shikoku - 1		
GI	ENDER	male - 5, female - 5		

(116) The background of consultants (n=10)

2.3.1. Monosyllabic transive verbs

In this subsection, we look at the correspondence between the quality of the vowel and verbal telicity in monosyllabic transitive verbs. The correspondence is identified across syllable structures (V, CV, VC, and CVC). This is diagnosed with the four (a)telicity tests introduced in section 2.1.4.

2.3.1.1. Monosyllabic verbs containing /e/ or /u/ are telic

All of the verb stems containing either /e/ or /u/ are telic. Such telic verbs are felicitous with a time-span adverb 'in x time'. In contrast, they test negatively in the three atelicity tests: they are infelicitous with a durative adverb 'for x time', they are infelicitous with a punctual adverb, and they have no past entailment in the progressive, as summarized below.

- 2

(117)	Diagnostic tests	Verbs containing /e, u/		
	Telicity tests			
a.	Felicitous with time-span adverb	YES		
	Atelicity tests			
b.	Felicitous with durative adverb	NO		
с.	Felicitous with punctual adverb	NO		
d.	Past entailment in the progressive	NO		

2.3.1.1.1. Monosyllabic verbs with /e/ are telic

There is only one verb which consists of a single vowel, namely \acute{e} 'get', as in (118).

(118) e verb stems (n=1)

				Diagnostics for (a)telicity				
Syllable	Present	Past	Gloss	in	for	at	past entailment	
e	é-ru	é-ta	get	Yes	No	No	No	

This verb stem is felicitous with a time-span adverb 'in x time' (119a) but it is infelicitous with a durative adverb 'for x time' (119b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is non-cancellable (119c). The verb stem in the progressive does not entail that the eventuality took place in the past (119d).

(119)	a.	Meari-wa	(gohunde)	itido	issatu-no	hon-o	<u>é</u> -ta
		MTOP	in.5.min	once	one.CL-GE	N book-A	ACC get-PST
		'Mary got	a book onc	e (in five	e minutes).'		

- b. Meari-wa (*gohunnoaida) itido issatu-no hon-o <u>é</u>-ta M.-TOP for.5.min once one.CL-GEN book-ACC get-PST 'Mary got a book once (*for five minutes).'
- c. Meari-wa kuzi-tyoodo-ni itido issatu-no hon-o $\underline{\acute{e}}$ -ta M.-TOP nine.o'clock-sharp-at once one.CL-GEN book-ACC get-PST = 'Mary completed getting a book once at nine sharp.'

*zissai, Meari-wa kuzi-han-ni mada so-no hon-o <u>é</u>-te-i-ta in.fact M.-TOP nine-half-at still that-GEN book-ACC get-OP-be-PST Lit. 'in fact, Mary was still getting the book at 9:30.' intended 'Mary had been getting the book since nine.' d. Meari-wa ima issatu-no hon-o <u>é</u>-te-iru
M-TOP now one.CL-GEN book-ACC get-OP-be-PRS 'Mary is now getting a book.'
☆ 'Mary got a book.'

There is only one instance of CV verb stem where the vowel is /e/, namely *hé*- 'pass', as in (120).

(120) *Ce* verb stems (n=1)

				Diagnostics for (a)telicity				
Syllable	Present	Past	Gloss	in	for	at	past entailment	
Ce	hé-ru	hé-ta	pass	Yes	No	No	No	

The verb stem is felicitous with a time-span adverb 'in x time' (121a) but it is infelicitous with a durative adverb 'for x time' (121b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is non-cancellable (121c). The verb stem in the progressive does not entail that the eventuality took place in the past (121d).

(121)	a.	Meari-wa (gohunde) itido hitotu-no mati-o h <u>é</u> -ta MTOP 5.min-at once one.CL-GEN town-ACC pass-PST 'Mary passed a town once (in five minutes).'
	b.	Meari-wa (*gohunnoaida) itido hitotu-no mati-o h $\underline{\acute{e}}$ -ta MTOP for.5.min once one.CL-GEN town-ACC pass-PST 'Mary passed a town once (*for five minutes).'
	Meari-wa kuzi-tyoodo-ni itido hitotu-no mati-o h $\underline{\acute{e}}$ -ta MTOP nine.o'clock-sharp-at once one.CL-GEN town-ACC pass-PST = 'Mary completed passing a town once at nine sharp.'	
		*zissai, Meari-wa kuzi-han-ni mada so-no mati-o h <u>é</u> -te-i-ta in.fact MTOP nine-half-at still that-GEN town-ACC pass-OP-be-PST lit. 'in fact, Mary was still passing the town at 9:30.' intended 'Mary had been passing the town since nine.'
	d.	Meari-wa ima hitotu-no mati-o h <u>é</u> -te-iru M-TOP now one.CL-GEN town-ACC pass-OP-be-PRS 'Mary is now passing a town.' ★ 'Mary passed a town.'

With CVC verb stems, there are three verb stems containing /e/, as shown in (122).

(122) *CeC* verb stems (n=3)

				Diagnostics for (a)telicity				
Syllable	Present	Past	Gloss	in	for	at	past entailment	
	kér-u	két-ta	kick	Yes	No	No	No	
CeC	nér-u	nét-ta	knead	Yes	No	No	No	
	sér-u	sét-ta	bid	Yes	No	No	No	

An example of such a verb stem is $k\acute{e}t$ - 'kick'. This verb stem is felicitous with a time-span adverb 'in x time' (123a), but it is infelicitous with a durative adverb 'for x time' (123b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is non-cancellable (123c). The verb stem in the progressive does not entail that the eventuality took place in the past (123d).

- (123) a. Meari-wa (gohunde) itido hitotu-no kan-o k<u>é</u>t-ta M.-TOP 5.min-at once one.CL-GEN can-ACC kick-PST 'Mary kicked a can once (in five minutes).'
 - b. Meari-wa (*gohunnoaida) itido hitotu-no kan-o k<u>é</u>t-ta M.-TOP for.5.min once one.CL-GEN can-ACC kick-PST 'Mary kicked a can once (*for five minutes).'
 - c. Meari-wa kuzi-tyoodo-ni itido hitotu-no kan-o k $\underline{\acute{e}}$ t-ta M.-TOP nine.o'clock-sharp-at once one.CL-GEN can-ACC kick-PST = 'Mary completed kicking a can once at nine sharp.'

*zissai, Meari-wa kuzi-han-ni mada sono kan-o k $\underline{\acute{e}}$ t-te-i-ta in.fact M.-TOP nine-half-at still that can-ACC kick-OP-be-PST lit. 'in fact, Mary was still kicking the can at 9:30.' intended 'Mary had been kicking the can since nine.'

d. Meari-wa ima hitotu-no kan-o k<u>é</u>t-te-i-ru
 M-TOP now one.CL-GEN can-ACC kick-OP-be-PRS
 'Mary is now kicking a can.'
 ☆ 'Mary kicked a can.'

2.3.1.1.2. Monosyllabic verbs with /u/ are telic

Verb stems containing /u/ are attested in VC and CVC forms. In VC form, there are three verb stems containing /u/, as shown in (124).

(124) uC verb stems (n=3)

				Diagnostics for (a)telicity				
Syllable	Present	Past	Gloss	in	for	at	past entailment	
	úr-u	út-ta	hit	Yes	No	No	No	
uC	ur-u	ut-ta	sell	Yes	No	No	No	
	um-u	un-da	bear	Yes	No	No	No	

An example of such a verb stem is *u* 'hit'. This verb stem is felicitous with a time-span adverb 'in x time' (125a) but it is infelicitous with a durative adverb 'for x time' (125b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is non-cancellable (125c). The verb stem in the progressive does not entail that the eventuality took place in the past (125d).

(125)	a.	Takashi-ga	(gohunde)	itido	hitotu-no	booru-o	<u>ú</u> t-ta	
		TNOM	in.5.minute	once	one.CL-GEN	ball-ACC	hit-PST	
'Takashi hit a ball once (in five minutes).'								

- b. Takashi-ga (*gohunnoaida) itido hitotu-no booru-o $\underline{\acute{u}}$ t-ta T.-NOM for.5.minute once one.CL-GEN ball-ACC hit-PST 'Takashi hit a ball once (*for five minutes).'
- c. Takashi-wa kuzi-tyoodo-ni itido hitotu-no booru-o $\underline{\acute{u}}$ t-ta T.-TOP 9.0'clock-sharp-at once one.CL-GEN ball-ACC hit-PST = 'Takashi completed hitting a ball once at nine sharp.'

*zissai, Takashi-wa kuzi-han-ni mada sono booru-o $\underline{\acute{u}}$ t-te-i-ta in.fact T.-TOP 9-half-at still that ball-ACC hit-OP-be-PST lit. 'in fact, Takashi was still hitting the ball at 9:30.' intended 'Takashi had been hitting the ball since nine.'

d. Meari-ga ima hitotu-no booru-o <u>ú</u>t-te-i-ru
M-NOM now one.CL-GEN ball-ACC hit-OP-be-PRS
'Mary is now hitting a ball.'
☆ 'Mary hit a ball.'

With CVC verb stems, there are 13 verb stems containing /u/, as shown in (126).

				Diagn	ostics fo	or (a)telio	city
Syllable	Present	Past	Gloss	in	for	at	past entailment
	tur-u	tut-ta	pull up	Yes	No	No	No
	súr-u	sút-ta	strike	Yes	No	No	No
	suw-u	sut-ta	suck	Yes	No	No	No
	zúr-u	zút-ta	drag	Yes	No	No	No
~ ~	núw-u	nút-ta	sew	Yes	No	No	No
CuC	nuw-u	nut-ta	rub	Yes	No	No	No
	yúw-u	yút-ta	do up one's hair	Yes	No	No	No
	yuw-u	yut-ta	utter	Yes	No	No	No
	kúw-u	kút-ta	devour	Yes	No	No	No
	hur-u	hut-ta	swing	Yes	No	No	No
	tum-u	tun-da	stack	Yes	No	No	No
	kum-u	kun-da	scoop	Yes	No	No	No
	hum-u	hun-da	tread	Yes	No	No	No

(126) CuC verb stems (n=13)

An example of such a verb stem is *tut*- 'pull up'. This verb stem is felicitous with a time-span adverb 'in x time' (127a) but it is infelicitous with a durative adverb 'for x time' (127b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is non-cancellable (127c). The verb stem in the progressive does not entail that the eventuality took place in the past (127d).

- (127) a. Takashi-ga (gohunde) itido ippiki-no sakana-o t<u>u</u>t-ta T.-NOM in.5.minute once one.CL-GEN fish-ACC pull.up-PST 'Takashi pulled up a fish once (in five minutes).'
 - b. Takashi-ga (*gohunnoaida) itido ippiki-no sakana-o t<u>u</u>t-ta T.-NOM for.5.minute once one.CL-GEN fish-ACC pull.up-PST 'Takashi pulled up a fish once (*for five minutes).'
 - c. Takashi-wa kuzi-tyoodo-ni itido ippiki-no sakana-o t \underline{u} t-ta T.-TOP 9.0'clock-sharp-at once one.CL-GEN fish-ACC fish-PST = 'Takashi completed pulling up a fish once at nine sharp.'

*zissai, Takashi-wa kuzi-han-ni made sono sakana-o t \underline{u} t-te-i-ta In.fact T.-TOP 9-half-at still that fish-ACC fish-OP-be-PST lit. 'in fact, Takashi was still pulling up the fish at 9:30.' intended 'Takashi had been pulling up the fish since nine.'

d. Takashi-ga ima hitotu-no sakana-o t<u>u</u>t-te-iru
T-NOM now one.CL-GEN fish-ACC pull.up-OP-be-PRS 'Takashi is now pulling up a fish.'
☆ 'Takashi pulled up a fish (out of water).'

2.3.1.2. Monosyllabic verbs containing /i/ or /o/ are atelic

All of the verb stems containing either /i/ or /o/ are atelic. Such atelic verb stems are infelicitous with a time-span adverb 'in x time'. In contrast, they test positively in the three atelicity tests: they are felicitous with a durative adverb 'for x time', they are felicitous with a punctual adverb, and they have past entailment in the progressive, as summarized below.

(128)	Diagnostic tests	Verbs containing /i, o/
	Telicity tests	
a.	Felicitous with time-span adverb	NO
	Atelicity tests	
b	. Felicitous with durative adverb	YES
c.	Felicitous with punctual adverb	YES
d	Past entailment in the progressive	YES

2.3.1.2.1. Monosyllabic verbs with /i/ are atelic

With CV verb stems, there are four verb stems containing /i/, as shown in (129).

				Diagnosti	cs for (a)	telicity	
Syllable	Present	Past	Gloss	in	for	at	past entailment
	ki-ru	ki-ta	wear	No	Yes	Yes	Yes
Ci	mí-ru	mí-ta	see	No	Yes	Yes	Yes
	ni-ru	ni-ta	simmer	No	Yes	Yes	Yes
	su-ru	si-ta	do	No	Yes	Yes	Yes

(129) Ci verb stems (n=4)

An example of the verb stems is ki- 'wear'. The verb stem is infelicitous with a time-span adverb 'in x time' (138a), but it is felicitous with a durative adverb 'for x time' (130b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is cancellable (130c). The verb stem in the progressive entails that the eventuality took place in the past (130d).

- (130) a. Meari-wa (*gohunde) itido ittyaku-no kimono-o k<u>i</u>-ta M.-TOP in.5.minute once one.CL-GEN kimono-ACC wear-PST 'Mary wore a kimono once (*in five minutes).'
 - b. Meari-wa (gohunnoaida) itido ittyaku-no kimono-o k<u>i</u>-ta M.-TOP for.5.minute once one.CL-GEN kimono-ACC wear-PST 'Mary wore a kimono once for five minutes.'

c. Meari-wa kuzi-tyoodo-ni itido ittyaku-no kimono-o ki-ta M.-TOP 9.0'clock-sharp-at once one-GEN kimono-ACC wear-PST = 'Mary started wearing a kimono once at nine sharp.'

zissai, Meari-wa kuzi-han-ni mada sono kimono-o k<u>i</u>-te-i-ta In.fact M.-TOP 9.half.-at still that kimono-ACC wear-OP-be-PST 'In fact, Mary was still wearing the kimono at 9:30.' = 'Mary had been wearing the kimono at 9:30.'

d. Meari-wa ima ittyaku-no kimono-o k<u>i</u>-te-i-ru
 M.-TOP now one.CL-GEN kimono-ACC wear-OP-be-PRS
 'Mary is now wearing a kimono.'
 → 'Mary wore a kimono.'

With VC verb stems, there is one verb stem containing i/i, *it*- 'fry', as in (131).

(131) iC verb stems (n=1)

				Diagnostics for (a)telicity					
Syllable	Present	Past	Gloss	in for at past entai					
iC	ír-u	ít-ta	fry	No	Yes	Yes	Yes		

The verb stem is infelicitous with a time-span adverb 'in x time' (132a), but it is felicitous with a durative adverb 'for x time' (132b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is cancellable (132c). The verb stem in the progressive entails that the eventuality took place in the past (132d).

- (132) a. Meari-wa (*gohunde) itido hitotu-no mame-o <u>í</u>t-ta M.-TOP in.5.minute once one.CL-GEN bean-ACC fry-PST 'Mary fried a bean once (*in five minutes).'
 - b. Meari-wa (gohunnoaida) itido hitotu-no mame-o <u>í</u>t-ta M.-TOP for.5.minute once one.CL-GEN bean-ACC fry-PST 'Mary fried a bean once (for five minutes).'
 - c. Meari-wa kuzi-tyoodo-ni itido hitotu-no mame-o \underline{i} t-ta M.-TOP 9.0'clock-sharp-at once one-GEN bean-ACC fry-PST = 'Mary started frying a bean once at nine sharp.'

zissai, Meari-wa kuzi-han-ni mada sono mame-o <u>í</u>t-te-i-ta In.fact M.-TOP 9.half.-at still that bean-ACC fry-OP-be-PST 'In fact, Mary was still frying the bean at 9:30.' = 'Mary had been frying the bean at 9:30.' d. Meari-wa ima hitotu-no mame-o <u>í</u>t-te-i-ru
 M.-TOP now one.CL-GEN bean-ACC fry-OP-be-PRS
 'Mary is now frying a bean once'
 → 'Mary fried a bean.'

With CVC verb stems, there are three verb stems containing /i/, as shown in (133).

(133) CiC verb stems (n=3)

				Diagno	Diagnostics for (a)telicity				
Syllable	Present	Past	Gloss	in	for	at	past entailment		
	kír-u	kít-ta	cut	No	Yes	Yes	Yes		
CiC	sir-u	sit-ta	know	No	Yes	Yes	Yes		
	hír-u	hít-ta	fart/excrete	No	Yes	Yes	Yes		

An example of such a verb stem is kit- 'cut'. This verb stem is infelicitous with a time-span adverb 'in x time' (134a), but it is felicitous with a durative adverb 'for x time' (134b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is cancellable (134c). The verb stem in the progressive entails that the eventuality took place in the past (134d).

- (134) a. Meari-wa (*gohunde) itido itimai-no kami-o k<u>í</u>t-ta M.-TOP in.5.minute once one.CL-GEN paper-ACC cut-PST 'Mary cut a piece of paper once (*in five minutes).'
 - b. Meari-wa (gohunnoaida) itido itimai-no kami-o k<u>í</u>t-ta M.-TOP for.5.minute once one.CL-GEN paper-ACC cut-PST 'Mary cut a piece of paper once (for five minutes).'
 - c. Meari-wa kuzi-tyoodo-ni itido itimai-no kami-o k<u>í</u>t-ta M.-TOP 9.0'clock-sharp-at once one.CL-GEN paper-ACC cut-PST = 'Mary started cutting a piece of paper once at nine sharp.'

zissai, Meari-wa kuzi-han-nimada so-no kami-o k<u>í</u>t-te-i-ta In.fact M.-TOP 9-half-at still that-GEN paper-ACC cut-OP-be-PST lit. 'In fact, Mary was still cutting a piece of paper at 9:30.' = 'Mary had been cutting the piece of paper since nine.'

d. Meari-wa ima itimai-no kami-o k<u>í</u>t-te-i-ru M.-TOP now one.CL-GEN paper-ACC cut-OP-be-PRS 'Mary is now cutting a piece of paper once' \rightarrow 'Mary cut a piece of paper.'

2.3.1.2.2. Monosyllabic verbs with /o/ are atelic

Verb stems containing /o/ are attested with VC and CVC templates. There are two VC verb stems containing /o/, as shown in (135).

(135) oC verb stems (n=2)

				Diagnosti	cs for (a)	telicity	
Syllable	Present	Past	Gloss	in	for	at	past entailment
oC	or-u	ot-ta	chase	No	Yes	Yes	Yes
	ór-u	ót-ta	bend	No	Yes	Yes	Yes

An example of such a verb stem is ot- 'chase'. This verb stem is infelicitous with a time-span adverb 'in x time' (136a), but it is felicitous with a durative adverb 'for x time' (136b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is cancellable (136c). The verb stem in the progressive entails that the eventuality took place in the past (136d).

(136)	a.	Taro-wa	(*gohunde)	itido	ippiki-no	usagi-o	<u>o</u> t-ta
		TTOP	in.5.minute	once	one.CL-GEN	rabbit-ACC	chase-PST
		'Taro cha	used a rabbit of	once (*in fiv	ve minutes).'		

- b. Taro-wa (gohunnoaida) itido ippiki-no usagi-o <u>o</u>t-ta T.-TOP for.5.minute once one.CL-GEN rabbit-ACC chase-PST 'Taro chased a rabbit once (for five minutes).'
- c. Hanako-wa kuzi-tyoodo-ni itido ippiki-no usagi-o $\underline{o}t$ -ta H.-TOP 9.0'clock-sharp-at once one.CL-GEN rabbit-ACC chase-PST = 'Hanako started chasing a rabbit once at nine sharp.'

zissai, Hanako-wa kuzi-han-ni mada sono usagi-o $\underline{o}t$ -te-i-ta in.fact H.-TOP 9-half-at still that rabbit-ACC chase-OP-be-PST lit. 'in fact, Hanako was still chasing the rabbit at 9:30.' = 'Hanako had been chasing the rabbit since nine.'

d. Taro-wa ima ippiki-no usagi-o $\underline{o}t$ -te-i-ru T.-TOP now one.CL-GEN rabbit-ACC chase-OP-be-PRS 'Taro is now chasing a rabbit once' \rightarrow 'Taro chased a rabbit.'

There are 10 CVC verb stems containing /o/, as shown in (137).

					Diagnost	ics for (a))telicity
Syllable	Present	Past	Gloss	in	for	at	past entailment
	mót-u	mót-ta	carry	No	Yes	Yes	Yes
	mor-u	mot-ta	heap	No	Yes	Yes	Yes
	tór-u	tót-ta	take	No	Yes	Yes	Yes
CoC	hór-u	hót-ta	dig	No	Yes	Yes	Yes
	mom-u	mon-da	massage	No	Yes	Yes	Yes
	tob-u	ton-da	fly	No	Yes	Yes	Yes
	sór-u	sót-ta	shave	No	Yes	Yes	Yes
	nóm-u	nón-da	swallow	No	Yes	Yes	Yes
	yóm-u	yón-da	read	No	Yes	Yes	Yes
	yob-u	yon-da	invite	No	Yes	Yes	Yes

(137) CoC verb stems (n=10)

An example of such a verb stem is $m \delta t$ - 'carry'. This verb stem is infelicitous with a time-span adverb 'in x time' (138a). Meanwhile, it is felicitous with a durative adverb 'for x time' (138b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is cancellable (138c). The verb stem in the progressive entails that the eventuality took place in the past (138d).

- (138) a. Taro-wa (*gohunde) itido hitotu-no kaban-o m<u>ó</u>t-ta T.-TOP in.5.minute once one.CL-GEN bag-ACC carry-PST 'Taro carried a bag once (*in five minutes).'
 - b. Taro-wa (gohunnoaida) itido hitotu-no kaban-o m<u>ó</u>t-ta T.-TOP for.5.minute once one.CL-GEN bag-ACC carry-PST 'Taro carried a bag once (for five minutes).'
 - c. Meari-wa kuzi-tyoodo-ni itido hitotu-no kaban-o \underline{mot} -ta M.-TOP 9.o'clock-sharp-at once one.CL-GEN bag-ACC carry-PST = 'Mary started carrying a bag once at nine sharp.'

zissai, Meari-wa kuzi-han-ni mada sono kaban-o m<u>ó</u>t-te-i-ta in.fact M.-TOP 9-half-at still that bag-ACC carry-OP-be-PST lit. 'in fact, Mary was still carrying the bag at 9:30.' = 'Mary had been carrying the bag since nine.'

d. Meari-wa ima hitotu-no kaban-o m<u>ó</u>t-te-i-ru
 M.-TOP now one.CL-GEN bag-ACC carry-OP-be-PRS
 'Mary is now carrying a bag'
 → 'Mary carried a bag.'

I have shown that in the existing monosyllabic verb stems, the quality of the non-low vowels functions as a predictor of verbal telicity. Namely, /e/ and /u/ are only found in the context of telic verb stems, while /i/ and /o/ are only found in the context of atelic verb stems.

This correspondence between the non-low vowels and verbal telicity in the existing monosyllabic verb stems is without exceptoin. Moreover, both telic and atelic vowels are distributed not only in the monomoraic form but also in the bimoraic form, as shown in (139).¹³

		Monomoraic (n=	Bimoraic verb stems (n=35)					
		V (n=1)	CV (n=5)	VC (n=6)		CV (n=	/C 29)	
Telicity	Vowel			Co	Coda		oda	
				/t/	/n/	/t/	/n/	
Telic	/e/ (n=5)	1	1	-	-	3	-	
	/u/ (n=16)	-	-	2	1	10	3	
Atelic	/i/ (n=8)	-	4	1 -		3	-	
	/o/ (n=12)	-	-	2	-	5	5	

(139) The distribution of the monosyllabic transitive verb stems in moraicity (n=41)

Regarding the consonant quality of the onset, we do not see any difference in distribution of the telic and the atelic vowels, either, as shown in (140).¹⁴

¹³ As we see through this section, the correspondence between the non-low vowels and verbal telicity is observed in the existing monosyllabic verb stems, regardless of whether the verb stem is monomoraic or bimoraic. However, we also notice that the monomoraic form and the bimoraic form differ in type frequency. Namely, the number of bimoraic verb stems is far larger than that of the monomoraic verb stems. In fact, this type frequency of moraicity plays a role in productivity. Chapter 3 shows that in monosyllabic nonce verb stems, native speakers are sensitive to the vowel-telicity correspondence only in the monomoraic form, but not in the bimoraic form.

¹⁴ The voiced obstruents /b, d, z, g/ tend not to occur in the onset of the Yamato-Japanese verb stems. This phenomenon might be related to *Rendaku* by which voicing of voiceless obstruents functions as a linking morpheme in compounds (see also section 2.2.2.5.1).

]	Bilabia (n=4)	1	Alveolar (n=20)					Coronal (n=5)		Glottal (n=5)	no onset (n=7)	
		m (n=4)	b	W	t (n=4)	d	s (n=6)	z (n=1)	n (n=5)	j (n=4)	k (n=5)	g	h (n=5)	
Telic	/e/	-	-	-	-	-	1	-	1	-	1	-	1	1
	/u/	-	-	-	2	-	2	1	2	2	2	-	2	3
Atelic	/i/	1	-	-	-	-	2	-	1	-	2	-	1	1
	/0/	3	-	-	2	-	1	-	1	2	-	-	1	2

(140) The distribution of the monosyllabic verb stems in onset consonant quality (n=41)

2.3.1.3. Monosyllabic verbs containing /a/ are either telic or atelic

While the non-low vowels have a fixed telicity value, the low vowel has no fixed telicity value: some verbs with /a/ are telic, while others are atelic. Verb stems containing /a/ are attested with VC and CVC templates. There is only one VC verb stem containing /a/, án- 'knit', as in (141).

(141) aC verb stems (n=1)

				Verbal	Diagno	ostics for	r (a)telic	eity
Syllable	Present	Past	Gloss	telicity	in	for	at	past entailment
aC	ám-u	án-ta	knit	Telic	Yes	No	No	No

The verb stem \dot{an} - 'knit' is telic, as diagnosed by the four (a)telicity tests. It is felicitous with a time-span adverb 'in x time' (142a), but it is infelicitous with a durative adverb 'for x time' (142b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is non-cancellable (142c). The verb stem in the progressive does not entail that the eventuality took place in the past (142d).

- (142) a. Meari-wa (gohunde) itido itimai-no seetaa-o <u>á</u>n-da M.-TOP 5.min-at once one.CL-GEN sweater-ACC knit-PST 'Mary knitted a sweater (in five minutes).'
 - b. Meari-wa (gohunnoaida) itido itimai-no seetaa-o <u>á</u>n-da M.-TOP for.5.min once one.CL-GEN sweater-ACC knit-PST 'Mary knitted a sweater (*for five minutes).'

c. Meari-wa kuzi-tyoodo-ni itido itimai-no seetaa-o $\underline{\acute{a}}$ n-da M.-TOP 9.0'clock-sharp-at once one.CL-GEN sweater-ACC knit-PST = 'Mary completed knitting a sweater once at nine sharp.'

*zissai, Meari-wa kuzi-han-ni mada sono seetaa-o $\underline{\acute{a}}$ n-de-i-ta in.fact M.-TOP 9-half-at still that sweater-ACC knit-OP-be-PST Lit. 'in fact, Mary was still knitting the sweater at 9:30.' Intended 'Mary had been knitting the sweater since nine.'

d. Meari-wa ima itimai-no seetaa-o <u>á</u>n-de-i-ru
 M-TOP now one.CL-GEN sweater-ACC get-OP-be-PRS
 'Mary is now knitting a sweater.'
 ☆ 'Mary knitted a sweater.'

The CVC template is crucial to show that verb stems containing /a/ do not have a fixed telicity value. In particular, six CVC verb stems are telic while the other six are atelic, as in (143).

				Verbal telicity	Diagno	stics for ((a)telicity	
Syllable	Present	Past	Gloss	venervj	in	for	at	past entailment
	kaw-u	kat-ta	buy		Yes	No	No	No
	sár-u	sát-ta	leave		Yes	No	No	No
	tát-u	tát-ta	depart	Telic	Yes	No	No	No
	war-u	wat-ta	break		Yes	No	No	No
CaC	har-u	hat-ta	post		Yes	No	No	No
	hám-u	hán-da	browse		Yes	No	No	No
	mát-u	mát-ta	wait		No	Yes	Yes	Yes
	maw-u	mat-ta	dance		No	Yes	Yes	Yes
	yar-u	yat-ta	do/send	Atelic	No	Yes	Yes	Yes
	háw-u	hát-ta	creep		No	Yes	Yes	Yes
	yám-u	yán-da	suffer		No	Yes	Yes	Yes
	kám-u	kán-da	bite		No	Yes	Yes	Yes

(143) CaC verb stems (n=12)

This establishes that the low vowel /a/ does not specify the telicity value of the verb stem that contains it. Below are examples of telic and atelic verb stems containing /a/. *kat*- 'buy' is an instance of a telic verb stem. It is felicitous with a time-span adverb 'in x time' (144a), but it is infelicitous with a durative adverb 'for x time' (144b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is non-cancellable (144c). The verb stem in the progressive does not entail that the eventuality took place in the past (144d).

- (144) a. Takashi-wa (gohunde) itido ittyaku-no sebiro-o k<u>a</u>t-ta T.-TOP 5.min-at once one.CL-GEN suit-ACC buy-PST 'Takashi bought a suit (in five minutes).'
 - b. Takashi-wa (*gohunnoaida) itido ittyaku-no sebiro-o k<u>a</u>t-ta T.-TOP for.5.min once one.CL-GEN suit-ACC buy-PST 'Takashi bought a suit (*for five minutes).'
 - c. Takashi-wa kuzi-tyoodo-ni itido ittyaku-no sebiro-o k<u>a</u>t-ta T.-TOP 9.0'clock-sharp-at once one.CL-GEN suit-ACC knit-PST = 'Takashi completed buying a suit once at nine sharp.'

*zissai, Takashi-wa kuzi-han-ni mada sono suit-o k<u>a</u>t-te-i-ta in.fact T.-TOP 9-half-at still that suit-ACC buy-OP-be-PST Lit. 'in fact, Takashi was still buying the suit at 9:30.' Intended 'Takashi had been buying the suit since nine.'

d. Takashi-wa ima ittyaku-no sebiro-o k<u>a</u>t-de-i-ru
 T-TOP now one.CL-GEN suit-ACC buy-OP-be-PRS
 'Takashi is now buying a suit.'
 ☆ 'Takashi bought a suit.'

An example of an atelic verb stem containing /a/ is *mát*- 'wait'. This verb stem is infelicitous with a time-span adverb 'in x time' (145a), but it is felicitous with a durative adverb 'for x time' (145b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is cancellable (145c). The verb stem in the progressive entails that the eventuality took place in the past (145d).

- (145) a. Taro-wa (*gohunde) itido hitori-no yuuzin-o m<u>á</u>t-ta T.-TOP in.5.minute once one.CL-GEN friend-ACC wait-PST 'Taro waited for a friend once (*in five minutes).'
 - b. Taro-wa (gohunnoaida) itido hitori-no yuuzin-o m<u>á</u>t-ta T.-TOP for.5.minute once one.CL-GEN friend -ACC wait-PST 'Taro waited for a friend once (for five minutes).'
 - c. Taro-wa kuzi-tyoodo-ni itido hitori-no yuuzin-o m $\underline{\acute{a}}$ t-ta T.-TOP 9.0'clock-sharp-at once one.CL-GEN friend-ACC wait-PST = 'Taro started waiting for a friend once at nine sharp.'

zissai, Taro-wa kuzi-han-ni mada sono yuuzin-o $m\underline{\acute{a}}t$ -te-i-ta in.fact T.-TOP 9-half-at still that friend-ACC wait-OP-be-PST lit. 'in fact, Taro was still waiting for the friend at 9:30.' = 'Taro had been waiting for the friend since nine.' d. Taro-wa ima hitori-no yuuzin-o m<u>á</u>t-te-i-ru T.-TOP now one.CL-GEN friend-ACC wait-OP-be-PRS 'Taro is now waiting for a friend.' \rightarrow 'Taro waited for a friend.'

2.3.1.4. Summary of monosyllabic transitive verbs

In this section, I have shown that in monosyllabic transitive verbs, the quality of the non-low vowels functions as a predictor of verbal telicity. In particular, /e/ and /u/ are only found in the context of telic verbs, as schematized in (146), while /i/ and /o/ are only found in the context of atelic verbs, as in (147). In contrast, /a/ has no fixed telicity value, as in (148). The correspondence was demonstrated with the four telicity tests.

(146)
$$\begin{bmatrix} verb stem \\ / (C) \\ verb stem \\ / (C) \\ | \\ / (e/, /u/) \\ | \\ telic \\ \end{bmatrix}$$

2.3.2. Bisyllabic transitive verbs

In this subsection, we consider bisyllabic transitive verbs. I demonstrate that there is again a strict correspondence between the quality of the non-low vowels and verbal telicity. In particular, it is the rightmost vowel which functions as a predictor of verbal telicity in this case. The quality of the first vowel, on the other hand, has no effect on the telicity. The correspondence is identified across all possible syllable structures (VV, CVV, VCV, VVC, CVCV, CVVC, VCVC, and CVCVC).



2.3.2.1. Bisyllabic verbs containing /e/ or /u/ as their second vowel are telic

All of the verb stems containing either /e/ or /u/ as the second vowel are telic. Such telic verbs are felicitous with a time-span adverb 'in x time'. In contrast, they test negatively in the three atelicity tests: they are infelicitous with a durative adverb 'for x time', they are infelicitous with a punctual adverb 'at x time', and they have no past entailment in the progressive.

2.3.2.1.1. Bisyllabic verbs with /e/ as their second vowel are telic

All verbs with /e/ as their second vowel are telic. Verb stems containing /e/ are attested with CVCVC template. There are four verb stems containing /e/, as shown below.

				Diagnostics for (a)telicity			
Syllable	Present	Past	Gloss	in	for	at	past entailment
	tunér-u	tunét-ta	pinch	Yes	No	No	No
CVCeC	hinér-u	hinét-ta	twist	Yes	No	No	No
	syabér-u	syabét-ta	chatter	Yes	No	No	No
	sesér-u	sesét-ta	fool/pick	Yes	No	No	No

(150) CVCeC verb stems (n=4)

An example of such a verb stem is *tunét*- 'pinch'. This verb stem is felicitous with a time-span adverb 'in x time' (151a), but it is infelicitous with a durative adverb 'for x time' (151b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is non-cancellable (151c). The verb stem in the progressive does not entail that the eventuality took place in the past (151d).

- (151) a. Taro-wa (gohunde) ikkai Meari-no ude-o tun<u>é</u>t-ta T.-TOP in.5.minute once M.-GEN arm-ACC pinch-PST 'Taro pinched Mary's arm once (in five minutes).'
 - b. Taro-wa (*gohunnoaida) ikkai Meari-no ude-o tun<u>é</u>t-ta T.-TOP for.5.minute once M.-GEN arm -ACC pinch-PST 'Taro pinched Mary's arm once (*for five minutes).'

c.	Taro-wa kuzi-tyoodo-ni ikkai Meari-no ude-o tun <u>é</u> t-ta							
	TTOP 9.o'clock-sharp-at once MGEN arm-ACC pinch-PST							
	 = 'Taro finished pinching Mary's arm once at nine sharp.' ≠ 'Taro started pinching Mary's arm once at nine sharp.' 							
	*zissai, Taro-wa kuzi-han-nimada Meari-no ude-o tun <u>é</u> t-te-i-ta in fact T-TOP 9-half-at still M-GEN arm-ACC ninch-OP-he-PST							
	lit. *'in fact, Taro was still pinching Mary's arm at 9:30.'							
d.	Taro-wa ima Meari-no ude-o tun <u>é</u> t-te-i-ru							
	TTOP now M GEN arm-ACC pinch-OP-be-PRS							
	'Taro is now pinching Mary's arm.'							
	★ 'Taro pinched Mary's arm.'							

2.3.2.1.2. Bisyllabic verbs with /u/ as their second vowel are telic

All verbs with /u/ as their second vowel are telic, independent of the syllable structures and of the quality of the first vowel. Verb stems containing /u/ are attested with VCVC and CVCVC templates. There are three VCVC verb stems containing /u/, as shown below.

				Diagnostics for (a)telicity			
Syllable	Present	Past	Gloss	in	for	at	past entailment
	okur-u	okut-ta	send	Yes	No	No	No
VCuC	egúr-u	egút-ta	gouge	Yes	No	No	No
	abúr-u	abút-ta	roast	Yes	No	No	No

(152) VCuC verb stems (n=3)

An example of such a verb stem is *okut-* 'send'. This verb stem is felicitous with a time-span adverb 'in x time' (153a), but it is infelicitous with a durative adverb 'for x time' (153b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is non-cancellable (153c). The verb stem in the progressive does not entail that the eventuality took place in the past (153d).

- (153) a. Taro-wa (gohunde) Meari-ni ikkai ittuu-no iimeiru-o ok<u>u</u>t-ta T.-TOP in.5.minute Mary-DAT once one.CL-GEN email-ACC send-PST 'Taro sent an email to Mary once (in five minutes).'
 - b. Taro-wa (*gohunnoaida) ikkai Meari-ni ittuu-no iimeiru-o ok<u>u</u>t-ta T.-TOP for.5.minute once M.-DAT one.CL-GEN email -ACC send-PST 'Taro sent an email to Mary once (*for five minutes).'
c. Taro-wa kuzi-tyoodo-ni ikkai Meari-ni ittuu-no iimeiru-o ok \mathbf{u} t-ta T.-TOP 9.0'clock-sharp-at once M.-DAT one.CL-GEN email-ACC send-PST = 'Taro finished sent an email to Mary once at nine sharp.' \neq 'Taro started sending an email to Mary once at nine sharp.'

*zissai, Taro-wa kuzi-han-nimada sono iimeiru-o ok<u>u</u>t-te-i-ta in.fact T.-TOP 9-half-at still that email-ACC send-OP-be-PST lit. '*in fact, Taro was still sending that email to Mary at 9:30.'

d. Taro-wa ima Meari-ni ittuu-no iimeiru-o ok<u>u</u>t-te-iru
 T.-TOP now M.-DAT one.CL-GEN email-ACC send-OP-be-PRS
 'Taro is now sending an email to Mary.'
 → 'Taro sent an email to Mary.'

There are 28 CVCVC verb stems containing /u/, as shown in (154).

				Diagno	stics for	(a)telicity	
Syllable	Present	Past	Gloss	in	for	at	past entailment
	tikúr-u	tikút-ta	inform	Yes	No	No	No
	sikúm-u	sikún-da	plan	Yes	No	No	No
	kosúr-u	kosút-ta	scrub	Yes	No	No	No
	kezur-u	kezut-ta	whittle	Yes	No	No	No
	mekur-u	mekut-ta	leaf (a page)	Yes	No	No	No
	megur-u	megut-ta	go round	Yes	No	No	No
	megum-u	megun-da	give generously	Yes	No	No	No
	kukur-u	kukut-ta	tie together	Yes	No	No	No
	susur-u	susut-ta	sip	Yes	No	No	No
	tukúr-u	tukút-ta	make	Yes	No	No	No
CVCuC	tudur-u	tudut-ta	spell	Yes	No	No	No
Cveue	yusur-u	yusut-ta	swing	Yes	No	No	No
	sukuw-u	sukut-ta	scoop	Yes	No	No	No
	nuguw-u	nugut-ta	wipe	Yes	No	No	No
	tutúm-u	tutún-da	wrap	Yes	No	No	No
	nusúm-u	nusún-da	rob	Yes	No	No	No
	kurúm-u	kurún-da	roll	Yes	No	No	No
	musub-u	musun-da	knot	Yes	No	No	No
	kasúr-u	kasút-ta	graze	Yes	No	No	No
	sagur-u	sagut-ta	search	Yes	No	No	No
	sasur-u	sasut-ta	rub	Yes	No	No	No
	nagúr-u	nagút-ta	punch	Yes	No	No	No
	nasúr-u	nasút-ta	rub on	Yes	No	No	No
	nabúr-u	nabút-ta	mock at	Yes	No	No	No
	makur-u	makut-ta	roll up	Yes	No	No	No
	matur-u	matut-ta	offer (honorific)	Yes	No	No	No
	tagúr-u	tagút-ta	haul	Yes	No	No	No
	hazum-u	hazun-da	bound	Yes	No	No	No

(154) CVCuC verb stems (n=28)

An example of such a verb stem is *megut-* 'go round'. This verb stem is felicitous with a timespan adverb 'in x time' (155a), but it is infelicitous with a durative adverb 'for x time' (155b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is non-cancellable (155c). The verb stem in the progressive does not entail that the eventuality took place in the past (155d).

- (155) a. Taro-wa (gohunde) itido hitotu-no meiro-o me<u>gu</u>t-ta T.-TOP in.5.minute once one.CL-GEN maze-ACC go.round-PST 'Taro went around a maze once (in five minutes).'
 - b. Taro-wa (*gohunnoaida) itido hitotu-no meiro-o meg<u>u</u>t-ta T.-TOP for.5.minute once one.CL-GEN friend -ACC go.round-PST 'Taro went around a maze once (*for five minutes).'
 - c. Taro-wa kuzi-tyoodo-ni itido hitotu-no meiro-o meg<u>u</u>t-ta T.-TOP 9.0'clock-sharp-at once one.CL-GEN friend-ACC go.round-PST = 'Taro finished going round a maze once at nine sharp.' \neq 'Taro started going around a maze once at nine sharp.'

*zissai, Taro-wa kuzi-han-nimada sono meiro-o me<u>gu</u>t-te-i-ta in.fact T.-TOP 9-half-at still that maze-ACC go.round-OP-be-PST lit. '*in fact, Taro was still going round that maze at 9:30.'

d. Taro-wa ima hitotu-no meiro-o meg<u>u</u>t-te-i-ru
 T.-TOP now one.CL-GEN maze-ACC go.round-OP-be-PRS
 'Taro is now going around a maze.'
 ☆ 'Taro went around a maze.'

2.3.2.2. Bisyllabic verbs containing /i/ or /o/ as their second vowel are atelic

All of the verb stems containing either i/o or o/o as the second vowel are atelic. Such atelic verbs are infelicitous with a time-span adverb 'in x time'. In contast, they test positively in the three atelicity tests: they are felicitous with a durative adverb 'for x time', they are felicitous with a punctual adverb 'at x time', and they have past entailment in the progressive.

2.3.2.2.1. Bisyllabic verbs with /i/ as their second vowel are atelic

/i/ in Vowel 2 corresponds to an atelic interpretation, regardless of syllable type and the quality of Vowel 1. Verb stems containing /i/ are attested in VV, CVV, CVCV, VCVC, and CVCVC forms. With VV template, there is a verb stem containing /i/, *oi*- 'put'.

(156) Vi verb stems (n=1)

				Diagnostics for (a)telicity					
Syllable	Present	Past	Gloss	in	for	at	past entailment		
Vi	ok-u	oi-ta	put	No	Yes	Yes	Yes		

The verb stem is infelicitous with a time-span adverb 'in x time' (157a), but it is felicitous with a durative adverb 'for x time' (157b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is cancellable (157c). The verb stem in the progressive entails that the eventuality took place in the past (157d).

- (157) a. Taro-wa (*gohunde) ikkai tukue-no ue-ni issatu-no hon-o o<u>i</u>-ta
 T.-TOP in.5.minute once desk-GEN up-DAT one.CL-GEN book-ACC put-PST
 'Taro put a book on the desk once (*in five minutes).'
 - b. Taro-wa (gohunnoaida) ikkai tukue-no ue-ni issatu-no hon-o o<u>i</u>-ta T.-TOP for.5.minute once desk-GEN up-DAT one.CL-GEN book-ACC put-PST 'Taro put a book on the desk once (for five minutes).'
 - c. Taro-wa kuzi-tyoodo-ni ikkai tukue-no ue-ni issatu-no hon-o o<u>i</u>-ta T.-TOP 9-sharp-at once desk-GEN up-DAT 1.CL-GEN book-ACC put-PST = 'Taro started putting a book on the desk once at nine sharp.'

zissai, Taro-wa kuzi-han-ni mada tukue-no ueni in.fact T.-TOP 9-half-at still desk-GEN up-DAT

sono hon-o o<u>i</u>-te-i-ta that book-ACC put-OP-be-PST lit. 'in fact, Taro was still putting that book on the desk at 9:30.' = 'Taro had been putting a book on the desk since nine.'

d. Taro-wa ima tukue-no ue-ni issatu-no hon-o o<u>i</u>-te-i-ru T.-TOP now desk-GEN up-DAT one.CL-GEN book-ACC put-OP-be-PRS 'Taro is now putting a book on the desk.' \rightarrow 'Taro put a book on the desk.'

With CVV template, there are 25 verb stems containing /i/ which vary in the quality of Vowel 1, as shown in (158).

				Diagn	ostics fo	or (a)teli	city
Syllable	Present	Past	Gloss	in	for	at	past entailment
	kik-u	kii-ta	listen to	No	Yes	Yes	Yes
	sik-u	sii-ta	lay	No	Yes	Yes	Yes
	hik-u	hii-ta	pull	No	Yes	Yes	Yes
	siír-u	síi-ta	force	No	Yes	Yes	Yes
	kók-u	kói-ta	excrete	No	Yes	Yes	Yes
	tók-u	tói-ta	dissolve,melt	No	Yes	Yes	Yes
	dok-u	doi-ta	pull back	No	Yes	Yes	Yes
CVi	nok-u	noi-ta	pull back	No	Yes	Yes	Yes
CVI	suk-u	sui-ta	plow	No	Yes	Yes	Yes
	suk-u	sui-ta	like	No	Yes	Yes	Yes
	nuk-u	nui-ta	unplug	No	Yes	Yes	Yes
	húk-u	húi-ta	blow	No	Yes	Yes	Yes
	huk-u	hui-ta	sweep	No	Yes	Yes	Yes
	muk-u	mui-ta	face	No	Yes	Yes	Yes
	muk-u	mui-ta	show one's fangs	No	Yes	Yes	Yes
	kúir-u	kúi-ta	regret	No	Yes	Yes	Yes
	kák-u	kái-ta	write	No	Yes	Yes	Yes
	sak-u	sai-ta	bloom	No	Yes	Yes	Yes
	sák-u	sái-ta	tear	No	Yes	Yes	Yes
	tak-u	tai-ta	make a fire	No	Yes	Yes	Yes
	nak-u	nai-ta	cry	No	Yes	Yes	Yes
	hák-u	hái-ta	sweep	No	Yes	Yes	Yes
	mak-u	mai-ta	roll	No	Yes	Yes	Yes
	mák-u	mái-ta	seed	No	Yes	Yes	Yes
	yak-u	yai-ta	burn	No	Yes	Yes	Yes

(158) CVi verb stems (n=25)

An example of such a verb stem is $k\dot{u}i$ - 'regret'. This verb stem is infelicitous with a time-span adverb 'in x time' (159a), but it is felicitous with a durative adverb 'for x time' (159b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is cancellable (159c). The verb stem in the progressive entails that the eventuality took place in the past (159d).

- (159) a. Taro-wa (*gohunde) ikkai hitotu-no ayamati-o kú<u>i</u>-ta
 T.-TOP in.5.minute once one.CL-GEN fault-ACC regret-PST
 'Taro regretted a fault once (*in five minutes).'
 - b. Taro-wa (gohunnoaida) ikkai hitotu-no ayamati-o kú<u>i</u>-ta T.-TOP for.5.minute once one.CL-GEN fault-ACC regret-PST 'Taro regretted a fault once (for five minutes).'

c. Taro-wa kuzi-tyoodo-ni ikkai hitotu-no ayamati-o kú<u>i</u>-ta T.-TOP 9.0'clock-sharp-at once one.CL-GEN fault-ACC regret-PST = 'Taro started regretting a fault once at nine sharp.'

zissai, Taro-wa kuzi-han-ni mada sono ayamati-o kú<u>i</u>-te-i-ta in.fact T.-TOP 9-half-at still that fault-ACC regret-OP-be-PST lit. 'in fact, Taro was still regretting a fault at 9:30.' = 'Taro had been regretting a fault since nine.'

d. Taro-wa ima ikkai hitotu-no ayamati-o kúi-te-iru
 T.-TOP now once one.CL-GEN fault-ACC regret-OP-be-PRS
 'Taro is now regretting a fault once.'
 → 'Taro regretted a fault.'

With VCV template, there are two verb stems containing /i/, as shown below.

(160) VCi verb stems (n=2)

				Diagn	ostics for	у	
Syllable	Present	Past	Gloss	in	for	at	past entailment
VCi	óbir-u	óbi-ta	take on	No	Yes	Yes	Yes
	abir-u	abi-ta	bathe	No	Yes	Yes	Yes

An example of such a verb stem is *óbi*- 'carry'. This verb stem is infelicitous with a time-span adverb 'in x time' (161a). Meanwhile, it is felicitous with a durative adverb 'for x time' (161b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is cancellable (161c). The verb stem in the progressive entails that the eventuality took place in the past (161d).

- (161) a. Taro-wa (*gohunde) ikkai ippon-no katana-o ób<u>i</u>-ta T.-TOP in.5.minute once one.CL-GEN sword-ACC carry-PST 'Taro carried a sword once (*in five minutes).'
 - b. Taro-wa (gohunnoaida) ikkai ippon-no katana-o ób<u>i</u>-ta T.-TOP for.5.minute once one.CL-GEN sword-ACC carry-PST 'Taro carried a sword once (for five minutes).'

c. Taro-wa kuzi-tyoodo-ni ikkai ippon-no katana-o ób<u>i</u>-ta T.-TOP 9.0'clock-sharp-at once one.CL-GEN sword-ACC carry-PST = 'Taro started carrying a sword once at nine sharp.'

zissai, Taro-wa kuzi-han-ni mada sono katana-o ób<u>i</u>-te-i-ta in.fact T.-TOP 9-half-at still that sword-ACC carry-OP-be-PST lit. 'in fact, Taro was still carrying a sword at 9:30.' = 'Taro had been carrying a sword since nine.'

d. Taro-wa ima ikkai ippon-no katana-o óbi-te-i-ru
 T.-TOP now once one.CL-GEN sword-ACC carry-OP-be-PRS
 'Taro is now carrying a sword once.'
 → 'Taro carried a sword.'

With CVCV template, there are nine verb stems containing /i/, as shown below.

				Diagn	ostics fo	or (a)teli	city
Syllable	Present	Past	Gloss	in	for	at	past entailment
	mús-u	músi-ta	steam	No	Yes	Yes	Yes
	kas-u	kasi-ta	lend	No	Yes	Yes	Yes
	sás-u	sási-ta	stub	No	Yes	Yes	Yes
CVCi	tas-u	tasi-ta	add	No	Yes	Yes	Yes
	dás-u	dási-ta	put out	No	Yes	Yes	Yes
	nás-u	nási-ta	perform	No	Yes	Yes	Yes
	házir-u	házi-ta	be ashamed of	No	Yes	Yes	Yes
	wabir-u	wabi-ta	apologize	No	Yes	Yes	Yes
	karir-u	kari-ta	borrow	No	Yes	Yes	Yes

(162) *CVCi* verb stems (n=9)

An example of such a verb stem is *músi*- 'steam'. This verb stem is infelicitous with a time-span adverb 'in x time' (163a), but it is felicitous with a durative adverb 'for x time' (163b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is cancellable (163c). The verb stem in the progressive entails that the eventuality took place in the past (163d).

(163) a. Taro-wa (*gohunde) ikkai hitotu-no mús**i-**ta manzyu-o T.-TOP in.5.minute once one.CL-GEN bun-ACC steam-PST 'Taro steamed a bun once (*in five minutes).' b. Taro-wa (gohunnoaida) ikkai hitotu-no mús**i**-ta manzyu-o T.-TOP for.5.minute one.CL-GEN bun-ACC steam-PST once 'Taro steamed a bun once (for five minutes).'

c. Taro-wa kuzi-tyoodo-ni ikkai hitotu-no manzyu-o mús<u>i</u>-ta T.-TOP 9.0'clock-sharp-at once one.CL-GEN bun-ACC steam-PST = 'Taro started steaming a bun once at nine sharp.'

zissai, Taro-wa kuzi-han-ni mada sono manzyu-o mús<u>i</u>-te-i-ta in.fact T.-TOP 9-half-at still that bun-ACC steam-OP-be-PST lit. 'in fact, Taro was still steaming a bun at 9:30.' = 'Taro had been steaming a bun since nine.'

d. Taro-wa ima ikkai hitotu-no manzyu-o mús<u>i</u>-te-i-ru
 T.-TOP now once one.CL-GEN bun-ACC steam-OP-be-PRS
 'Taro is now steaming a bun once.'
 → 'Taro steamed a bun.'

With VCVC template, there is a single verb stem containing /i/, *izir*- 'finger'.

(164) VCiC verb stems (n=1)

				Diagnostics for (a)telicity					
Syllable	Present	Past	Gloss	in	for	at	past entailment		
VCiC	izír-u	izít-ta	finger	No	Yes	Yes	Yes		

The verb stem is infelicitous with a time-span adverb 'in x time' (165a), but it is felicitous with a durative adverb 'for x time' (165b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is cancellable (165c). The verb stem in the progressive entails that the eventuality took place in the past (165d).

- (165) a. Taro-wa (*gohunde) ikkai ippiki-no ari-o iz<u>í</u>t-ta T.-TOP in.5.minute once one.CL-GEN ant-ACC finger-PST 'Taro fingered an ant once (*in five minutes).'
 - b. Taro-wa (gohunnoaida) ikkai ippiki-no ari-o iz<u>í</u>t-ta T.-TOP for.5.minute once one.CL-GEN ant-ACC finger-PST 'Taro fingered an ant once (for five minutes).'
 - c. Taro-wa kuzi-tyoodo-ni ikkai ippiki-no ari-o iz<u>í</u>t-ta T.-TOP 9.o'clock-sharp-at once one.CL-GEN ant-ACC finger-PST = 'Taro started fingering an ant once at nine sharp.'

zissai, Taro-wa kuzi-han-ni mada sono ari-o izít-te-i-ta in.fact T.-TOP 9-half-at still that ant-ACC finger-OP-be-PST lit. 'in fact, Taro was still fingering an ant at 9:30.' = 'Taro had been fingering an ant since nine.' d. Taro-wa ima ikkai ippiki-no ari-o iz<u>í</u>t-te-i-ru
 T.-TOP now once one.CL-GEN ant-ACC finger-OP-be-PRS
 'Taro is now fingering an ant once.'
 → 'Taro fingered an ant.'

With CVCVC template, there are 14 verb stems containing /i/ which vary in the quality of Vowel 1, as shown below.

				Diagn	ostics f	for (a)tel	licity
Syllable	Present	Past	Gloss	in	for	at	past entailment
	tigír-u	tigít-ta	cut into pieces	No	Yes	Yes	Yes
	sikír-u	sikít-ta	compart	No	Yes	Yes	Yes
	mikír-u	mikít-ta	forsake	No	Yes	Yes	Yes
	misír-u	misít-ta	acquaint	No	Yes	Yes	Yes
arraia	kogír-u	kogít-ta	cut into small pieces	No	Yes	Yes	Yes
CVC1C	kozír-u	kozít-ta	wrench	No	Yes	Yes	Yes
	segír-u	segít-ta	dam	No	Yes	Yes	Yes
	negír-u	negít-ta	beat down	No	Yes	Yes	Yes
	nezír-u	nezít-ta	twist	No	Yes	Yes	Yes
	musir-u	musit-ta	pluck	No	Yes	Yes	Yes
	kagír-u	kagít-ta	limit	No	Yes	Yes	Yes
	kazír-u	kazít-ta	gnaw	No	Yes	Yes	Yes
	nazír-u	nazít-ta	rebuke	No	Yes	Yes	Yes
	hasír-u	hasít-ta	run on	No	Yes	Yes	Yes

(166)	CVCiC verb stems	(n=14)
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An example of such a verb stem is *segit*- 'dam'. This verb stem is infelicitous with a time-span adverb 'in x time' (167a), but it is felicitous with a durative adverb 'for x time' (167b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is cancellable (167c). The verb stem in the progressive entails that the eventuality took place in the past (167d).

- (167) a. Taro-wa (*gohunde) ikkai ippon-no ogawa-o segít-ta T.-TOP in.5.minute once one.CL-GEN stream-ACC dam-PST 'Taro dammed a stream once (*in five minutes).'
 - b. Taro-wa (gohunnoaida) ikkai ippon-no ogawa-o seg<u>í</u>t-ta T.-TOP for.5.minute once one.CL-GEN stream-ACC dam-PST 'Taro dammed a stream once (for five minutes).'

c. Taro-wa kuzi-tyoodo-ni ikkai ippon-no ogawa-o seg<u>í</u>t-ta T.-TOP 9.0'clock-sharp-at once one.CL-GEN stream-ACC dam-PST = 'Taro started damming a stream once at nine sharp.'

zissai, Taro-wa kuzi-han-ni mada sono ogawa-o se<u>gí</u>t-te-i-ta in.fact T.-TOP 9-half-at still that stream-ACC dam-OP-be-PST lit. 'in fact, Taro was still damming a stream at 9:30.' = 'Taro had been damming a stream since nine.'

d. Taro-wa ima ikkai ippon-no ogawa-o segít-te-i-ru
 T.-TOP now once one.CL-GEN stream-ACC dam-OP-be-PRS
 'Taro is now daming a stream once.'
 → 'Taro dammed a stream.'

2.3.2.2.2. Bisyllabic verbs with /o/ as their second vowel are atelic

/o/ in Vowel 2 corresponds to an atelic interpretation across syllable structures. Verb stems containing /i/ are attested in VVC, CVVC, VCVC, and CVCVC forms. There are two VVC verb stems, as shown below.

(168) *VoC* verb stems (n=2)

				Diagnostics for (a)telicity				
Syllable	Present	Past	Gloss	in	for	at	past entailment	
VoC	oow-u	oot-ta	cover	No	Yes	Yes	Yes	
	aór-u	aót-ta	agitate	No	Yes	Yes	Yes	

An example of such a verb stem is *oot*- 'cover'. This verb stem is infelicitous with a time-span adverb 'in x time' (169a), but it is felicitous with a durative adverb 'for x time' (169b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is cancellable (169c). The verb stem in the progressive entails that the eventuality took place in the past (169d).

- (169) a. Taro-wa (*gohunde) ikkai siito-de itidai-no kuruma-o o<u>o</u>t-ta
 T.-TOP in.5.minute once sheet-at one.CL-GEN car-ACC cover-PST
 'Taro covered a car with the sheet once (*in five minutes).'
 - b. Taro-wa (gohunnoaida) ikkai siito-de itidai-no kuruma-o o<u>o</u>t-ta T.-TOP for.5.minute once sheet-at one.CL-GEN car-ACC cover-PST 'Taro covered a car with the sheet once (for five minutes).'

c. Taro-wa kuzi-tyoodo-ni ikkai siito-de itidai-no kuruma-o o<u>o</u>t-ta T.-TOP 9.o'clock-sharp-at once sheet-at one.CL-GEN car-ACC cover-PST = 'Taro started covering a car with the sheet at nine sharp.'

zissai, Taro-wa kuzi-han-ni mada siito-de sono kuruma-o o \underline{o} t-te-i-ta in.fact T.-TOP 9-half-at still sheet-at that car-ACC cover-OP-be-PST lit. 'in fact, Taro was still covering that car with the sheet at 9:30.' = 'Taro had been covering a car with the sheet since nine.'

d. Taro-wa ima siito-de itidai-no kuruma-o o<u>o</u>t-te-i-ru T.-TOP now sheet-at one.CL-GEN car-ACC cover-OP-be-PRS 'Taro is now covering a car with the sheet.' \rightarrow 'Taro covered a car with the sheet.'

With CVVC template, there are two verb stems containing /o/, as shown below.

(170) *CVoC* verb stems (n=2)

				Diagnostics for (a)telicity				
Syllable	Present	Past	Gloss	in	for	at	past entailment	
CVoC	seó-u	seót-ta	shoulder	No	Yes	Yes	Yes	
	haór-u	haót-ta	put on	No	Yes	Yes	Yes	

An example of such a verb stem is *seót*- 'shoulder'. This verb stem is infelicitous with a timespan adverb 'in x time' (171a), but it is felicitous with a durative adverb 'for x time' (171b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is cancellable (171c). The verb stem in the progressive entails that the eventuality took place in the past (171d).

- (171) a. Taro-wa (*gohunde) ikkai hitori-no rooba-o se<u>ó</u>t-ta
 T.-TOP in.5.minute once one.CL-GEN old.lady-ACC shoulder-PST
 'Taro shouldered an old lady once (*in five minutes).'
 - b. Taro-wa (gohunnoaida) ikkai hitori-no rooba-o se<u>ó</u>t-ta T.-TOP for.5.minute once one.CL-GEN old.lady-ACC shoulder-PST 'Taro shouldered an old lady once (for five minutes).'

c. Taro-wa kuzi-tyoodo-ni ikkai hitori-no rooba-o se \underline{o} t-ta T.-TOP 9.0'clock-sharp-at once one.CL-GEN old.lady-ACC shoulder-PST = 'Taro started shouldering an old lady at nine sharp.'

zissai, Taro-wa kuzi-han-ni mada sono rooba-o se<u>ó</u>t-te-i-ta in.fact T.-TOP 9-half-at still that old.lady-ACC shoulder-OP-be-PST lit. 'in fact, Taro was still shouldering that old lady at 9:30.' = 'Taro had been shouldering an old lady since nine.'

d. Taro-wa ima hitori-no rooba-o se<u>ó</u>t-te-i-ru T.-TOP now one.CL-GEN old.lady-ACC shoulder-OP-be-PRS 'Taro is now shouldering an old lady.' \rightarrow 'Taro shouldered an old lady.'

With VCVC template, there are six verb stems, as shown below.

				Diagnostics for (a)telicity						
Syllable	Present	Past	Gloss	in	for	at	past entailment			
	inór-u	inót-ta	wish	No	Yes	Yes	Yes			
	idóm-u	idón-da	challenge	No	Yes	Yes	Yes			
VCoC	ogor-u	ogot-ta	be proud	No	Yes	Yes	Yes			
	osow-u	osot-ta	strike	No	Yes	Yes	Yes			
	odor-u	odot-ta	dance	No	Yes	Yes	Yes			
	omów-u	omót-ta	think	No	Yes	Yes	Yes			

(172) *VCoC* verb stems (n=6)

An example of such a verb stem is *inót*- 'wish'. This verb stem is infelicitous with a time-span adverb 'in x time' (173a), but it is felicitous with a durative adverb 'for x time' (173b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is cancellable (173c). The verb stem in the progressive entails that the eventuality took place in the past (173d).

- (173) a. Taro-wa (*gohunde) ikkai hitotu-no seikoo-o in<u>ó</u>t-ta T.-TOP in.5.minute once one.CL-GEN success-ACC wish-PST 'Taro wished for a success once (*in five minutes).'
 - b. Taro-wa (gohunnoaida) ikkai hitotu-no seikoo-o in<u>ó</u>t-ta T.-TOP for.5.minute once one.CL-GEN success-ACC wish-PST 'Taro wished for a success once (for five minutes).'

c. Taro-wa kuzi-tyoodo-ni ikkai hitotu-no seikoo-o in \underline{o} t-ta T.-TOP 9.0'clock-sharp-at once one.CL-GEN success-ACC wish-PST = 'Taro started wishing for a success at nine sharp.'

zissai, Taro-wa kuzi-han-ni mada sono seikoo-o in $\underline{6}$ t-te-i-ta in.fact T.-TOP 9-half-at still that success-ACC wish-OP-be-PST lit. 'in fact, Taro was still wishing for that success at 9:30.' = 'Taro had been wishing for a success since nine.'

d. Taro-wa ima hitotu-no seikoo-o in<u>ó</u>t-te-i-ru
 T.-TOP now one.CL-GEN success-ACC wish-OP-be-PRS
 'Taro is now wishing for a success.'
 → 'Taro wished for a success.'

With CVCVC template, there are 20 verb stems, as shown below.

				Diagr	ostics fo	or (a)teli	city
Syllable	Present	Past	Gloss	in	for	at	past entailment
	kikóm-u	kikón-da	wear (extra clothes)	No	Yes	Yes	Yes
	sikóm-u	sikón-da	train	No	Yes	Yes	Yes
	nikóm-u	nikón-da	stew	No	Yes	Yes	Yes
	mikom-u	mikon-da	estimat	No	Yes	Yes	Yes
	metór-u	metót-ta	marry	No	Yes	Yes	Yes
CVCoC	tunór-u	tunót-ta	collect	No	Yes	Yes	Yes
CVCOC	nanór-u	nanót-ta	give one's name	No	Yes	Yes	Yes
	mamór-u	mamót-ta	guard	No	Yes	Yes	Yes
	tamót-u	tamót-ta	hold	No	Yes	Yes	Yes
	kamór-u	kamót-ta	pull a fast one on	No	Yes	Yes	Yes
	tadór-u	tadót-ta	track back	No	Yes	Yes	Yes
	sator-u	satot-ta	realize	No	Yes	Yes	Yes
	tayór-u	tayót-ta	rely on	No	Yes	Yes	Yes
	nazór-u	nazót-ta	trace	No	Yes	Yes	Yes
	kakow-u	kakot-ta	enclose	No	Yes	Yes	Yes
	sasow-u	sasot-ta	entice	No	Yes	Yes	Yes
	matów-u	matót-ta	robe	No	Yes	Yes	Yes
	yatów-u	yatót-ta	hire	No	Yes	Yes	Yes
	kakom-u	kakon-da	enclose	No	Yes	Yes	Yes
	nagóm-u	nagón-da	relax	No	Yes	Yes	Yes

(174) CVCoC verb stems (n=20)

An example of such a verb stem is *mamót*- 'guard'. This verb stem is infelicitous with a timespan adverb 'in x time' (175a), but it is felicitous with a durative adverb 'for x time' (175b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is cancellable (175c). The verb stem in the progressive entails that the eventuality took place in the past (175d).

- (175) a. Taro-wa (*gohunde) ikkai hitori-no kodomo-o mam<u>ó</u>t-ta
 T.-TOP in.5.minute once one.CL-GEN child-ACC guard-PST
 'Taro guarded a child once (*in five minutes).'
 - b. Taro-wa (gohunnoaida) ikkai hitori-no kodomo-o mam<u>ó</u>t-ta T.-TOP for.5.minute once one.CL-GEN child-ACC guard-PST 'Taro guarded a child once (for five minutes).'
 - c. Taro-wa kuzi-tyoodo-ni ikkai hitori-no kodomo-o mam \underline{o} t-ta T.-TOP 9.0'clock-sharp-at once one.CL-GEN child-ACC guard-PST = 'Taro started guarding a child at nine sharp.'

zissai, Taro-wa kuzi-han-ni mada sono kodomo-o mam<u>ó</u>t-te-i-ta in.fact T.-TOP 9-half-at still that child-ACC guard-OP-be-PST lit. 'in fact, Taro was still guarding that child at 9:30.' = 'Taro had been guarding a child since nine.'

d. Taro-wa ima hitori-no kodomo-o mam \underline{o} t-te-i-ru T.-TOP now one.CL-GEN child-ACC guard-OP-be-PRS 'Taro is now guarding a child.' \rightarrow 'Taro guarded a child.'

I have shown that in the existing bisyllabic transitive verb stems, the quality of the nonlow vowels functions as a predictor of verbal telicity. In particular, this vowel-telicity correspondence is position sensitive, namely, in the second syllable of the bisyllabic verb stem, but not in the first syllable. The telic verb stems contain either /e/ or /u/ in the second syllable, while the atelic verb stems contain either /i/ or /o/ in the second syllable. This correspondence between the non-low vowels and verbal telicity is thorough in the second syllable of the existing bisyllabic verb stems. Given that vowel quality corresponds to verbal telicity in the monosyllabic verb stems, the rightmost vowel plays a crucial role in determining verbal telicity in Y-J verb stems. The telicity of the verb stem is not affected by the moraicity of the second syllable: both telic and atelic vowels are dominantly distributed in the bimoraic form, as shown in (176).¹⁵

¹⁵ Notice again that /u/ and /o/ never occur in the monomoraic rightmost syllable of the verb stem. See footnote 9 for why we do not have cases where /e/ does not occur in the monomoraic second syllable of the bisyllabic transitive verb stems.

		Monomoraic (n=3	Bimoraic verb stems (n=80)				
		V (n=26)	CV (n=11)	VC (n=4)		CV (n=	VC 76)
Telicity	Vowel	•		Co	da	Co	oda
				/t/	/n/	/t/	/n/
Telic	/e/ (n=4)	-	-	-	-	4	-
	/u/ (n=31)	-	-	-	-	24	7
Atelic	/i/ (n=52)	26	11	-	-	15	-
	/o/ (n=30)	-	-	4	-	19	7

(176) The distribution of the bisyllabic verb stems in moraicity of the second syllable

Regarding the consonant quality of the second syllable, we do not see any difference in distribution of the telic and the atelic vowels, either, as shown in (177).¹⁶ It is true that within the second syllable, the telic vowels /e, u/ always occur with an onset consonant while the atelic vowels /i, o/ do not. However, this co-occurrence is accidental given that the telic vowels /e, u/ occur without an onset in some of the monosyllabic verb stems (see (139)).

		Bi (n	labial =10)			Alveolar (n=47)			Coronal (n=30)		Glottal	no onset (n=30)			
		m (n=4)	b (n=6)	w	t (n=6)	d (n=4)	s (n=20)	z (n=9)	n (n=3)	r (n=5)	j	k (n=16)	g (n=14)	h	
Telic	/e/	-	1	-	-	-	1	-	2	-	-	-	-	-	-
	/u/	-	2	-	2	1	8	2	-	1	-	8	7	-	-
Atelic	/i/	-	3	-	-	-	9	6	-	1	-	2	5	-	26
	/0/	4	-	-	4	3	2	1	1	3	-	6	2	-	4

(177) The distribution of the bisyllabic verb stems in consonant quality of the second syllable

¹⁶ Unlike in the monosyllabic verb stems, the voiced obstruents /b, d, z, g/ frequently occur in the onset of the second syllable of the bisyllabic verb stems. This is partially due to that the voiceless obstruents /h, t, s, k/ undergoes Rendaku. This implies that such bisyllabic verb stems are compounds. For instance, in (i), the bisyllabic verb stem *ko-gir*- consists of two independent stems *ko* 'small' and *kir* 'cut', and the second stem *kir*- undergoes Rendaku.

2.3.2.3. Bisyllabic verbs containing /a/ as their second vowel are either telic or atelic

In contrast to the four vowels /e, u, i, o/, if the second vowel is /a/ the telicity is not uniquely determined; there are both telic and atelic verbs containing /a/. Verb stems containing /a/ are attested in VCVC and CVCVC forms. There are six VCVC verb stems containing /a/.

				Verbal		Diagno	ostics for (a	a)telicity
Syllable	Present	Past	Gloss	telicity	in	for	at	past entailment
	ibár-u	ibvt-ta	be proud of	A / 1*	No	Yes	Yes	Yes
	ogám-u	ogán-da	worship	Atelic	No	Yes	Yes	Yes
VCaC	iwáw-u	iwát-ta	celebrate	celebrate		No	No	No
	eráb-u	erán-da	select	Telic	Yes	No	No	No
	asar-u	asat-ta	hunt for		Yes	No	No	No
	araw-u	arat-ta	wash		Yes	No	No	No

(178) VCaC verb stems (n=6)

Of the six verb stems, two are telic while the other four are atelic. An example of a telic verb stem is *erán*- 'select'. This verb stem is telic, as diagnosed by the four (a)telicity tests. It is felicitous with a time-span adverb 'in x time' (179a), but it is infelicitous with a durative adverb 'for x time' (179b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is non-cancellable (179c). The verb stem in the progressive does not entail that the eventuality took place in the past (179d).

- (179) a. Taro-wa (gohunde) ikkai issatu-no hon-o er<u>á</u>n-da
 T.-TOP in.5.minute once one.CL-GEN book-ACC select-PST
 'Taro selected a book once (in five minutes).'
 - b. Taro-wa (*gohunnoaida) ikkai issatu-no hon-o er<u>á</u>n-da T.-TOP for.5.minute once one.CL-GEN book-ACC select-PST 'Taro selected a book once (*for five minutes).'
 - c. Taro-wa kuzi-tyoodo-ni ikkai issatu-no hon-o $er\underline{\acute{a}}n$ -da T.-TOP 9.0'clock-sharp-at once one.CL-GEN book-ACC select-PST = 'Taro finished selecting a book once at nine sharp.' \neq 'Taro started selecting a book once at nine sharp.'

*zissai, Taro-wa kuzi-han-nimada sono hon-o er<u>á</u>n-de-i-ta in.fact T.-TOP 9-half-at still that book-ACC select-OP-be-PST lit. '*in fact, Taro was still selecting at 9:30.' d. Taro-wa ima issatu-no hon-o erán-de-i-ru
 T.-TOP now one.CL-GEN book-ACC select-OP-be-PRS
 'Taro is now selecting a book.'
 ☆ 'Taro selected a book.'

An example of an atelic verb stem is *ibát*- 'be proud of'. This verb stem is infelicitous with a time-span adverb 'in x time' (180a), but it is felicitous with a durative adverb 'for x time' (180b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is cancellable (180c). The verb stem in the progressive entails that the eventuality took place in the past (180d).

- (180) a. Taro-wa (*gohunde) ikkai hitotu-no seikoo-o ibát-ta
 T.-TOP in.5.minute once one.CL-GEN success-ACC be.proud-PST
 'Taro was proud of a success once (*in five minutes).'
 - b. Taro-wa (gohunnoaida) ikkai hitotu-no seikoo-o ib<u>á</u>t-ta T.-TOP for.5.minute once one.CL-GEN success-ACC be.proud-PST 'Taro was proud of a success once (for five minutes).'
 - c. Taro-wa kuzi-tyoodo-ni itido hitotu-no seikoo-o ib $\underline{\acute{a}}$ t-ta T.-TOP 9.0'clock-sharp-at once one.CL-GEN success-ACC be.proud-PST = 'Taro started being proud of a success once at nine sharp.'

zissai, Taro-wa kuzi-han-ni mada sono seikou-o ib<u>á</u>t-te-i-ta in.fact T.-TOP 9-half-at still that success-ACC be.proud-OP-be-PST lit. 'in fact, Taro was still proud of that success at 9:30.' = 'Taro had been being proud of a success since nine.'

d. Taro-wa ima hitotu-no seikoo-o ibát-te-i-ru
 T.-TOP now one.CL-GEN success-ACC be.proud-OP-be-PRS
 'Taro is now proud of a success.'
 → 'Taro was proud of a success.'

With CVCVC template, there are 34 verb stems containing /a/, as shown below.

				Verbal		Diagnos	stics for	(a)telicity
Syllable	Present	Past	Gloss	telicity	in	for	at	past entailment
	tikaw-u	tikat-ta	swear		Yes	No	No	No
	kagar-u	kagat-ta	darn		Yes	No	No	No
	katar-u	katat-ta	speak		Yes	No	No	No
	nasár-u	nasát-ta	do (honorific)	Telic	Yes	No	No	No
	mawar-u	mawat-ta	turn over	Telle	Yes	No	No	No
	watar-u	watat-ta	cross over		Yes	No	No	No
	haráw-u	harát-ta	sweep off/ pay		Yes	No	No	No
	hakár-u	hakát-ta	olan		Yes	No	No	No
	kabáw-u	kabát-ta	shield		No	Yes	Yes	Yes
	kamáw-u	kamát-ta	care about		No	Yes	Yes	Yes
	saraw-u	sarat-ta	snatch away		No	Yes	Yes	Yes
	naráw-u	narát-ta	learn/ copy		No	Yes	Yes	Yes
	kazar-u	kazat-ta	decorate		No	Yes	Yes	Yes
CVCaC	sawar-u	sawat-ta	touch	Atelic	No	Yes	Yes	Yes
	waraw-u	warat-ta	laugh at	1 itelie	No	Yes	Yes	Yes
	maga-u	magat-ta	be mistaken		No	Yes	Yes	Yes
	manab-u	manan-da	study/imitate		No	Yes	Yes	Yes
	tatam-u	tatan-da	fold		No	Yes	Yes	Yes
	nayám-u	nayán-da	suffer from		No	Yes	Yes	Yes
	hasám-u	hasán-da	sandwich		No	Yes	Yes	Yes
	habám-u	habán-da	block		No	Yes	Yes	Yes
	mihar-u	mihat-ta	keep an eye on		No	Yes	Yes	Yes
	miyár-u	miyát-ta	gaze		No	Yes	Yes	Yes
	simaw-u	simat-ta	finish/put away		No	Yes	Yes	Yes
	miáw-u	miát-ta	look at each other		No	Yes	Yes	Yes
	nináw-u	ninát-ta	take (on oneself)		No	Yes	Yes	Yes
	sikar-u	sikat-ta	scold		No	Yes	Yes	Yes
	sibár-u	sibát-ta	tie		No	Yes	Yes	Yes
	sitaw-u	sitat-ta	yearn for		No	Yes	Yes	Yes
	susam-u	susan-da	avoid		No	Yes	Yes	Yes
	negáw-u	negát-ta	wish		No	Yes	Yes	Yes
	neraw-u	nerat-ta	target		No	Yes	Yes	Yes
	netám-u	netán-da	begrudge		No	Yes	Yes	Yes
	segám-u	segán-da	nag		No	Yes	Yes	Yes

(181) CVCaC verb stems (n=34)

Of the 34 verb stems, eight are telic and 26 are atelic. An example of a telic verb stem is *watat*-'cross over'. This verb stem is telic, as diagnosed in the four (a)telicity tests. It is felicitous with a time-span adverb 'in x time' (182a), but it is infelicitous with a durative adverb 'for x time' (182b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is noncancellable (182c). The verb stem in the progressive does not entail that the eventuality took place in the past (182d).

- (182) a. Taro-wa (gohunde) itido hitotu-no hasi-o wat<u>a</u>t-ta T.-TOP in.5.minute once one.CL-GEN bridge-ACC cross.over-PST 'Taro crossed over a bridge once (in five minutes).'
 - b. Taro-wa (*gohunnoaida) itido hitotu-no hasi-o wat<u>a</u>t-ta T.-TOP for.5.minute once one.CL-GEN bridge-ACC cross.over-PST 'Taro crossed over a bridge once (*for five minutes).'
 - c. Taro-wa kuzi-tyoodo-ni itido hitotu-no hasi-o wat<u>a</u>t-ta T.-TOP 9.0'clock-sharp-at once one.CL-GEN bridge-ACC cross.over-PST = 'Taro finished crossing over a bridge once at nine sharp.' \neq 'Taro started crossing over a bridge once at nine sharp.'

*zissai, Taro-wa kuzi-han-nimada sono hasi-o wat<u>a</u>t-te-i-ta in.fact T.-TOP 9-half-at still that bridge-ACC cross.over-OP-be-PST lit. '*in fact, Taro was still crossing over that bridge at 9:30.'

An example of an atelic verb stem is *mihat-* 'watch'. This verb stem is infelicitous with a timespan adverb 'in x time' (183a). Meanwhile, it is felicitous with a durative adverb 'for x time' (183b). The eventuality denoted by the verb stem with a punctual adverbial 'at x time' is cancellable (183c). The verb stem in the progressive entails that the eventuality took place in the past (183d).

- (183) a. Taro-wa (*gohunde) itido hitori-no syuuzin-o mih<u>a</u>t-ta
 T.-TOP in.5.minute once one.CL-GEN prisoner-ACC watch-PST
 'Taro watched a prisoner once (*in five minutes).'
 - b. Taro-wa (gohunnoaida) itido hitori-no syuuzin-o mih<u>a</u>t-ta T.-TOP for.5.minute once one.CL-GEN prisoner-ACC watch-PST 'Taro watched a prisoner once (for five minutes).'

c. Taro-wa kuzi-tyoodo-ni itido hitori-no syuuzin-o mih<u>a</u>t-ta T.-TOP 9.0'clock-sharp-at once one.CL-GEN prisoner-ACC watch-PST = 'Taro started watching a prisoner once at nine sharp.'

zissai, Taro-wa kuzi-han-ni mada sono syuuzin-o mih<u>a</u>t-te-i-ta in.fact T.-TOP 9-half-at still that prisoner-ACC watch-OP-be-PST lit. 'in fact, Taro was still watching that prisoner at 9:30.' = 'Taro had been watching a prisoner since nine.'

d. Taro-wa ima hitori-no syuuzin-o mih<u>a</u>t-te-i-ru
 T.-TOP now one.CL-GEN prisoner-ACC watch-OP-be-PRS
 'Taro is now watching a prisoner'
 → 'Taro watched a prisoner.'

2.3.3. Summary

In this section, I have shown that in Yamato-Japanese verbs, the quality of the non-low vowels strictly corresponds to verbal telicity. This correspondence is sensitive to the vowel position, namely, at the rightmost vowel. In monosyllabic verb stems, the quality of the vowel corresponds to verbal telicity, as in (184). In bisyllabic verb stems, the second vowel (Vowel2) corresponds to verbal telicity, as in (185). Thus, verb stems containing /e, u/ as the rightmost vowel are telic while verb stems containing /i, o/ as the rightmost vowel are atelic. In contrast, verb stems containing the low vowel /a/ as the rightmost vowel can be either telic or atelic.

(184) Monosyllabic verb stem

(185) Bisyllabic verb stem

The correspondence between vowel quality and verbal telicity is unique to Yamato-Japanese verbs. I conclude this chapter by showing that in Sino Japanese verbs, vowel quality does not correspond to verbal telicity. As seen in section 2.2.2, Sino-Japanese verb stems are complex; they consist of the light verb *-su* and a noun (Martin 1975; Iida 1987; Miyagawa 1987, 1991; Grimshaw and Mester 1988; Shibatani and Kageyama 1988; Grimshaw 1990; Tsujimura 1990a, 1990b; Uchida and Nakayama 1993; among many).

- (186) <u>Sino-Japanese verb stems</u>
 - a. kenkyuu-suresearch-do-
 - b. benkyou-sustudy-do-

The noun as such can be used as an argument of the verb, as shown in (187).

(187) <u>kenkyuu</u>-o okonau research-ACC excute

The noun originates from a Chinese verb ('verbal noun') and thus can take an argument even though it is used as a noun (Miyagawa 1987). This is shown in (188).

(188) John-ga DNA-o <u>kenkyuu</u>-chuuni J.-NOM DNA-ACC research-while 'while John is doing his research on DNA, ...' (Adopated from Uchida and Nakayama 1993:626 ex. 7)

In Sino-Japanse verb stems, it is the verbal noun that determines verbal telicity (Uchida and Nakayama 1993). Atelic and telic verbs in Sino-Japanese are exemplified in (189) and (190), respectively.

- (189) <u>Atelic verbs</u> a. **soozi**-
 - <u>soozi</u>-suclean-do
 - b. <u>benkyoo</u>-sustudy-do-
 - c. <u>kenkyuu</u>-suresearch-do

- d. <u>unten</u>-sudrive-do
- (190) <u>Telic verbs</u>
 - a. <u>tyuusi</u>-sucancelation-do
 - b. <u>taiho</u>-suarrest-do
 - c. <u>kounyuu</u>-supurchase-do
 - d. <u>gensen</u>-sucareful.selection-do

The (a)telicity is diagnosed with the past entailment in the progressive form. In (191), for instance, the atelic verbal noun *soozi* 'cleaning' has a past entailment in the progressive form. In contrast, in (192), the telic verbal noun *tyuusi* 'stop' does not.

(191)	a.	Mary-ga MNOM 'Mary is now → 'Mary clear	ima now cleaning ned her	heya-o room-ACC g her room.' room.'	<u>soozi</u> -si-te-i-ru cleaning-do-OP-be-PRES
	b.	Taro-ga TNOM 'Taro is now s → 'John studi	ima now tudying ed prep	zentisi-o preposition-A preposition.' osition.'	benkyoo-si-te-i-ru CC study-do-OP-be-PRES
	c.	John-wa JTOP 'John is now c → 'John did h	ima now loing hi is resea	DNA-o DNA-ACC s research on D rch on DNA.'	<u>kenkyuu</u> -si-te-i-ru research-do-OP-be-PRES NA.'
	d.	Bill-ga BNOM 'Bill is now dr → 'Bill drove	ima now riving a a car.'	kuruma-o car-ACC car.'	<u>unten</u> -si-te-i-ru driving-do-OP-be-PRES

- - b. Yamada keizi-wa ima suri-o <u>taiho</u>-si-te-i-ru
 Y. officier-TOP now pickpocket-ACC arrest-do-OP-be-PRES
 'Officer Yamada is arresting a pickpocket.'
 ☆ 'Officer Yamada arrested a pickpocket.'
 - c. Ted-ga ima hon-o <u>kounyuu</u>-si-te-i-ru
 T.-NOM now town-ACC purchase-do-OP-be-PRES
 'Ted is now purchasing a book.'
 ☆ 'Ted purchased a book.'
 - c. sensei-ga ima kyoukasyo-o <u>gensen</u>-si-te-i-ru
 T.-NOM now town-ACC careful.selection-do-OP-be-PRES
 'The teacher is carefully selecting a textbook now.'
 → 'The teacher carefully selected a textbook.'

As (193) shows, even though we have seen the limited number of loanword verbs, the (a)telicity does not correspond to the quality of Vowel 2 nor any other particular sound pattern.

Verbal	Vowel	melody	Verbal noun	Gloss
telicity	Vowel 1	Vowel 2		
	00	i	soozi-	'clean'
Atelic	е	00	benkyoo-	'study'
1 itelie	e	uu	kenkyuu-	'research'
	u	e	unten-	'drive'
	uu	i	tyuusi-	'stop'
Telic	ai	0	taiho-	'arrest'
	ou	uu	kounyuu-	'purchase'
	e	e	gensen-	'careful selection'

(193) Telicity not corresponding to vowel quality in loanword verb stems

CHAPTER 3

Speakers of Japanese are sensitive to the correspondence between vowel quality and telicity in nonce verbs

Based on the existing monosyllabic verbs and bisyllabic verbs, I have shown in Chapter 2 that the vowel quality of the rightmost vowel is associated with a telicity value. In this chapter, I provide experimental support for the claim that the correspondence between vowel quality and telicity is part of the synchronic grammar. In section 3.1, I discuss three experiments I have conducted. In section 3.2, I conclude that speakers of Japanese are sensitive to the correspondence in nonce verbs.

3.1. The experiments

I have conducted three experiments to test whether the correspondence between vowel quality and verbal telicity is part of the grammar. I first explain the general design of the three experiments. Then, I discuss their specific methodologies and their results.

3.1.1. General experimental design

I explain the general experimental design of all three experiments. I discuss the subjects, the task, stimuli, the procedure, and predictions in turn.

3.1.1.1. Subjects

The purpose of the experiments was to examine whether the correspondence between vowel quality and telicity value is active in the grammar. Thus, the grammar of speakers had to be developed and stable (cf. Köhler 1929; Cassidy and Kelly 1991, 2001; Bates et al. 1995; Westbury 2005; Stockall and Marantz 2006; among many). Consequently, the subjects were all adult fluent speakers of Japanese. No subject participated in more than one experiment.

3.1.1.2. The task

To examine whether speakers are sensitive to the correspondence between vowel quality and verbal telicity, I used a perception task, in particular, a forced-choice task. The forced-choice

task was designed to match vowel quality with telicity (cf. Ramachandran and Hubbard 2001). A nonce verb was first presented as an auditory stimulus. The verb contained one of the five Japanese vowels /e, u, i, o, a/. The auditory stimulus was followed by a pair of video clips depicting two types of events: one telic and one atelic. Crucially, the depicted events did not correspond to any event associated with an existing verb that would name that event. The subjects were then asked to choose a movie clip which they thought matched the nonce verb. I will discuss the types of events depicted in the video in more detail in section 3.1.1.3.¹⁷

3.1.1.3. Stimuli

Sound Tokens

The nonce verbs which were used in the experiments were presented in auditory form. This was essential because the purpose of the experiments was to examine whether the vowel quality is associated with telicity.

The nonce verbs were modeled on existing monosyllabic or bisyllabic verbs, as in (194).

- (194) a. Monosyllabic verb: $_{Verb}[(C) V(C)]$ -ta
 - b. Bisyllabic verb: $_{Verb}[(C) V(C) V(C)]$ -ta

The nonce verbs followed Japanese syllable structures, phoneme inventories, and phonological constraints (see also section 2.2.4). The nonce verbs were recorded in a sound booth (IAC) by a female speaker of Japanese (Tokyo dialect) who was in her 20s. The tokens were digitally recorded with a Sennheiser MKH416P48 microphone and edited using the free audio editor program, Audacity (http://audacity.sourceforge.net).

¹⁷ In the present experiments, I used the perceptual forced-choice task where auditory stimuli precedes visual stimuli. There are also other possible ways of testing sound-meaning correspondences such as production tasks (see Berko 1958; Smith and Baker 1976; Kelly and Bock 1988; Pinker and Prince 1988; Cassidy and Kelly 1991, 2001; Kelly 1992; Kamachi et al. 2003; Farmer et al. 2006; among many).

Video clips

Animated video clips were created to visually depict a telic or an atelic event. The animated video clips allowed for a straightforward depiction of the event endpoint, i.e., telicity (Behrend 1990; Behrend et al. 1995; Carr and Johnston 2001; Wagner and Carey 2003).¹⁸

I created animated video clips using the graphic program Motion Artist 4 (Smith Micro Software, Watsonville). The depicted event contained two event participants: one who initiated the event and one who underwent it. Each video clip was 2 seconds long. All telic events reached their natural endpoint at 1.6 seconds of the clip while the atelic event continued till the end (see Figures 1 and 2 in section 3.1.2.2). The event occurred once with no repetition. Whether the events were unambiguously depicting a natural endpoint (telic) or not (atelic) was independently double-checked with two adults.

To avoid the influence of existing verbs, all the video clips depicted an event which was unfamiliar and as such was not associated with an existing verb (cf. Behrend 1990; Behrend et al. 1995; Carr and Johnston 2001). To make sure that the events were unfamiliar, the main participants in the event were two alien creatures who were able to perform tasks which humans cannot. The unfamiliarity of the depicted event was independently checked with two adult speakers of Japanese. None of these speakers could come up with an attested Japanese verb denoting the depicted event. All the video clips used in the experiments are available in Quick Time format at http://cid-8e817abac54f7bb2.skydrive.live.com/browse.aspx/video.

3.1.1.4. The procedure

The experiments were conducted with each subject individually completing the task. It was conducted in a quiet place (a lab or a library). Before the experiments, the subjects watched an animated instruction presented on a laptop. The instructions were given in Japanese. The text and its English translation are given below.

¹⁸ If a picture-story show is used, each picture might be taken as depicting an independent event with an inherent endpoint (cf. van Hout 1998; Schulz and Penner 2002).

(Japanese)

ようこそ、言語学研究室へ!この研究の目的は新しい日本語の動詞を作ることにありま す。皆さんにはそのお手伝いをしてもらいたいと思います。ご協力よろしくお願いします。 この実験では、まず、日本語には存在しない、動詞のような語を聞いてもらいます。その 後、2つのアニメーションが流れます。アニメーションでは、宇宙からやってきた主人公の ペペさんが不思議な行動を取ります。みなさんには2つのアニメーションのうち、動詞の ような語にふさわしいものを選んで頂きます。Aの選択肢を選びたい場合はAのボタンを、 Bの選択肢を選びたい場合はBのボタンを押してください、

(English translation)

Welcome to the Linguistics Lab! The main purpose of this study is to create new Japanese verbs! You can help us. We appreciate your cooperation. In this task, you first listen to a verb-like token in the sentence, which does NOT exist in Japanese yet. Two animated video clips follow where a character Pepe takes unfamiliar actions, given that he comes from outer space. You can choose one of the clips which you think better matches the verb-like token. If you want to choose choice A, push button A on the keypad. If you want to choose choice B, then push button B.

After the instructions, the subjects were familiarized with the forced-choice task through a training session. The session contained several trials that were not used in the actual experiments.

The forced-choice task was programmed with PsyScope X Build 51 (Cohen et al. 1993) and implemented on the Apple laptop. The task proceeded as follows. A nonce verb was first presented auditorily, in a transitive sentence frame. Thus, the sentence contained a subject and an object, as exemplified in (195).

(195) *Pepe-ga pengin-o <u>mút</u>-ta*, <u>mút</u>-ta P.-NOM penguin-ACC token-PST

The verb was repeated once again at the end, in order for the subjects not to miss the unfamiliar nonce verb. The total length of a token was 2-3 seconds. Subjects heard the token over headphones. After a 0.5 second silence, a pair of animated video clips appeared on the high-quality laptop screen. A 0.5 second break was inserted in between the video clips. The video clips depicted either an event with an inherent endpoint (i.e., a telic event) or an event without a

natural endpoint (i.e., an atelic event). The run time of each video clip was 2 seconds. Thus, the total interval from the sound token to the video clips was 8 seconds, as summarized in (196). The interval was deliberately short to make sure that the temporally stored information in working memory would not decay (cf. Towse et al. 2000). At the end of the task, the subjects chose the movie clip that they thought matched the nonce verb by pressing a button.

(196) A trial of the forced-choice task



The tokens were randomized in presentation. The experiment was self-paced; the next trial proceeded after the button was pressed. Thus, the subjects could freely take a short break between trials. It took subjects around 15 minutes to complete the task in Experiments 2 and 3, and 5-7 minutes in Experiment 1. After the experiment, we collected the subjects' background information.

3.1.1.5. Predictions

In this subsection, I show how to analyze the results of the subjects' responses and the predictions, based on the generalization that holds for existing verbs. Throughout the experiments, two vowels were compared at a time. If a nonce verb contains /e/ or /u/, which corresponds to a telic value in existing verbs, the subjects are predicted to tend to choose a telic movie clip. If, on the other hand, a nonce verb contains /i/ or /o/, which corresponds to an atelic interpretation in existing verbs, the subjects are predicted to tend to choose an atelic interpretation in existing verbs, the subjects are predicted to tend to choose an atelic movie clip.

(197)	Auditory stimulus	Visual stimulus	Predicted choice
	t <u>e</u> -ta	Telic/atelic movie clips	Telic
	t <u>u</u> -ta	Telic/atelic movie clips	Telic
(198)	<u>Auditory stimulus</u> t <u>i</u> -ta	<u>Visual stimulus</u> Telic/atelic movie clips Telic/atelic movie clips	Predicted choice Atelic

If the two vowels which differ in their telicity are compared (e.g. te-/ti-), there should be a difference between them in the telicity of the video clips which the subjects chose.

		PREDICTEI	O CHOICE
PAIRS OF V	OWELS	Telic	Atelic
/u/ – telic	/o/ – atelic	/u/	/o/
/u/- telic	/i/ – atelic	/u/	/i/
/e/ – telic	/o/ – atelic	/e/	/o/
/e/ – telic	/i/ – atelic	/e/	/i/

(199) Predictions of subjects' choice (pairs of different types of vowels for telicity)

If two verbs which are the same in their corresponding telicity (e.g. te-/tu-) are compared, there should not be a difference between them in the telicity of the video clips which the subjects chose.

(200) Predictions of subjects' choice (pairs of the same type of vowels for telicity)

		PREDICTEI	D CHOICE
PAIRS OF	VOWELS	Telic	Atelic
/u/ – telic	/e/ – telic	/u/, /e/	
/o/ – atelic	/i/ – atelic		/o/, /i/

It was also expected that for a nonce verb which contained /a/, either a telic or an atelic move clip would be chosen at chance level, given that /a/ has no fixed telicity value in existing verb stems. Thus, comparing /a/ with the non-low vowels /e, u, i, o/ which has a fixed telicity value in existing verb stems would give rise to a slight difference in choice of video clips.

	~ ~ ~	PREDICTED CHOICE			
PAIRS OF VO	OWELS	Telic	Atelic		
/a/ —	/e/ – telic	/e/, /a/	/a/		
/a/ —	/u/ – telic	/u/, /a/	/a/		
/a/ —	/i/ – atelic	/a/	/i/, /a/		
/a/ —	/o/ – atelic	/a/	/o/, /a/		

(201) Predictions of subjects' choice (comparing /a/ with the other vowels)

To statistically test whether the difference between the compared two vowels in the choice of telicity was significant, I conducted a *d*-prime (d') test. The *d'*-test is a suitable statistical test for non-parametric tasks like forced-choice tasks (Macmillan and Creelman 2004).

In the *d*'-test we first set up the null hypothesis which claimed that the subjects had a bias towards the choice of telic video clips across the compared vowels. Take the contrast between /u/ and /i/, for example. The null hypothesis predicted that telic video clips would be chosen for both /u/ and /i/ (i.e., the values in W and X would both be at a high rate in the table (202)).

	The type of video clips chosen				
	Telic	Atelic			
Vowel /u/	W	Y			
Vowel /i/	Х	Z			

(202)

If the null hypothesis was rejected, we would take the alternative hypothesis which claimed that the difference between the compared two vowels in the choice of telicity was significant.¹⁹

The *d*'-value was the difference between *z*-transforms of the number of telic video clips chosen for the compared vowels. The *z*-transforms were conversions of the values of the compared vowel rates to standard deviation units. The equation of the *d*'-value is shown in (203) (see table A5.1 in Appendix 5, Macmillan and Creelman 2004 for *z*-transforms).

(203) d' = z(W) - z(X)

The value d'=0 indicated that the subjects chose telic video clips for both of the compared vowels. The greater the d' value was, the more different in the choice of telicity the compared vowels were. Then, the question arose as to whether the calculated d' value indicated that the difference between the compared vowels in the choice of telicity was significant.

The null hypothesis d'=0 was tested by "measuring the deviation (z) between the observed and the hypothesized values (d'_0) in units of standard error [(se)]" (Wickens 2001: 208). The equation is given in (204) where the superscript " \wedge " is a function.

¹⁹ In the analyses, I avoid using a chi square test, which is another statistical test for non-parametric values. Unlike the d'-test, chi square measures *the sum* of deviations from expected frequencies in *all* the four columns of the table (202). Then, the test takes as significant not only if the subjects are sensitive to the correspondence between stimulus and response, but also if the subjects have responses biases, which is properly excluded in the d'-test.

(204)
$$z = \frac{\hat{d}' - d'_0}{\hat{s}e(\hat{d}')}$$
 (Wickens 2001: 208 Equation 11.10)

If the *z*-value was greater than the critical value 1.96 at the 5% significance level in a two-tailed test, there was less than 5% probability that the subjects had a response bias. Thus, we could reject the null hypothesis and take the alternative, which claimed that the difference between the compared two vowels in the choice of telicity was significant.

If the compared vowels correspond to the same telicity value in existing verbs, we expected that responses to the vowels would be similar. That is, the deviation (z) for the compared vowels would be smaller than the critical value 1.96.

To calculate *d'*- and *z*-values and to statistically test the null hypothesis throughout the experiments, I used the program PTestD (Yasuharu Okamoto, Japan Women's University, http://mcn-www.jwu.ac. jp/~yokamoto/books/ sdtwickens/c11s4eq1110/).

In the following three subsections, I discuss the specific methods of the three experiments, and their results. Experiment 1, which was originally designed as the pilot study, was to examine whether the subjects are sensitive to the correspondence of vowel quality with verbal telicity in monosyllabic nonce verbs. I focused on the non-low vowels /e, u, i, o/ which have a fixed telicity value in the existing verb stems. To focus on the correspondence of vowel quality with an endpoint of an event, the movie clips used in Experiment 1 depicted an endpoint, but not an initial point.

Experiment 2 was to examine whether the subjects are sensitive to the correspondence at a particular vowel position, namely, at the rightmost vowel. This position sensitivity was examined with bisyllabic nonce verbs. The Experiment 2 also included the low vowel /a/ which does not have a fixed telicity value in the existing verb stems.

The purpose of Experiment 3 was threefold. First, the experiment was to examine whether the subjects are sensitive to the correspondence in moraicity. In the existing verb stems, we have seen that the rightmost vowel tends to be bimoraic, but not to be monomoraic. We were concerned whether this type frequency affects the subjects' sensitivity to the vowel-telicity

correspondence. This was examined by comparing monomoraic and bimoraic monosyllabic nonce verbs. Second, the Experiment 3 was to examine whether the vowel quality really corresponds to an endpoint of an event, and not to an initial point. If this is so, it was expected that the subjects would be sensitive to the vowel-telicity correspondence, regardless of whether video clips depict an initial point of an event. Thus, the Experiment 3 used video clips depicting not only an endpoint but also an initial point of an event. These video clips were compared with those of the Experiment 1 which depicted only an endpoint of an event.

3.1.2. Experiment 1: monosyllabic nonce verbs and no initial point

In Experiment 1, I examined whether subjects are sensitive to the correspondence between the quality of the non-low vowels in the presented nonce verb and the presence of an endpoint in the event depicted in the video clip. The results indicate that the subjects are sensitive to the correspondence in monosyllabic nonce verbs. Below I explain the methodology specific to this pilot study and then discuss the results in detail.

3.1.2.1. Subjects

The subjects of Experiment 1 were 21 adult native speakers of Japanese. Sixteen subjects spoke the Eastern dialect and 5 subjects the Western dialect. Their ages ranged from 20 to 50: 10 in the 20s, 8 in the 30s, 3 over 40. There were 15 women and 6 men. None of them reported a history of seeing or hearing disabilities and they were all right-handed. They lived in Vancouver, Canada: 8 for less than a year, 7 for less than five years, and 6 for more than five years. They were recruited by public advertisement and they were paid for their participation.

DIALECTS	Eastern (16), Western (5)
AGE	20-29 yrs (10), 30-39 yrs (8), > 40 yrs (3)
GENDER	Women (15), Men (6)
HEARING	No disability
SIGHT	No disability
HANDEDNESS	Right-handed
RESIDENCE	Vancouver, Canada: < 1 yr (8), < 5yrs (7), > 5yrs (6)
RECRUITMENT	Public advertisement
PARTICIPATION	Paid

(205) Subject pool for Experiment 1

3.1.2.2. Stimuli

Audio stimuli

Experiment 1 included 20 nonce verbs which observed the phonological constraints of Japanese, as identified in section 2.2.4. Out of the 20 nonce verbs, 12 were monosyllabic and were used to test 6 types of minimal pairs. Thus, all of the 21 subjects took one minimal pair per type regarding the non-low vowels, as shown in (206). The remaining 8 tokens were used as fillers.

		Tested tokens
Pairs of contrasted vowels		(syllable structure)
/u/-telic	/o/-atelic	sú- / só-
/u/-telic	/i/-atelic	mút- / mít-
/e/-telic	/o/-atelic	ben-/bon-
/e/-telic	/i/-atelic	hen- / hin-
/u/-telic	/e/-telic	nun- / nen-
/o/-atelic	/i/-atelic	zot- / zit-

(206)	The tested	nonce verbs	in Ex	periment	1
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Visual stimuli

For the visual stimuli, I created 14 pairs of telic and atelic video clips: 6 pairs for the 6 minimal pairs of the nonce verbs and 8 pairs for the 8 filler nonce verbs. Thus, with the same pair of video clips, a minimal pair of nonce verbs only differed in vowel quality.

Note that in Experiment 1, no video clip contained the initial point of the event. The atelic events and the telic events visually differed only in the absence or the presence of an endpoint. An example pair of telic and atelic video clips (snapshots from the clips) is given below.



Figure 1: Snapshots from a movie clip of telic motion (with no initial point)

Figure 2: Snapshots from a movie clip of atelic motion (with no initial point)



The properties of the auditory and visual stimuli are summarized in (207).

	VIDEO CLIPS		
	TYPE OF EVENT	LENGTH OF TIME	
NONCE VERBS (20)		Total run time: 2 seconds	
		Initial point: No	
Tested tokens (12)	6 telic eventualities	Endpoint: 1.6 seconds	
(a minimal pair of vowels * 6 types)	6 atelic eventualities	Endpoint: No	
Filler tokens (8)	8 telic eventualities	Endpoint: 1.6 seconds	
	8 atelic eventualities	Endpoint: No	

(207) Auditory and visual stimuli for Experiment 1

3.1.2.3. Results of Experiment 1

The results of the experiment indicate that subjects were sensitive to the correspondence between the non-low vowels and telicity in nonce verbs. First we compared nonce verbs containing vowels that differ in telicity in existing verbs (e.g., /u/-telic and /o/-atelic). In those cases there was a significant difference in the choice of events. Figure 3 shows that the deviation (*z*) between the observed and the hypothesized *d'* values was greater than the critical value 1.96 (the red dotted line in Figure 3, significance level $\alpha = 0.05$ in a two-tailed test). The *z* value for the e/o contrast was 4.0675 (*d'* = 1.6122, *p* < 0.01), the *z* value for the u/i contrast 3.7220 (*d'* = 1.4892, *p* < 0.01), the *z* value for the u/o contrast 2.2407 (*d'* = 0.8689, *p* = 0.02), and the *z* value for the e/i contrast 2.0405 (*d'* = 0.8164, *p* = 0.04). These results indicate that an event with an inherent endpoint was chosen for the nonce verb containing the vowels /e/ and /u/, which are the ones that correspond to telic events in existing verbs. In contrast, events that lack inherent endpoints were chosen for nonce verbs containing the vowels /i/ and /o/, which are the ones that correspond to atelic events in existing verbs.

The next comparison was between nonce verbs containing vowels that do not differ in telicity in existing verbs (e.g., /u/-telic and /e/-telic). In this case there was <u>no</u> significant difference in the choice of events. Figure 3 shows that the deviation (z) was smaller than 1.96. The z value for the e/u contrast was 0.3146 (d' = 0.1230, p = 0.76), and the z value for the o/i contrast was 0.3342 (d' = 0.1352, p = 0.74). These results indicate that if the paired vowels are associated with the same telicity value in existing verbs, the telicity value of the video clip chosen in the task was also the same.



3.1.3. Experiment 2: bisyllabic nonce verbs

The results of the Experiment 1 indicate that speakers of Japanese are indeed sensitive to the correspondence between the non-low vowels and verbal telicity in monosyllabic nonce verbs. Given this fact, it was expected that the vowel-telicity correspondence would be sensitive to a particular vowel position, namely, at the rightmost vowel of the verb. In the existing verb stems, the vowel-telicity correspondence is observed only at the rightmost vowel. Experiment 2 was to examine this position sensitivety of the vowel-telicity correspondence in bisyllabic nonce verbs. The Experiment 2 also included the low vowel /a/ which does not have a fixed telicity value in the existing verb stems. The results of Experiment 2 show that in nonce verbs the low vowel can in fact be associated with a fixed telicity value.

3.1.3.1. Subjects

The subjects of Experiment 2 were 15 adult fluent speakers of Japanese. 6 subjects spoke the Eastern dialect and 9 subjects spoke the Western dialect. Their ages ranged from 20 to 40: 11 in the 20s, 4 in the 30s. There were 9 women and 6 men. None of them reported a history of seeing or hearing disabilities. The subjects were all right-handed. They lived in Vancouver, Canada: 11

for less than a year, 4 for less than five years. They were recruited by public advertisement and they were paid for their participation.

DIALECTS	Eastern (6), Western (9)
AGE	20s (11), 30s (4)
GENDER	Female (9), Male (6)
HEARING	No disability
SIGHT	No disability
HANDEDNESS	Right (15)
RESIDENCE	Vancouver, Canada: (11) <1 year, (4) >1 year
RECRUITMENT	Public advertisement
PARTICIPATION	Paid

(208) Subject pool for Experiment 2

3.1.3.2. Stimuli

Audio stimuli

In the Experiment 2, bisyllabic nonce verbs were used as audio stimuli. There are 8 possible combinations of vowels and consonants in bisyllabic verbs, as shown in (209).

(209)	a.	V.V-ta
	b.	CV.V-ta
	c.	V.CV-ta
	d.	CV.CV-ta
	e.	CV.VC-ta
	f.	V.VC-ta
	g.	V.CVC-ta
	h.	CV.CVC-ta

For the experiment, I chose (209g) VCVC and (209h) CVCVC forms for three reasons. First, VCVC and CVCVC forms had a clear boundary, with an intervening consonant in between Vowel 1 and Vowel 2. This criterion excluded four of the 7 logical possibilities (i.e., (a), (b), (e), and (f) in (209)). Second, VCVC and CVCVC forms have a stem-final consonant which is attested across all the five vowels /e, u, i, o, a/ in existing verbs. This criterion excludes three possibilities ((a) to (d)) because they are not attested in existing verbs if Vowel 2 is a back vowel /u, o, a/. Third, in the existing verb stems, such a closed syllable structure is dominant at the rightmost vowel.
As for the type of consonants, we tested four sets of tokens: 3 sets for VCVC form (a-c) and 1 set for CVCVC form (d), as shown in (210).

- (210) a. VbVt-ta
 - b. VgVt-ta
 - c. VrVt-ta
 - d. hVrVt-ta

To look at the sensitivity to the correspondence between vowel quality and verbal telicity in Vowel 1 and in Vowel 2 of bisyllabic nonce verbs, we examined a 5*5 paradigm (the five vowels /e, u, i, o, a/ in Vowel 1 and in Vowel 2) for each type of the tokens above. The paradigm was examined with the same pair of telic and atelic video clips. Given the 4 sets of the paradigm, the total number of tokens presented to all the subjects was 100. Experiment 2 did not include filler tokens. All the tokens used are listed in the paradigms below. Note that some actual verbs were included in the paradigms (marked with $^{\diamond}$).

V1/V2	i	u	e	0	а
		ibut-ta▲			ibat-ta▲
i	ibit-ta	'smoke'	ibet-ta	ibot-ta	'be proud'
					ubat-ta▲
u	ubit-ta	ubut-ta	ubet-ta	ubot-ta	'steal'
e	ebit-ta	ebut-ta	ebet-ta	ebot-ta	ebat-ta
0	obit-ta	obut-ta	obet-ta	obot-ta	obat-ta
		abut-ta▲			
а	abit-ta	ʻgrill'	abet-ta	abot-ta	abat-ta

b.	VgVt-ta
----	---------

VbVt-ta

V1/V2	i	u	e	0	а
i	igit-ta	igut-ta	iget-ta	igot-ta	igat-ta
u	ugit-ta	ugut-ta	uget-ta	ugot-ta	ugat-ta▲ 'drill'
		egut-ta [▲]	4800 tu	48°° 44	
e	egit-ta	'scoop'	eget-ta	egot-ta	egat-ta
0	ogit-ta	ogut-ta	oget-ta	ogot-ta	ogat-ta
a	agit-ta	agut-ta	aget-ta	agot-ta	agat-ta

c. VrVt-ta

V1/V2	i	u	e	0	а
i	irit-ta	irut-ta	iret-ta	irot-ta	irat-ta
u	urit-ta	urut-ta	uret-ta	urot-ta	urat-ta
e	erit-ta	erut-ta	eret-ta	erot-ta	erat-ta
0	orit-ta	orut-ta	oret-ta	orot-ta	orat-ta
а	arit-ta	arut-ta	aret-ta	arot-ta	arat-ta

d. *hVrVt-ta*

V1/V2	i	u	e	0	а
i	hirit-ta	hirut-ta	hiret-ta	hirot-ta	hirat-ta
u	hurit-ta	hurut-ta	huret-ta	hurot-ta	hurat-ta
e	herit-ta	herut-ta	heret-ta	herot-ta	herat-ta
0	horit-ta	horut-ta	horet-ta	horot-ta	horat-ta
					harat-ta▲
а	harit-ta	harut-ta	haret-ta	harot-ta	'pay'

Visual stimuli

For visual stimuli, I designed 4 pairs of telic and atelic video clips for the different consonant types. In Experiment 2, for all the video clips, an initial point of the event was set up at 0.4 seconds after the start of the movie clip. The initial point was captured by the causer shifting from a preconditional state to initiate the event in question. Thus, the telic event started at 0.4 seconds and ended at 1.6 seconds within the 2-second movie clip. An example of the telic movie clips is given in Figure 4.

Figure 4: Snapshots from a movie clip of telic motion (with an initial point)



In contrast, the atelic event started at 0.4 seconds and continued to the end of the movie clip. Examples of the atelic video clips are given in Figure 5.



Figure 5: Snapshots from a movie clip of atelic motion (with an initial point)

The above audio and visual stimuli are summarized in (212).

	VIDI	EO CLIPS
	TYPE OF EVENT	LENGTH OF TIME
		Total run time: 2 seconds
NONCE VERBS (100)		Initial point: 0.4 seconds
Tested tokens (100)	4 telic eventualities	Endpoint: 1.6 seconds
$V I(/e/, /u/, /o/, /1/, a/)^*$ $V 2(/o/, /u/, /o/, /i/, a/)^*$	4 atelic eventualities	Endpoint: No
4 tokens		

3.1.3.3. Results of Experiment 2

We begin by looking at the results of the experiment for the non-low vowels /i, o, u, e/ (15 subjects * 4 token types * 5 vowels in Vowel 1). The overall results show that the speakers are sensitive to the correspondence between the quality of Vowel 2 and the telicity in bisyllabic nonce verbs.

First we compared nonce verbs whose Vowel 2 differs in telicity in existing verbs (e.g., /u/-telic and /o/-atelic). In most cases, there was a significant difference in the choice of events. Figure 6 shows that the deviation (*z*) between the observed and the hypothesized *d'* values was greater than the critical value 1.96 (the red dotted line in Figure 6, significance level $\alpha = 0.05$ in two-tailed test). The *z* value for the e/i contrast was 3.0361 (*d'* = 0.3109, *p* < 0.01), the *z* value for the u/i contrast was 2.2093 (*d'* = 0.2261, *p* = 0.03), and the *z* value for the e/o contrast was 2.0522 (*d'* = 0.2104, *p* = 0.04). The results for these three pairs indicate that an event with an endpoint was chosen for the nonce verbs containing the vowel corresponding to a telic interpretation. In contrast, an event that lacks an endpoint was chosen for the nonce verbs containing the vowel corresponding to an atelic interpretation. However, there was no significant difference between /u/ and /o/ in the choice of events (*z* = 1.2271, *d'* = 0.1257, *p* = 0.22).

The next comparison was between nonce verbs containing vowels that do not differ in telicity in existing verbs (e.g., /u/-telic and /e/-telic). In this case there was <u>no</u> significant difference in the choice of events. Figure 6 shows that the deviation (z) was smaller than 1.96 (o/i: z = 0.9810, d' = 0.1004, p = 0.33; e/u: z = 0.8241, d' = 0.0848, p = 0.81 These results indicate that if the paired vowels are associated with the same telicity value in existing verbs, the telicity value of the video clip chosen in the task was also the same.



The sensitivity to the correspondence between the quality of Vowel 2 and telicity was contrasted with the results for Vowel 1. With Vowel 1, regardless of whether the pair of vowels differ in telicity in existing verbs, there was no significant difference between pairs of vowels in the choice of events. This is shown in Figure 7 (e/i: z = 0.1694, d' = 0.0179, p = 0.87; u/i: z = 0.2538, d' = 0.0269, p = 0.80; e/o: z = 1.3535, d' = 0.1433, p = 0.18; u/o: z = 0.9301, d' = 0.0985, p = 0.35; o/i: z = 1.1840, d' = 0.1254, p = 0.12; e/u: z = 0.4232, d' = 0.0448, p = 0.67). The clear difference between the results for Vowel 1 and Vowel 2 indicates that the quality of the rightmost vowel indeed associates with telicity.



We turn to the results of the individual tokens for Vowel 2. The results show that the subjects' sensitivity to the correspondence between vowel quality and telicity varied across the tokens. We begin with the results of the nonce verbs in VbVt- form. First we compared nonce verbs containing vowels that differ in telicity in existing verbs (e.g., /u/-telic and /i/-atelic). In the contrasts e/i and u/i, there was a significant difference in the choice of telicity. This is shown in Figure 8 (shaded in the table of the figure) (e/i: z = 3.6780, d' = 0.7528, p < 0.01; u/i: z = 2.4845, d' = 0.5094, p = 0.01). However, in comparing /e, u/ with /o/, which is associated with an atelic interpretation in existing verbs, there was no significant difference in the choice of telicity (e/o: z

= 1.5027, d' = 0.3107, p = 0.13; u/o: z = 0.3281, d' = 0.0673, p = 0.72). The next comparison was between nonce verbs containing vowels that do not differ in telicity in existing verbs (e.g., /u/-telic and /e/-telic). In the contrast e/u, there was no significant difference in the choice of telicity (e/u: z = 1.1730, d' = 0.2440, p = 0.24). However, there was a significant difference in the contrast o/i, which was unexpected (o/i: z = 2.1531, d' = 0.4421, p = 0.03).

In VgVt- form, when the pair of vowels differs in telicity in existing verbs (e.g., /u/-telic and /o/-atelic), only in the contrast e/i was there a significant difference in the choice of events (e/i: z = 1.9959, d' = 0.4111, p = 0.04). In the other contrasts, u/i, e/o, and u/o, there was no significant difference in the choice of events (u/i: z = 1.4841, d' = 0.3047, p = 0.14; e/o: z = 1.8315, d' = 0.3776, p = 0.07; u/o: z = 1.3201, d' = 0.2713, p = 0.19). For those pairs of vowels which do not differ in telicity in existing verbs (e.g., /u/-telic and /e/-telic), there was no significant difference in the choice of events. Figure 8 shows that the deviation (z) was smaller than 1.96 (e/u: z = 0.5086, d' = 0.1063, p = 0.61; o/i: z = 0.1633, d' = 0.0334, p = 0.87).

In VrVt- form, regardless of whether the pair of vowels differs in telicity in existing verbs, there was no significant difference in the choice of events (e/i: z = 1.3114, d' = 0.2685, p < 0.19; u/i: z = 0.8201, d' = 0.1682, p < 0.41; e/o: z = 1.8315, d' = 0.3776, p = 0.07; u/o: z = 1.3201, d' = 0.2713, p = 0.19; e/u: z = 0.4903, d' = 0.1004, p = 0.62; o/i: z = 0.8201, d' = 0.1682, p = 0.41).

Lastly, we look at the results of nonce verbs in hVrVt form. In hVrVt form, again, regardless of whether the pair of vowels differs in telicity in existing verbs, there was no significant difference in the choice of events (e/i: z = 0.8186, d' = 0.1677, p = 0.41; u/i: z = 0.3280, d' = 0.0673, p < 0.74; e/o: z = 0.8201, d' = 0.1682, p = 0.41; u/o: z = 1.3114, d' = 0.2685, p = 0.19).

To summarize the results of the individual tokens, among the three tokens in VCVC form, the VbVt and VgVt forms partially showed a significant difference in the choice of events, if the pair of vowels differs in telicity in existing verbs. VrVt forms, however, did not show any significant differences. Finally, for the CVCVC form (hVrVt), there was no significant difference between any pair of vowels in the choice of events, either.



Experiment 2 also included the low vowel /a/, which has no fixed telicity value in existing verbs: some verbs with /a/ are interpreted as telic while others are interpreted as atelic. Here we compare the overall results of /a/ with those of the non-low vowels /e, u, i, o/. First we compared /a/ with /e, u/, which corresponds to a telic interpretation in existing verbs. In this case, there was a significant difference between /a/ and /e, u/ in the choice of events, as Figure 9 shows (e/a: z = 3.7797, d' = 0.3868, p < 0.01; u/a: z = 2.9512, d' = 0.3020, p < 0.01). The next comparison was between /a/ and /o, i/, which corresponds to an atelic interpretation in existing verbs. In this comparison, there was no significant difference between /a/ and /o, i/ in the choice of telicity (o/a: z = 1.7211, d' = 0.1764, p = 0.09; i/a: z = 0.7395, d' = 0.750, p = 0.46). These results indicate that an atelic movie clip was chosen for /a/ in the position of Vowel 2 of bisyllabic nonce verbs.



The results of /a/ in Vowel 2 were contrasted with those in Vowel 1. First we compared /a/ with /e, u/, which corresponds to a telic interpretation in existing verbs. In this case, there was no significant difference between /a/ and /e, u/ in the choice of telicity, as Figure 10 shows (e/a: z = 0.9305, d' = 0.0985, p = 0.35; u/a: z = 0.5072, d' = 0.0537, p = 0.61). The next comparison was between /a/ and /o, i/, which corresponds to an atelic interpretation in existing verbs. In this comparison, there was also no significant difference between /a/ and /o, i/ in the choice of telicity (o/a: z = 0.4227, d' = 0.0447, p = 0.89; i/a: z = 0.7610, d' = 0.0806, p = 0.45). That is, in Vowel 1 of the nonce verbs, regardless of whether the compared vowels correspond to a telic or an atelic interpretation in existing verbs, the comparison with /a/ did not show any significant difference in the choice of events. This fact indicates that the speakers performed at chance in the association of /a/ at Vowel 1 with telicity, given that the results of the non-low vowels /e, u, i, o/ showed that at Vowel 1, the quality of the vowel does not associate with telicity.



3.1.4. Experiment 3: moraicity of nonce verbs and an initial point

The results of the Experiments 1 and 2 show that speakers of Japanese are sensitive to the correspondence between vowel quality and verbal telicity at the rightmost vowel. Experiment 3 further looks into the rightmost syllable and examines whether the variance of syllable structure affects the sensitivity to the correspondence. As seen in section 2.2.2, the existing verb stems differ in frequency of moraicity: bimoraic forms appear more frequently than monomoraic forms do. In Experiments 1 and 2, the tested tokens were limited in variance of moraicity. In particular, in the Experiment 1, the syllable structure of all but one nonce verb was CVC, as shown in (213).

		Т	ested tokens	(syllable stru	icture)
Pairs of contrasted vowels		V-	CV-	VC-	CVC-
/u/-telic	/o/-atelic		sú- / só-		
/u/-telic	/i/-atelic				mút- / mít-
/e/-telic	/o/-atelic				ben- / bon-
/e/-telic	/i/-atelic				hen- / hin-
/u/-telic	/e/-telic				nun- / nen-
/o/-atelic	/i/-atelic				zot- / zit-

(213) Tested nonce verbs in Experiment 1

Thus, Experiment 3 compared bimoraic forms with monomoraic forms and its results show that the type frequency affects the sensitivity to the vowel-telicity correspondence.

The Experiment 3 was also to examine whether vowel quality indeed corresponds to an endpoint of an event, but not to an initial point. In the Experiment 1, we focused on an endpoint of the event depicted in the video clips and none of the video clips depicted an initial point. In the Experiment 3, we used video clips which depict not only an endpoint but also an initial point of an event. With such video clips, the results show that vowel quality still corresponded to an endpoint of an event. I show its results in detail below.

3.1.4.1. Subjects

The subjects of Experiment 3 were 49 adult native speakers of Japanese. 32 subjects spoke the Eastern dialect and 17 subjects spoke the Western dialect. Their ages ranged from 20 to 50: 30 in the 20s, 14 in the 30s, 5 over 40. The subjects included 36 women and 13 men. None of them reported a history of seeing or hearing disabilities. 47 of the subjects were right-handed, while 2 were left-handed. They lived in Vancouver, Canada: 32 for less than a year, 15 for less than five years, and 2 for more than five years. They were recruited by public advertisement and they were paid for their participation.

DIALECTS	Eastern (32), Western (17)
AGE	20-29 yrs (30), 30-39 yrs (14), > 40 yrs (5)
GENDER	Women (36), Men (13)
HEARING	No disability
SIGHT	No disability
HANDEDNESS	Right-handed (47), Left-handed (2)
RESIDENCE	Vancouver, Canada: < 1 yr (32), < 5yrs (15), > 5yrs (2)
RECRUITMENT	Public advertisement
PARTICIPATION	Paid

(214) Subject pool for Experiment 3

3.1.4.2. Stimuli

Audio stimuli

In Experiment 3, 40 nonce verbs which followed the phonological rules of Japanese were used. The nonce verbs included 25 monosyllabic testing tokens and 15 bisyllabic filler tokens. Thus, for all of the 49 subjects, the five vowels /e, u, i, o, a/ were examined in all possible syllable structures (V, VC, CV and CVC), as shown in (215). The consonants in onset and coda were controlled across the vowels.

Quality of vowel	Tested tokens				
	V-	VC-	CV-	CVC-	
/e/-telic	é-(da)	éd-(da)	sé-(ta)	bet-(ta), nen- (da)	
/u/-telic	ú-(da)	úd-(da)	sú- (ta)	but-(ta), nun-(da)	
/o/-atelic	ó-(da)	ód-(da)	só-(ta)	bot-(ta), non-(da)	
/i/-atelic	í-(da)	íd-(da)	sí-(ta)	bit-(ta), nin-(da)	
/a/-	á-(da)	ád-(da)	sá-(ta)	bat-(ta), nan-(da)	

(215) Tested nonce verbs in Experiment 3

To avoid using existing verbs in comparisoin with the Experiment 1, the nonce verbs in V and VC forms looked slightly unnatural; the nonce verbs in V and VC forms were followed by the past tense suffix -da, which occurs only after a nasal in coda in existing verbs. (see also section 2.2.4).

Visual stimuli

I used the sets of telic and atelic video clips which were used in Experiment 3. The type of auditory tokens and the sets of video clips which were assigned to them are summarized in (216).

(216)

	Ех		
Animation no.	Token type Sensitivity to the		Token type in
	(monosyllabic)	correspondence attested	experiment 2
1	bVt- (CVC)	Yes	VbVt- (VCVC)
2	Vd- (VC)	Yes	VgVt- (VCVC)
3	sV- (CV)	No	VrVt- (VCVC)
4	nVn- (CVC)	Yes	hVrVt- (CVCVC)

3.1.4.3. Results of Experiment 3

The results of the Experiment 3 show that the subjects were again sensitive to the correspondence between vowel quality and verbal telicity in monosyllabic nonce verbs. I first discuss the non-low vowels /e, u, i, o/ which display an unambiguous association with telicity. We first compared nonce verbs containing vowels that differ in telicity in existing verbs (e.g.,

/u/-telic and /o/-atelic). In this case there was a significant difference in the choice of events. Figure 11 shows that the deviation (*z*) between the observed and the hypothesized *d'* values was greater than the critical value 1.96 (the red dotted line, significance level $\alpha = 0.05$ in a two-tailed test). The *z* value for the e/o contrast was 4.2678 (*d'* = 0.4876, *p* < 0.01), the *z* value for the u/i contrast 2.933 (*d'* = 0.3399, *p* = 0.01), the *z* value for the u/o contrast 4.7647 (*d'* = 0.5456, *p* < 0.01), and the *z* value for the e/i contrast 2.4407 (*d'* = 0.2819, *p* < 0.01). These results indicate that an event with an inherent endpoint was chosen for the nonce verbs containing the vowel /e, u/ (= telic). In contrast, an event that lacks an inherent endpoint was chosen for the nonce verbs containing the vowel /i, o/ (= atelic).

The next comparison was between nonce verbs containing vowels that do not differ in telicity in existing verbs (e.g., /u/-telic and /e/-telic). In this case there was <u>no</u> significant difference in the choice of events. Figure 11 shows that the deviation (z) was smaller than 1.96 (e/u: z = 0.4892, d' = 0.0580, p = 0.62; o/i: z = 1.8146, d' = 0.2058, p = 0.07.²⁰ These results indicate that if the paired vowels are associated with the same telicity value in existing verbs, the telicity value of the video clip chosen in the task was also the same.



²⁰ Note that the *p*-value of of the o/i contrast was 0.07 (< 0.10) and was unexpectedly close to the significance level $\alpha = 0.05$, compared with the *p*-value of of the e/u contrast (*p* = 0.62). See alo the results of the individual tokens.

In sum, despite the presence of an initial point in the depicted event, the subjects were sensitive to the correspondence between vowel quality and verbal telicity. That is, the presence of an initial point does not affect sensitivity to the association. We can conclude that the vowel quality is indeed associated with the endpoint of an event only.

As for type frequency, the moraicity of the nonce verbs had an influence on the correspondence. In the remainder of this section I discuss in detail the results of the monomoraic and bimoraic nonce verbs. In particular, I show that only in the bimoraic nonce verbs the subjects were sensitive to the correspondence between vowel quality and verbal telicity.

We begin with the results of the nonce verbs in CVC form. There are two tokens to consider: bVt- and nVn-. In the bVt form, if the pair of vowels differs in telicity in existing verbs (e.g., /u/-telic and /o/-atelic), there was a significant difference between the vowels in the choice of events. Figure 12 shows that the deviation (*z*) between three of the pairs of vowels was greater than the critical value 1.96 (e/o: z = 3.831, d' = 0.9758, p < 0.01; u/i: z = 3.6365, d' = 0.9828, p < 0.01; u/o: z = 5.6002, d' = 1.448, p < 0.01). The *z* value for the contrast e/i was almost at 1.96 (*z* = 1.9523, d' = 0.5106, p = 0.05). If the pair of vowels does not differ in telicity in existing verbs (e.g., /u/-telic and /e/-telic), there was no significant difference in the choice of events. Figure 12 shows that the deviation (*z*) was smaller than 1.96 (e/u: z = 1.604, d' = 0.4722, p = 0.10; o/i: z = 1.8363, d' = 0.4652, p = 0.07).

As for the nVn form, if the pairs of vowels which differ in telicity in existing verbs were compared (e.g., /u/-telic and /o/-atelic), there was a significant difference between the vowels in the choice of events in three of the pairs (e/o: z = 3.0271, d' = 0.7827, p < 0.01; u/i: z = 2.0816, d' = 0.5628, p = 0.04; u/o: z = 3.5591, d' = 0.9270, p < 0.01). The e/i contrast was exceptional and there was no significant difference between the vowels; the z value for the contrast was below 1.96 (z = 1.5671, d' = 0.4182, p = 0.12). If the pair of vowels does not differ in telicity in existing verbs (e.g., /u/-telic and /e/-telic), there was no significant difference in the choice of events. Figure 12 shows that the deviation (z) was smaller than 1.96 (e/u: z = 0.5023, d' = 0.1443, p = 0.62; o/i: z = 1.4332, d' = 0.36447, p = 0.15).

Next we turn to tokens of the form VC. If the pair of vowels differs in telicity in existing verbs, most pairs, namely u/o and u/i, showed a significant difference in the choice of telicity (u/o: z = 3.1388, d' = 0.8247, p < 0.01; u/i: z = 2.0816, d' = 0.5626, p = 0.04). The z value for e/o was 1.8978 (d' = 0.4891, p = 0.06) which was close to 1.96. However, the pair of vowels e/i did not show a significant difference in the choice of telicity. The z value for e/i was 0.85424 (d' = 0.2271, p = 0.39) which was much smaller than 1.96. In the comparison between nonce verbs containing vowels that do not differ in telicity in existing verbs (e.g., /u/-telic and /e/-telic), there was no significant difference in the choice of events. Figure 12 shows the z value for e/u was 1.203 (d' = 0.3355, p = 0.23) and the z value for o/i was 1.027 (d' = 0.2621, p = 0.30).

In the above bimoraic forms the correspondence between the non-low vowels and verbal telicity can unambiguously detected. In contrast, in the monomoraic forms, the subjects did not seem to be sensitive to the correspondence. In the CV form (*sV*-) of the nonce verbs, there was no significant difference between the vowels in the choice of telicity regardless of whether the pair of vowels differs in telicity in existing verbs (e/o: z = 0.000, d' = 0.000, p = 1.00; u/i: z = 1.217, d' = 0.3083, p = 0.42; u/o: z = 0.406, d' = 0.1032, p = 0.68; e/i: z = 0.810, d' = 0.2051, p = 0.22; e/u: z = 0.406, d' = 0.1032, p = 0.68; o/i: z = 0.810, d' = 0.42).

The same effect was observed in the nonce verbs that consisted of a vowel only. If the pair of vowels differs in telicity in existing verbs, no pairs showed a significant difference in the choice of telicity (e/o: z = 0.61986, d' = 0.2621, p = 0.54; u/i: z = 1.8281, d' = 0.4123, p = 0.10; u/o: z = 1.0271, d' = 0.2568, p = 0.30; e/i: z = 0.41487, d' = 0.1066, p = 0.68). In the comparison of vowels which do not differ in telicity in existing verbs, there was a significant difference between /e/ and /u/ in the choice of telicity (e/u: z = 2.047, d' = 0.5189, p = 0.04). This fact was unexpected given both vowels correspond to a telic interpretation in existing verbs. As for comparing /i/ and /o/, there was no significant difference in the choice of telicity, unexpectedly close to the significance level (i/o: z = 0.611, d' = 0.1555, p = 0.07).



To summarize the results regarding the non-low vowels, we found two patterns for those pairs of vowels which differ in telicity value in existing verbs. If the nonce verb is bimoraic (CVC or VC), in most cases, there was a significant difference between the vowels in choice of events. If the nonce verb was monomoraic (VC or V), there was <u>no</u> significant difference between the vowels in choice of events (see also Chapter 5 for further discussion).

Now we turn to the results of the low vowel /a/ which has no fixed telicity value in existing verb stems (i.e., its telicity value is either telic or atelic). The experimental results indicate that a telic movie clip was chosen for monosyllabic nonce verbs containing /a/. This is shown by comparing the overall results of /a/ with those of the other non-low vowels. First we compared /a/ with /i, o/, the vowels which correspond to an atelic interpretation in existing verbs. In this case, there was a significant difference between /a/ and /i, o/ in the choice of telicity, as Figure 13 shows (a/i: z = 1.9578, d' = 0.2253, p = 0.05; a/o: z = 3.7811, d' = 0.4311, p < 0.01). The next comparison was between /a/ and /e, u/, which correspond to a telic interpretation in existing verb stems. In this comparison, there was no significant difference between /a/ and /e, u/ in the choice of telicity (a/u: z = 0.9705, d' = 0.0114, p = 0.33; a/e: z = 0.4809, d' = 0.0564, p = 0.63).



To recap, in Experiment 3, with respect to the non-low vowels /e, u, i, o/, the overall results indicate that speakers are sensitive to the association of the quality of the vowel with telicity in monosyllabic nonce verbs. In particular, with the video clips which depicted not only an endpoint but also an initial point of an event, the vowel quality was umambiguosly associated with an endpoint of an event. Moreover, the results of the individual tokens show that the sensitivity to the correspondence varied in moraicity. The subjects were sensitive to the correspondence only in the bimoraic forms which occur in the existing verb stems more frequently than the monomoraic forms do. The low vowel /a/ which has no fixed telicity value in the existing verb stems was associated with a telic interpretation in monosyllabic nonce verbs.

3.2. Discussion

We begin by discussing the overall results of the non-low vowels /e, u, i, o/ in the perception task in the Experiments 1 through 3. The overall results showed that the subjects were sensitive to the correspondence between the quality of the rightmost vowel in the nonce verbs and the telicity depicted by the video clips. If a pair of vowels differed in telicity in existing verbs (e.g. /e/-telic and /i/-atelic), there was a significant difference between the vowels in telicity choice. In contrast, if a pair of vowels was the same in telicity in existing verbs (e.g. /e/-telic and /u/-telic), there was no significant difference between the vowels in telicity choice. That is, the subjects had a significantly strong tendency to associate telic movie clips with the telic vowels /e, u/, compared with the vowels /i, o/. This significant tendency was observed both with the vowel of monosyllabic nonce verbs and with Vowel 2 of bisyllabic nonce verbs (in green in the table below), but not with Vowel 1 of bisyllabic nonce verbs. Although we cannot directly compare the results of the Experiments 1/3 and 2, it appears that the subjects were more sensitive to the correspondence between vowel quality and telicity in monosyllabic verbs than in bisyllabic verbs. This might be due to the fact that monosyllabic verbs are unique to Yamato-Japanese, which is our main concern. In contrast, bisyllabic verbs are found in both Yamato-Japanese and loan words. Loan words do not show the correspondence between vowel quality and telicity.

		Significant difference (<i>p</i> -value) with				
Pair of vowels	Telicity value	Vowel of monos	syllabic verbs	Bisyllabic verbs	(Experiment 2)	
		Experiment 1	Experiment 3	Vowel 2	Vowel 1	
e/i	Telic/Atelic	YES (0.04)	YES (0.01)	YES (< 0.01)	NO (0.87)	
e/o	Telic/Atelic	YES (< 0.01)	YES (< 0.01)	YES (0.04)	NO (0.18)	
u/i	Telic/Atelic	YES (< 0.01)	YES (< 0.01)	YES (0.03)	NO (0.80)	
u/o	Telic/Atelic	YES (0.02)	YES (< 0.01)	NO (0.22)	NO (0.35)	
e/u	Telic/Telic	NO (0.76)	NO (0.62)	NO (0.81)	NO (0.67)	
i/o	Atelic/Atelic	NO (0.74)	NO (0.07)	NO (0.33)	NO (0.12)	

(217) Summary of the results of Experiments 1, 2 and 3

In addition, the results of Experiments 1 and 3 show that vowel quality encoded only the endpoint of an event. In Experiment 1, the movie clips depicted the endpoint of an event, but not the initial point. In contrast, in Experiment 3, the movie clips depicted not only the endpoint but also the initial point of an event. Regardless of whether the initial point was depicted, the correspondence between vowel quality and telicity was identified. Consequently, with respect to the non-low vowels, these results indicate that the quality of the rightmost vowel associates with verbal telicity as part of the grammar.

Moreover, while the correspondence between the non-low vowels and verbal telicity is synchronically part of the grammar, the sensitivity to the correspondence seems to be also affected by type frequency. In the Experiment 3, the results of the individual tokens show that the sensitivity to the correspondence between the non-low vowels and verbal telicity varies in moraicity. The subjects were sensitive to the correspondence only in the bimoraic nonce verbs (in VC/CVC template), but not in the monomoraic nonce verbs (in V/CV template). This sensitivity difference correlates with type frequency. That is, in the existing monosyllabic verb stems, bimoraic forms occur (about 90%) more frequently than monomoraic forms do (about 10%) (see also section 2.2.2.2).

Furthermore, the comparison of the results of the Experiment 2 and 3 shows that the number of syllable also affects the sensitivity to the correspondence between the non-low vowels and verbal telicity. The overall results of the Experiment 3 show that in monosyllabic nonce verbs, the all pairs of vowels that differ in telicity in the existing verb stems also differed in chice of telic movie clips. With bimoraic nonce verbs, the overall results of the Experiment 2 also show a similar difference in choice of telic movie clips but this was observed in most, but not all, of the pairs of vowels which differ in telicity in the existing verb stems. We speculate that variance in response across the experiments reflects the uniqueness of monosyllabicity which is observed only in Yamato-Japanese verb stems, but not in loanword verb stems (see also section 2.2.2).

/a/, which has no fixed telicity value in existing verb stems, behaved differently from the non-low vowels in Experiments 2 and 3. The behavior of /a/ was inconsistent across monosyllabic and bisyllabic nonce verbs, as summarized in (218) below. In monosyllabic nonce verbs, there was a significant difference between /i, o/ and /a/ in telicity choice, while there was no significant difference between /e, u/ and /a/. That is, in parallel to /e, u/, a telic video clip was chosen for /a/ in monosyllabic nonce verbs. In contrast, in bisyllabic nonce verbs, there was a significant difference between /e, u/ and /a/ in telicity choice, while there was a significant difference between /e, u/ and /a/ in telicity choice, while there was a significant difference between /e, u/ and /a/ in telicity choice, while there was no significant difference between /e, u/ and /a/ in telicity choice, while there was no significant difference between /e, u/ and /a/ in telicity choice, while there was no significant difference between /e, u/ and /a/ in telicity choice, while there was no significant difference between /e, u/ and /a/ in telicity choice, while there was no significant difference between /i, o/ and /a/. That is, in parallel to /i, o/, an atelic video clip was chosen for /a/ in Vowel 2 of bisyllabic nonce verbs. Such tendencies were not found with Vowel 1 of bisyllabic nonce verbs at all. Consequently, these results indicate that /a/ as the rightmost vowel plays a role in telicity. There just remains the question of how the telicity value is exactly determined with /a/ at the rightmost vowel.

		Significant difference with				
Pair of	Telicity value	Vowel of	Vowel 2 of	Vowel 1 of		
vowels	in existing verbs	monosyllabic verb	bisyllabic verb	bisyllabic verb		
		(Experiment 3)	(Experiment 2)	(Experiment 2)		
a/e	/telic	NO	YES	NO		
a/u	/telic	NO	YES	NO		
a/i	/atelic	YES	NO	NO		
a/o	/atelic	YES	NO	NO		

(218) The telicity value of /a/ in nonce verbs

CHAPTER 4

The significance of the correspondence between vowel quality and verbal telicity

In Chapter 2 I have shown that within the existing Yamato-Japanese verb stems the non-low vowels correspond to verbal telicity. In Chapter 3 I have shown that adult fluent speakers of Japanese are sensitive to the correspondence in nonce verbs. On the basis of these data, which support the claim that the vowel-telicity correspondence is part of the grammar, I now discuss implications for phonology and syntax. In phonology, the vowel-telicity correspondence seemingly constitutes unnatural classes in standard distinctive features. I provide an analysis for the classes in section 4.2. In section 4.3, I provide a morpho-syntactic analysis for how the vowels determine verbal telicity, within the framework of Chomsky's Principles and Parameters in its minimalist incarnations (Chomsky 1995 and subsequent work). The present analysis has typological consequences. In section 4.4, I conclude with several signposts for future research.

4.1. Summary of the findings in Chapters 2 and 3

In this section, I summarize the findings reported in Chapters 2 and 3. This allows us to recapitulate the contexts in which the correspondence between vowel quality and verbal telicity holds.

We begin with the results of the non-low vowels. The non-low vowels strictly correspond to verbal telicity in existing monosyllabic verbs. In monosyllabic nonce verbs, subjects were also sensitive to this correspondence. These facts indicate that the correspondence between the nonlow vowels and verbal telicity is synchronically <u>part of the grammar</u>. This is summarized in table (219).

Vowel quality	Verbal telicity in		
	existing verbs	nonce verbs	
/e, u/	telic	telic	
/i, o/	atelic	atelic	

(219)) Monos	yllabic	verb	forms	with	the	non-low	vowels
-------	---------	---------	------	-------	------	-----	---------	--------

In bisyllabic existing verbs, the vowel position plays a crucial role; non-low vowels correspond to verbal telicity only in the second vowel position, but not in the first vowel position. The sensitivity to the vowel position also holds in bisyllabic nonce verbs; subjects were sensitive to the correspondence only in the second vowel position.

Vowel 1	Verbal t	elicity in	Vowel 2	Verbal telicity in		
		5			5	
	existing verbs nonce verbs			existing verbs	nonce verbs	
	C			C		
/e, u/	telic or atelic	telic or atelic	/e, u/	telic	telic	
,			,			
/i. o/	telic or atelic	telic or atelic	/i. o/	atelic	atelic	
<u> </u>			,			

(220) Bisyllabic verb forms with the non-low vowels

The facts of bisyllabic verbs and monosyllabic verbs indicate that the rightmost non-low vowels play a crucial role in determining verbal telicity.

We now turn to the peculiar results of the low vowel /a/. As in the non-low vowels, the low vowel determines verbal telicity in monosyllabic nonce verbs. In bisyllabic nonce verbs, the low vowel determines verbal telicity in the second vowel position. That is, the low vowel plays a role in determining verbal telicity in the rightmost vowel position. As with non-low vowels, the low vowel does not determine verbal telicity in the first vowel position of bisyllabic nonce verbs. However, the low vowel displays a peculiar pattern that differs from that of non-low vowels. It corresponds to different telicity values in monosyllabic and bisyllabic nonce verbs: telic in monosyllabics and atelic in bisyllabics. Moreover, the low vowel does not strictly correspond to verbal telicity in any vowel position of existing verbs. This is summarized in (221) and (222).

(221) Monosyllabic verb forms with the low vowel

Vowel quality	Verbal telicity in		
	existing verbs	nonce verbs	
/a/	telic or atelic	telic	

first vowel	Verbal telicity in		second vowel	Verbal to	elicity in
	existing verbs	nonce verbs		existing verbs	nonce verbs
/a/	telic or atelic	telic or atelic	/a/	telic or atelic	atelic

(222) Bisyllabic verb forms with the low vowel

In the remainder of this chapter, I discuss the implications for phonology and morpho-syntax of these patterns.

4.2. Implications for phonology

We begin with implications of the correspondence between vowel quality and verbal telicity for phonology. This correspondence raises a question regarding the phonological patterns of the vowels that encode telicity. On the basis of the findings reported in previous chapters, we can gain new insight into the phonology of Japanese vowels.

In terms of standard distinctive features, the non-low vowels /e, u, i, o/ are distinguished from the low vowel /a/ by means of the feature [low]. Thus, the [-low] vowels /e, u, i, o/ are marked for verbal telicity ([+telic] or [-telic]), while the [+low] vowel /a/ is unmarked for verbal telicity, as in (223).

Telicity	vowel	low	back	high	round
[+telic]	/e/	[-]	[-]	[-]	[-]
	/u/	[-]	[+]	[+]	[-] ²¹
[-telic]	/i/	[-]	[-]	[+]	[-]
	/0/	[-]	[+]	[-]	[-]
unmarked	/a/	[+]	[+]	[-]	[-]

(223) The Japanese vowels in standard distinctive features

The problem is that two vowels each encode telicity and atelicity, respectively, and that these pairs of vowels do not form a natural class in standard distinctive features, as shown in red in (225). Recall the pattern of vowel-telicity correspondence we have observed: the vowels /e/ and

²¹/u/ in Tokyo dialect is unrounded (e.g., Shibatani 1990: 161).

/u/ correspond to the [+telic] value. As illustrated in (224), /e/ is associated with [-back], [-high], and [-round] while /u/ is associated with [+back], [+high], and [+round].



The vowels /i/ and /o/ correspond to the [-telic] value, and /i/ and /o/ do not share distinctive features, either, as illustrated in (225). /i/ is associated with [-back], [+high], and [-round] while /o/ is associated with [+back], [-high], and [+round].



Consequently, the non-low vowels show a criss-cross pattern of their association with the telicity value, as in (226).



I suggest that the correspondence between the non-low vowels and verbal telicity is accounted for by how far the tongue is removed from the tongue rest position, in the course of articulation. In this analysis /e, u/ are close to the tongue rest position ([central]) while /i, o/ are far from the tongue rest position and at the edges of the vocal tract ([peripheral]). Thus, [central] corresponds to the telicity feature [+telic] while [peripheral] corresponds to [-telic], as summarized in (227).²²

Telicity	vowel	low	central/peripheral
[+telic]	/e/	[-]	
	/u/	[-]	[central]
[-telic]	/i/	[-]	
	/0/	[-]	[peripheral]
unmarked	/a/	[+]	[central]

(227) The non-low vowels in [central]/[peripheral]

That the distinction between [central] and [peripheral] plays a role in the phonology of Japanese vowels receives independent support. Zhu and Hatano (2010) show with MRI pictures that the highest point of the tongue (a large dot on figure (228)) is central in /e, u/ while the highest point is peripheral in /i, o/, as shown in (228). The tongue shape also shows similar patterns. In /e, u/, the entire tongue is centralized, while the tongue is peripheral in /i, o/.

²² Note that the analysis in terms of the distinction between [central] and [peripheral] is intended to account for the pattern of verbal telicity. This analysis does not exclude the other conventional distinctive features such as [back] and [high]. The latter features are necessary for other morpho-phonological phenomena (see also section 2.2.4).

 $^{^{23}}$ At this point /a/ is assumed to be associated with the feature [central] (Shibatani 1990, see also (97)). However, /a/ might not be specified for the [central]/[peripheral] distinction at all. This would be consistent with the fact that /a/ is the only low vowel in Japanese. If this is so, the vowel which is unmarked for the [central]/[peripheral] distinction is unmarked for telicity while the vowels which are marked for the [central]/[peripheral] distinction are marked for telicity. I leave this question open for future research.

(228) The highest point of the tongue in articulating Japanese vowels



(Zhu and Hatano 2010: 49 fig. 6 with modification)

Uemura (1997) also shows the significance of the [central]/[peripheral] distinction in Japanese vowels with X-ray movies, as in (229). Interestingly, these articulatory properties correspond to acoustic properties. The increase in the first formant (F1) corresponds to the lowering of the tongue while the increase in the second formant (F2) corresponds to the fronting of the tongue (Ladefoged 2001). As in (229), /i/ and /o/ are peripheral in the vocal tract while /e/ and /u/ are central.

(229) The articulatory and the acoustic differences of Japanese vowels



(Uemura 1997: 213 fig. 2)

The vowels in the nonce verbs which I have used in the experiments do indeed show similar acoustic properties. Although there were some variants due to effects of adjacent consonants, /i/ and /o/ were peripheral while /e/ and /u/ were central, as exemplified in (230) (see also Appendix D for other examples).²⁴ I measured F1 and F2 of the vowels in the nonce verbs in *Vd* form, with Praat version 5.1.17.



(230) Acoustic data (Hz) of the five vowels in *Vd-da* form (at 25% (circle) and at 75% (triangle) of vowel duration)

Although neither Zhu and Hatano (2010) nor Uemura (1997) conduct statistic tests, it is predicted that the [central]/[peripheral] distinction distinction will be significant. Harshman et al. (1977) measure the displacement from the tongue rest position (t_1) by setting 18 reference grids on x-ray pictures of the vocal tract in English vowels, as illustrated in (231).

²⁴ The data is from the Tokyo dialect speaker. /u/ in this dialect is fronted (or centralized) (see also Shibatani 1990).



(adopted from Harshman et al. 1977: 701 fig. 3)

They show that the [central]/[peripheral] distinction is significant. The t_1 values of the five English vowels which are relevant to our discussion are given in (232). In this table, the leftmost vowel has the greatest value in terms of forward and upward movement while the rightmost vowel has the smallest. These data indicate that among the five vowels, /i/ is produced with the tongue in the most forward and upward position, while /o/ is produced with the tongue in the least forward and upward position (i.e., the most backward and downward). In between these two peripheral vowels are the central vowels, /e/, /u/ and /a/.

Vowel	/i/	/e/	/a/	/u/	/0/
t_I	1.5220	1.0430	-0.3107	-0.8333	-1.3780
The movement	forward &	upward \leftarrow	→ b	ackward & d	downward
of the tongue					

(232) The measurement of the tongue movement in the course of articulation

We can also measure the non-low vowels in Japanese and examine whether the central vowels and the peripheral vowels will show a similar pattern to what Harshman et al. find. I leave this measurement for future research.²⁵

²⁵ One might wonder if the quality of the vowels have changed in the development of Japanese, given that we have seen the verb stems in the native lexical stratum. The vowel inventory of old Japanese has been controversial. Ono (1980) and Whitman (1985) claim that the vowel system consisted of four different vowels /a/, /i/, /u/, /o/, based on the low frequency of the mid-front vowel/e/. Ono (1957) argues for an eight-vowel system in old Japanese, based on orthographic differences between vowels: two orthographic variations for each of /i/, /e/ and /o/ (cf. Hashimoto 1934). Matsumoto (1975, 1995) claims that Japanese has long maintained the five-vowel system, explaining that one type of the three varying vowels is a by-product of vowel coalescence. For example, in (i), the second /a/ of ama 'rain' is suffixed with a particle –i. The coalescence of the two vowels /a/ and /i/ results in [e].

To recap, I have shown that the non-low vowels which correspond to verbal telicity are classified in how far the tongue is removed from the tongue rest position, in the course of articulation. The [central] vowels /e, u/ correspond to [+telic] while the [peripheral] vowels /i, o/ correspond to [-telic]. The grouping of /e/ and /u/ is not unique to telicity. In onomatopoeic expressions which imitate the sounds of a Japanese banjo (*Shamisen*), /e/ and /u/ are grouped together: /tin/ for high tone, /ten, tun/ for mid tone and /ton/ for low tone (Kindaichi 1988) (see Chapter 5 for more onomatopoeic expressions).

4.3. Implications for morpho-syntax

As seen in section 2.2, telicity is composed in phrasal syntax (Verkuyl 1972, 1993). In this context, the question arises as to what role the correspondence between the non-low vowels and verbal telicity plays in the calculation of phrasal telicity. In what follows, I develop a morpho-syntactic analysis within the Principles and Parameters framework in its minimalist incarnations (Chomsky 1995 and subsequent work). In particular, I adopt Travis' (1991, 1994, 2000, 2010) assumption according to which verbal telicity is encoded in a functional projection dedicated for inner Aspect (inner Asp). The projection of inner Asp (inner AspP) is in the complement of v which encodes the initial point of an eventuality. Thus, syntax represents part of the event structure which consists of v and inner Asp (cf. van Voorst 1988; Doron 2003). This approach is reminiscent of insights of Generative Semantics (Lakoff 1971, McCawley 1976, Ross 1976) where transitive verbs are lexically decomposed into several sub-events such as DO, BECOME and CAUSE. The approach allows us to explicitly explore the cross-linguistic variation which is associated with the observed sound-meaning correspondences regarding inner Aspect. The structure I assume is given in (234).

(i)	a.	saka + i liquor-i	→	sake	
	b.	ama + i rain-i	÷	ame	(Matsumoto 2006)

In Matsumoto's account the orthographic differences between vowels are observed at morpheme boundaries (e.g. the boundary between the noun root and its inflection). If this is correct, the orthographic differences can be attributed to functional differences of the vowels.

(234) ... [vP causer [v' [inner AspP undergoer [inner Asp <telicity>]]]

4.3.1. Yamato-Japanese

I propose that the Japanese vowels are associated with inner Aspect. In particular, /e, u/ specify inner Asp as [+telic] while /i, o/ specify inner aspect as [-telic]. This is schematized in (235).

(235) a. ...[vP causer [v⁴ [inner AspP undergoer [inner Asp
$$<$$
{/e/, /u/}, [+telic]>]]]]
b. ...[vP causer [v⁴ [inner AspP undergoer [inner Asp $<$ {/i/, /o/}, [-telic]>]]]]

The low vowel /a/ is also associated with inner Asp. Recall that in nonce verbs but not in existing verbs, the low vowel appears to determine verbal telicity in the rightmost vowel position, albeit with different values: [+telic] in monosyllabic verbs and [-telic] in bisyllabic verbs. But why does /a/ in the second vowel position correspond to different values of telicity? I propose that the low vowel corresponds to an unvalued telicity feature ([μ telic]), as in (236).²⁶

(236) ... [vP causer [v' [inner AspP undergoer [inner Asp </a/, [μ telic]>]]]

The valuation of the this unvalued telicity feature depends on the context. This analysis is consistent with the fact that the low vowel does not strictly correspond to verbal telicity in any vowel position of existing verbs. The remaining question is what context determines the unvalued feature. I leave this question for future research.²⁷

4.3.2. Typology of how inner Aspect is encoded

Languages differ as to how inner Aspect is encoded. There are languages aside from Japanese where inner Aspect is encoded by a dedicate form, namely, Arabic and Malagasy. These languages differ from languages such as English and Russian, where inner Aspect is not directly encoded. I show these two types of sound-meaning correspondence on inner Aspect. Thus,

²⁶ The unvalued telicity feature is different from an unspecified telicity feature for vowel quality in the first vowel position. The unspecified telicity feature does not determine the verbal telicity at all.

²⁷ We might have different results for the telicity value of the low vowel within the existing verb stems if we control for the context with animated video clips, as we did with nonce verbs (Chung-hye Han, personal communication).

another goal of this subsection is to develop a preliminary typology of the surface properties of verbal telicity marking.

4.3.2.1. Semitic

Arabic has a dedicated form for telicity. The telicity values [+telic] and [-telic] associate with the vowel quality of transitive verbs (Er-Rayyan 1986; Fassi Fehri 1993; Bahloul 1994). In particular, if /a/ is the second vowel of the verb, it is associated with a [+telic] interpretation, as shown in (237)²⁸ This is also attested with my consultants, as in (238).

(237)	Telic v	verbs					
	dar a ba 'h						
	wad a S	a 'put'					
	šak a ra	'thanl	ς'				
	kat a ba	. 'write	?				
	? ak a la	'eat'					
	qar a ?a	read'					
	šat a ma ʻinsult šal a ba ʻafflic		ť				
			et'		(Bahloul 1994: 55 ex. 8)		
(238)	a.	daraba	al kurah	(marrah wahida)	fi khilal saa s a		
		PST.hit.3sg	the ball	one.time	within.an.hour		
	'He hit the ball once in an hour.'						
	b.	*daraba	al kurah	(marrah wahida)	fi mudat saa s a		
		PST.hit.3sg	the ball	one.time	for.an.hour		
		'He hit the ba	all once for ar	n hour.'			

In contrast, if the second vowel of a transitive verb is /i/, then the verb is [-telic], as shown in (239).²⁹ This is exemplified with my consultants's data (240).

²⁸ The first vowel of the verb form associates with perfectivity while the third vowel associates with agreement for person, number and gender (see Bahloul 1994). ²⁹ See also Dobbs-Allsopp (2000) for Biblical Hebrew.

(239)		Atelic verbs			
		kar i ha	'hate'		
		?amila	'hope'		
		fah i ma	'understand'		
		S ar i ma	'learn'		
		qabila	'accept'		(Bahloul 1994: 55 ex. 10)
(240)	a.	*kariha	al kurah	(marrah wahida)	fi khilal saa s a
		PST.hate.3sg	the ball	one.time	within.an.hour
		'He hated the	ball once in ar	n hour.'	
	b.	kariha	al kurah	(marrah wahida)	fi mudat saa \$ a
		PST.hate.3sg	the ball	one.time	for.an.hour
		'He hated the	ball once for a	ın hour.'	

As in Japanese, the Arabic data suggest that vowel quality is associated with inner aspect and encodes verbal telicity. In this case, /a/ corresponds to [+telic] while /i/ corresponds to [-telic].

The remainder of the verb consists of three consonants. These make up the so called triconsonantal verbal root (cf. McCarthy 1979, 1981; Arad 2003; Faust 2008; Lowenstamm 2008), which is associated with meaning, independent from inner Asp. Thus, there are some cases where the same consonantal root appears across different stems (i.e., with different vowel patterns, the so-called *binyans*).³⁰ For example the root /hsb/ can occur in both telic and atelic verb stems, as shown in (241).

(241)	Ro	oot: /hsb/				
	a.	/hsb/+ /a_a_a/	\rightarrow	has <u>a</u> ba	'(he) computed (it)'	(telic)
	b.	$/hsb/ + /a_i_a/$	\rightarrow	has i ba	'(he) thought (it)'	(atelic)

(Er-Rayyan 1986: 75)

Arabic verbs are represented in (242) where I assume that the verbal root (Verb) is adjoined to inner Asp.

³⁰ Not all verb roots are used in all contexts. I assume that the possibility for such alternations is determined by the semantics of the root (cf. Arad 2003; Er-Rayyan 1986: 75).

(237) a. ...[vP [v' [inner AspP [inner Asp [Verb /CCC/] </a/, [+telic]>]]]

b. ... [vP [v' [inner AspP [inner Asp [Verb /CCC/] </i/, [-telic]>]]]

In sum, Arabic, like Japanese, has a dedicated form to mark verbal telicity.

4.3.2.2. Malagasy

Malagasy is another language which has a dedicated marker for verbal telicity in the form of two contrasting prefixes (Phillips 1996; Travis 2000). In particular, the prefix */ha-/* is always associated with a telic interpretation. That the complex verb is indeed telic can be seen on the basis of the fact that the event denoted by the prefixed verb cannot be cancelled, as shown in (243) (Travis 2000).

(243)	n-a- <u>ha</u> -vory	ny	ankizy	ny	mpampianatra
	PST-CAUS-TEL-meet	the	children	the	teachers
	'The teachers gathered the children.'				

*nefa	tsy	nanana	fotoan	a izy		
but	NEG	pst.have	time	they		
'but th	ney did	not have time.'			(Travis 2000: 173 ex. 43)	ł

In contrast, the prefix /an-/ is associated with an atelic interpretation. Verbs that are prefixed with /an-/ denote an event which can be cancelled, as shown in (244).³¹

(244) n-<u>am</u>-ory ny ankizy ny mpampianatra PST-ATEL-meet the children the teachers 'The teachers gathered the children'

nefa	tsy	nanana	fotoar	na izy	
but	NEG	pst.have	time	they	
'but t	hey did	not have tim	e.'		(Travis 2000: 172: ex. 40)

These data suggest that, in Malagasy, </ha-/, [+ telic]> and </an-/, [- telic]> are associated with inner Aspect. In particular I assume that these prefixes serve to value the telicity feature in inner Aspect, as shown in (245).³²

³¹ The prefix-ending /n/ is fused to the root-initial /v/.

Thus, the verbal root /vory/ has an independent meaning 'meet'. It does not serve to determine the telicity value. Consequently, one and the same root can combine with either the telic marker */ha-/* or the atelic marker */an-/*. This much provides evidence for the dissociation of verbal telicity from the verbal root itself.

4.3.2.3. English

In languages which have a dedicated marker for verbal telicity (e.g. Arabic and Malagasy), verbs are transparently morphologically complex. In contrast, in languages which have no dedicated marker for verbal telicity, seemingly simplex verbs are syntactically composed. For example, in English, the telic and the atelic predicates are not characterized by the presence of a special marker and therefore the decomposition is not detectable on the basis of morphological properties of the verb. That is, neither atelic nor telic verbs have a common marker, as shown below. Consider first the atelic verbs in (246).

(246)	Atelic verbs		
	know	run	
	believe	walk	
	have	swim	
	desire	push (a cart)	
	love	drive (a car)	
	understand		
	be happy		(Rothstein 2004:

That these verbs are all atelic can be seen on the basis of the fact that they are felicitous with a time-span adverb ('in x time'), but not with a durative adverb ('for x time'), as in (247) and (248).

- (247) a. *John loved Mary in an hour.
 - b. John loved Mary for years.

6)

³² It is sometimes assumed that feature valuation is only possible via AGREE and/or MOVE. Here I assume that external merge, just like internal merge, may serve to value the telicity feature (see also Pesetsky and Torrego 2006).

(248) a. *John **push**ed the cart in an hour.

b. John **push**ed the cart for an hour.

(Rothstein 2004: 24-26 ex 38, 42)

As for telic transitive verbs, the telicity value does not associate with a particular marker, as shown in (249).

(249)	Telic verbs		
	recognize	paint (a picture)	
	spot/notice	make (a chair)	
	find/lose	deliver (a sermon)	
	research	draw (a circle)	
		build (a house)	(Rothstein 2004: 6)

These telic verbs are felicitous with a time-span adverb ('in x time'), but not with a durative adverb ('for x time'), as in (250) and (251).

- (250) a. John **notice**d the picture in a few minutes.
 - b. *John **notice**d the picture for a few minutes.
- (251) a. John **built** the house in a year.

b.

*John **built** the house for years.

(Rothstein 2004: 24-26 ex 38, 42 with modification)

This establishes that there is no dedicated marker for telicity in English. Instead, a morphologically simplex form encodes both the core meaning of the verb and its telicity value. I use the term 'span' to refer to such a single form encoding the semantic values $\langle \Sigma \rangle$ of inner Asp and the verbal root, along the lines of Williams (2003). The representation of the telic verb *fix* is given in (252).

(252) ...
$$[vP [v' [inner AspP [inner Asp <[+telic]> [verb < \Sigma >]]]]]$$

 $<$ 'spanning'

4.3.2.4. Russian

In Russian simplex verbs, there is no dedicated marker of telicity. To change the telicity value of a given verb, the entire verb form changes.³³ Examples of Russian transitive verbs are given below. The simplex telic verbs in (253) are in perfective form and their imperfective counterparts are derived by prefixing (Smith 1991). Across these telic verbs, the telicity value does not correspond to a particular sound pattern.³⁴

(253)	Telic verbs				
	Perfective		Imperfective	Gloss	
a.	da-t'	\rightarrow	da-va-t'	'give'	
b.	kupi-t'	\rightarrow	pa-kupi-t'	'buy'	
c.	vibrasi-t'	\rightarrow	vibrasi-va-t'	'throw away'	
d.	pirista-t'	\rightarrow	pirista-va-t'	'stop/cease'	(cf. Smith 1991: 315 ex. 40)

Similarly, atelic verbs are not characterized by a dedicated marker, as shown in (254). Unlike the telic verbs, these atelic verbs have no perfective counterparts.

(257) multiple veros	(254)	Atelic verbs
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	Perfe	ctive	Imperfective	<u>Gloss</u>	
a.	n/a	←	zna-ť	'know'	
b.	n/a	←	bi-t'	'be'	
c.	n/a	\leftarrow	vigledit-t'	'look like'	
d.	n/a	←	znači-ť	'mean'	(cf. Smith 1991: 315 ex. 40)

The above data suggest that in Russian there is no dedicated form marking telicity. Consequently, a morphologically simplex form encodes verbal telicity. This suggests that what looks like a simplex verbal form is in fact associated with more than one meaning in the syntactic tree as indicated in (255). In other words the verbal form spans over inner Asp and the verbal root.

(255) ...
$$[vP [v' [inner AspP [inner Asp <[+telic]> [verb < \Sigma >]]]]$$

³³ It is known that some Russian preverbs determine telicity (Smith 1991; Ramchand 2004; Svenonius 2004a, 2004b; among others). However, in this thesis, these preverbs are not classified as dedicated markers for verbal telicity because they are not obligatory. That is, it is not the case that all telic verbs are so prefixed. This differs from Japanese where all telic verbs have /e/ or /u/ while all atelic verbs have /i/ or /o/. ³⁴ The suffix *-t* derives the citation form.

4.3.2.5. Summary of typology

We have now seen that the surface form of telicity marking differs across languages. On the one hand, languages differ as to whether or not they make use of a dedicated marker of verbal telicity. Such a marker only encodes the value of verbal telicity, but not other semantic content. On the other hand, dedicated telicity markers differ in their morphological properties across different languages. In Malagasy telicity marking is associated with a prefix, and as such telicity marking is concatenative. This contrasts with telicity marking in Arabic, which is non-concatenative in nature. This is summarized in (256).³⁵



Thus, there appear to be several parameters of variation in the encoding of telicity, as summarized in (257). First, telicity may or may not be associated with a dedicated marker. Second, if a language has dedicated marking for telicity, the marking may or may not be concatenative. In a language where telicity marking is concatenative (e.g. Malagasy), the verb is pronounceable and interpretable independent of telicity marking. Languages where telicity marking is non-concatenative differ in the status of the verb. In the absence of telicity marking, the verb can be interpretable but not pronounceable (as in Arabic). Interestingly, in Japanese the verb without telicity marking is neither pronounceable nor interpretable. This raises the question as to what the status of this verb without telicity marking is. I return to this question in Chapter 5.

³⁵ Verbal telicity is also overtly marked in sign languages such as American Sign Language (ASL) (Wilbur 2003, 2008; Malaia and Wilbur 2010). In ASL, in hand movement, a <u>rapid deceleration to a stop</u> denotes a telic event, while hand movement <u>continues relatively constantly</u> in atelic signs.
Verb property	Pronounceable	Interpretable
Malagasy	Yes	Yes
Arabic	No	Yes
Japanese	No	No

(257) Morpho-phonological (non-)concatenation in Arabic, Malagasy and Japanese

CHAPTER 5

Conclusion

In this dissertation, we have been concerned with how meaning is encoded in language. We have conducted a case study revealing a correspondence between vowel quality and verbal telicity in Yamato Japanese. In particular, verbal telicity is encoded by the quality of the rightmost vowel of the verb stem. /e/ or /u/ corresponds to [+telic] while /i/ or /o/ corresponds to [-telic]. This vowel-telicity correspondence holds not only in existing verbs but also in nonce verbs, as summarized in (258). That is, the correspondence is synchronically part of the grammar. Unlike the non-low vowels, the low vowel /a/ has no fixed telicity value in existing verbs. However, I have shown that in nonce verbs /a/ has a fixed telicity value. Thus, it is analyzable as corresponding to the unmarked value [μ telic]. The question remains as to how the value of [μ telic] is determined.

	(A = 0)		1	• •	1	1	1
1	7 N N	I he vowel-tellcity	corresnondend	re in exi	sting vern	s and nonce	verns
1	200		conceptingent			s una nonee	10100

	{/e/, /u/}	{/i/, /o/}	/a/
Existing verbs	[+telic]	[-telic]	no fixed value
Nonce verbs	[+telic]	[-telic]	[+telic] or [-telic]

The vowel-telicity correspondence has been revealed by restricting the empirical domain to the native lexical stratum of Japanese, Yamato-Japanese. Yamato-Japanese verbs differ from loanword verbs in verb formation: Yamato-Japanese verbs are inherently verbal whereas loanword verbs are derived from noun, as summarized in (259). Because all loanwords are nominal vowel quality does not correspond to telicity. Thus, the present study has shown that the domain partition is a necessary process to identify sound-meaning correspondences in a language.



The hitherto unrecognized vowel-telicity correspondence has implications for phonology and syntax. In phonology, I have suggested that the vowel quality which has a fixed telicity value is captured by how far the tongue is removed from the tongue rest position, in the course of articulation. In this analysis /e, u/ are close to the tongue rest position ([central]) while /i, o/ are far from the tongue rest position and at the edges of the vocal tract ([peripheral]). Thus, [central] corresponds to the telicity feature [+telic] while [peripheral] corresponds to [-telic], as summarized in (260).

Telicity	vowel	low	central/peripheral
[+telic]	/e/	[-]	
	/u/	[-]	[central]
[-telic]	/i/	[-]	
	/0/	[-]	[peripheral]

(260) The non-low vowels in [central]/[peripheral]

In future research, we will examine whether there is a significant distance between [central] and [peripheral] vowels (cf. Harshman et al. 1977). In parallel, we further need to investigate whether sound patterns have changed in the development of Japanese and whether the vowel-telicity correspondence holds not only synchronically but also diachronically. In fact, whether there was any change of vowel quality has been controversial (Ono 1957; Hattori 1959, 1976; Matsumoto 1975, 1995, 2006). This is because Japanese sound patterns used to be transcribed with Chinese characters which are originally ideograms, rather than alphabetic. There were 8 Chinese characters used for Japanese vowels and the number of the Chinese characters is larger than that

of the present Japanese vowels (Hashimoto 1949). One possibility is that these different characters represent different sounds (i.e., 8 vowels, rather than 5, in the old Japanese). An alternative is that they represent different functions (see also footnote 23).

Regarding syntax, within the framework of P&P and its minimalist incarnations, I have assumed that inner Aspect is the category responsible for determining verbal telicity and that the verbal root is adjoined to inner Asp. In particular, I claim that in Japanese inner Aspect has a dedicated form, in the form of vowel quality. This analysis has implications for the typology of form-meaning correspondence. Assume that languages share the universal categories (Cinque 1999). Then, languages vary in whether a single form corresponds to a single meaning (one-to-one sound-meaning correspondence), as represented in (261), or a single form corresponds to more than a meaning (one-to-many sound-meaning correspondence), as represented in (262).

(261) One-to-one sound-meaning correspondence



(262) <u>One-to-many sound-meaning correspondence</u>



We have seen that not only Japanese but also Arabic and Malagasy demonstrate one-to-one sound-meaning correspondences. These languages contrast with the languages which

demonstrate one-to-many sound-meaning correspondences. In the latter languages, a single form spans not only the verbal root but also inner Asp.

In what follows, I discuss more consequences of the present analysis which are speculative at this point. These relate to i) intransitives, ii) the properties of the consonantal parts of the verb stem and iii) vowel quality in other domains.

5.1. Intransitives

To identify the vowel telicity correspondence, we have paid attention to transitive predicates. This is because telicity is compositional and verbal telicity is identified only if the structural context such as the quantity of the direct object is controlled for it. Once we have identified the correspondence, the question arises as to whether the correspondence is observed not only in transitive predicates but also in intransitive predicates. In what follows, I show promising data of monosyllabic intransitives where the vowel-telicity correspondence is observed. (263) is the list of monosyllabic intransitive verbs which contain non-low vowels.

Syllable structure		/i/-[-telic]	/e/-[+telic]	/u/-[+telic]	/o/-[-telic]
V V		ì-ta 'be'			
	d-V		dé-ta 'go out'		
CV	n-V	ni-ta 'resemble'	ne-ta 'lie down/ sleep'		
	k-V	kí-ta 'come'			
VC	V-t	it-ta 'go'			ót-ta 'be' (HON)
VC	V-n			ún-da 'produce pus'	
	t-V-t	tit-ta 'scatter'	tét-ta 'shine'		
	s-V-n			sún-da 'finish/ clear/ inhabit'	
	n-V-t				not-ta 'ride on'
CVC	y-V-t				yót-ta 'be drunk', yot-ta 'drop by'
	k-V-t				kót-ta 'be addicted'
	k-V-n				kón-da 'be crowded'
	h-V-t		het-ta 'decrease'	fút-ta 'fall'	

(263) Monosyllabic intransitive Yamato-Japanese verbs

In the above intransitive verbs, the vowel quality determines telicity. Verb stems which contain /i/ or /o/ are [-telic] while verb stems containing /e/ or /u/ are [+telic]. Telicity is diagnosed with the four tests used in Chapter 2. Examples are given in (264) through (267).

- (264) a. hitori-no zyookyaku-ga gohunkan sono eki-ni i-ta one.CL-GEN passenger-NOM for.5.minute that station-at be-PAST 'There was a passenger at the station for five minutes.'
 - b. *hitori-no zyookyaku-ga gohunde sono eki-ni i-ta one.CL-GEN passenger-NOM in.5.minute that station-at be-PAST *'There was a passenger at the station in five minutes.'

c. hitori-no zyookyaku-ga kuzi-tyoodo-ni sono eki-ni i-ta one.CL-GEN passenger-NOM 9.sharp -at that station-at be-PAST 'There was a passenger at the station at nine sharp.'

zissai sono zyookyaku-wa kuzihan-ni mada sono eki-ni i-ta in.fact that passenger-TOP 9:30-at still that station-at be-PAST 'in fact, that passenger was still at the station at 9:30.'

- (265) a. hitori-no seerusuman-ga gohunkan sono mise-ni yot-ta one.CL-GEN salesperson-NOM for.5.minute that shop-at drop.by-PAST 'A salesperson dropped by at the shop for five minutes.'
 - b. *hitori-no seerusuman-ga gohunde sono mise-ni yot-ta
 one.CL-GEN salesperson-NOM in.five.minute that shop-at drop.by-PAST
 *'A salesperson dropped by at the shop in five minutes.'
 - c. hitori-no seerusuman-ga kuzityoodo-ni sono mise-ni yot-ta one.CL-GEN salesperson-NOM 9.sharp-at that shop-at drop.by-PAST 'A salesperson dropped by at the shop at nine sharp.'

zissai, sono seerusuman-wa kuzihanni mada sono mise-ni yot-te-i-ta in.fact that salesperson-TOP at.nine.thirty still that shop-at drop.by-te-i-PAST 'in fact, the salesperson was still dropping by at the shop at 9:30.'

- d. hitori-no seerusuman-wa ima sono mise-ni yot-te-i-ru one.CL-GEN salesperson-TOP now that shop-at drop.by-te-i-PRES lit. 'A salesperson is dropping by at the shop now.'
 → 'A salesperson dropped by at the shop.'
- (266) a. *hitori-no gaakusei-ga gohunkan huton-ni ne-ta one.CL-GEN student-NOM for.5.minute futon-at lie.down-PAST *'A student lay down on the futon for five minutes.'
 - b. hitori-no gaakusei-ga gohunde huton-ni ne-ta one.CL-GEN student-NOM in.5.minute futon-at lie.down-PAST 'A student lay down on the futon in five minutes.'

c. hitori-no gakusei-ga kuzityoodo-ni huton-ni ne-ta one.CL-GEN student-NOM 9.sharp-at futon-at lie.down-PAST 'A student lay down on the futon at nine sharp.'

zissai, sono gakusei-wa kuzihanni mada futon-ni ne-te-i-ta in.fact that student-TOP at.9:30 still futon-at lie.down-te-i-PAST 'in fact, the student was still lying down on the futon at 9:30.'

- d. hitori-no gakusei-wa ima sono huton-ni ne-te-i-ru one.CL-GEN student-TOP now that futon-at lie.down-te-i-PRES lit. 'A student is lying down on the futon now.'
 ☆ 'A student lay down on the futon.'
- (267) a. *ikken-no youken-ga gohunkan kono mooru-de sun-da one.CL-GEN work-NOM for.5.minute this mall-at be.done-PAST *'Work was done at this mall for five minutes.'

b. ikken-no youken-ga gohunde kono mooru-de sun-da one.CL-GEN work-NOM in.5.minute this mall-at be.done-PAST 'Work was done at this mall in five minutes.'

c. ikken-no youken-ga kuzityoodo-ni kono mooru-de sun-da one.CL-GEN work-NOM 9.sharp-at this mall-at be.done-PAST 'Work was done at this mall at nine sharp.'

*zissai, so-no youken-wa kuzihan-ni mada sono mooru-de sun-de-i-ta in.fact that work-TOP 9:30-at still that mall-at be.done-te-i-PAST *'Work was still being done at that mall at 9:30.'

d. ikken-no youken-ga ima sono mooru-de sun-de-i-ru one.CL-GEN work-NOM now that mall-at be.done-te-i-PRES 'Work is being done at that mall now.'
☆ 'Work was done.'

For future research, we need to investigate whether the vowel-telicity correspondence holds not only in monosyllabic but also in poly-syllabic intransitive verbs and also whether the correspondence is position-sensitive (i.e., at the rightmost vowel). If the correspondence holds in all the intransitives, inner Asp determines the verbal telicity in the intransitive, as in the transitive. This casts doubt on the common assumption that telicity can be used as a diagnostic to determine the structure of intransitives, namely, whether the structure contains v with no inner Asp (unergative) or it contains inner Asp with no v (unaccusative) (Takezawa 1991; Kishimoto 1996, 2005; Toratani 1998) (cf. Perlmutter 1978, 1988; Hoekstra 1984, 1988; Van Valin 1990; Levin and Rappaport 1995; Harves 2003, 2009; Friedmann 2007; for unaccusative tests in other languages).³⁶ If inner Asp determines verbal telicity of all intransitives, it might be the case that there is no structural difference between unergative intransitives and unaccusative intransitives in Japanese (see also Jacobsen 1992; Tsujimura and Iida 1999).

Notice that as (264) to (267) show, many intransitive verb stems obligatorily take a locative expression (i.e., a postpositional phrase or PP). Such PPs seem to denote a result state (cf. Tsujimura 1991). For instance, in (266), the verb *ne*- 'lie down' denotes the action of the undergoer's lying down on a futon. The undergoer may remain at the location denoted by the *huton-ni* 'on the futon'. This raises the question as to the structural position of the PP which affects the telicity interpretation. We need to further investigate how the PP plays a role in determining telicity (cf. Jackendoff 1996; Folli 2002; Folli and Ramchand 2005; Zagona 2005; Svenonius 2010).

5.2. Consonants as independent morphemes

If vowel quality is associated with inner Aspect, the question arises as to whether the rest of the verb stem has an independent meaning, as in Arabic. One possibility is that in the monosyllabic verb stem, the non-contiguous consonantal parts function as a single morpheme which denotes a meaning of Verb. However, this potential analysis is unlikely, given that the entire consonantal parts is not associated with an identifiable meaning (cf. McCarthy 1981; Arad 2003 for Semitic cases and see also section 4.3.2.1). For example, *ket*- 'kick' is a telic verb while *kit*- 'cut' is an atelic verb, as in (268). In this minimal pair, the vowel quality determines verbal telicity but the residual consonantal parts *kVt*- do not have a particular meaning.

³⁶ Independently, Miyagawa (1989, 1994) argues that the unaccusativity is diagnosed with floating numeral quantifier (FNQ). He shows that the argument of unaccusative intransitives and the direct object of transitives are modified by FNQs while the subject of transitives is not, as in (i). He attributes the similarity between the argument of unaccusative intransitives and the direct object of transitives to the structural similarity, namely, the internal argument of the verb. However, as many point out (Kageyama 1993; Gunji and Hashida 1998; Takami 1998, 2001; Ishii 1999; Nishigauchi and Ishii 2003; Nakanishi 2004, 2007, 2008), there are counterexamples to this diagnosis in which the subject of transitives is also modified by FNQs.

Telicity	Vowel	/kVt-/	/sVt-/	/hVt-/
[+telic]	/e/	k <u>e</u> t- 'kick'	s <u>e</u> t- 'bid'	het- 'decrease'
	/u/	k <u>u</u> t- 'devour'	s <u>u</u> t- 'strike'	h <u>u</u> t- 'swing'
[-telic]	/i/	k <u>i</u> t- 'cut'	s <u>i</u> t- 'know'	h <u>i</u> t- 'fart'
	/0/	k <u>o</u> t-	s <u>o</u> t- '	h <u>o</u> t- 'dig'

(268) Consonantal parts and verbal meanings

An alternative analysis, which I suggest here, is that each consonant functions as an independent morpheme. In particular, suppose that the onset consonant (Conset) is associated with the Verb under inner Asp, as represented in (269).

(269) The structural positions of Conset and the rightmost vowel



Thus, typologically Japanese differs slightly from Arabic. In Japanese a single consonant corresponds to the meaning of Verb while in Arabic the string of discontinuous triconsonants functions as Verb, as shown in the table below.

LANGAUGE	VERB	INNER ASP	MORPHOLOGY
Japanese	Conset	Rightmost vowel	Concatenative
Arabic	C_C_C	Second vowel	Non-concatenative

If Conset is adjoined to inner Asp as Verb, the subsequent question is what meaning the consonant has. I hypothesize that Conset in the verb denotes the manner of the event which the undergoer

undergoes. If this is correct, it is predicted that each consonant in onset will be associated with a different meaning regarding the manner. Here I show preliminary data regarding the meanings of C_{onset} . As (271) shows, for example, alveolar consonants each correspond to a particular meaning. /s/ corresponds to [friction], /n/ to [softness/stickiness], and /t/ to [instantaneity]. These consonants occur with the five vowels and denote different events. These verbs are exemplified in (272) and (273).

Vowel	/s/ - [friction]	/n/ - [stickiness/softness]	/t/ - [instantaneity]
/e/	/set/ 'bite/strive'	/net/ 'knead'	/tet/ 'kick'
/u/	/sut/ 'strike'	/nut/ 'paint'	/tut/ 'pull up'
/i/	/sit/ 'know'	/ni/ 'simmer'	/tit/ 'scatter'
/0/	/sot/ 'shave'	/not/ 'ride on (a horse)'	/tot/ 'take'
/a/	/sat/ 'shoot off'	/nat/ 'become'	/tat/ 'stand'

(271) A (non-exhaustive) list of the meanings which correspond to Conset

(272)	a.	Takasi-ga	Hirosi-to	sono	e-o	<u>s</u> et-ta
		TNOM	Hwith	that	picture-ACC	bit-PST
		'Takashi bit	that picture w	ith Hirosh	i.'	

b.	Takasi-ga	sono	kizi-o	<u>n</u> et-ta
	TNOM	that	dough-ACC	knead-PST
	'Takashi kne	eaded the	e dough.'	

c. Takasi-ga sono booru-o <u>k</u>et-ta T.-NOM that ball-ACC kick-PST 'Takashi kicked the ball.'

- (273) a. Takasi-ga sono matti-o <u>s</u>ut-ta T.-NOM that match-ACC strike-PST 'Takashi struck the match.'
 - b. Takasi-ga kabe-ni sono sikkui-o <u>n</u>ut-ta T.-NOM wall-to that plaster-ACC paint-PST 'Takashi painted the plaster on the wall.'

c. Takasi-ga sono musubi-o <u>k</u>ut-ta T.-NOM that rice.ball-ACC paint-PST 'Takashi devoured the rice ball.'

For future research, we need to establish how to diagnose the meaning of C_{onset} and examine whether all the consonants have a particular meaning regarding the manner of event.

Note that the meanings of the whole verbs are idiomatic to some extent. However, the idiomaticity of verbal meanings is not surprising given that such phenomena are observed in other languages as well. That is, the composition of inner Asp and Verb may be associated with a certain degree of idiomaticity (see Arabic verbs in section 4.3.2.1).³⁷

The issue of how the wole verb meaning is composed might also be related to whether the coda consonant (C_{coda}) which is moraic also plays a role. I cannot provide any analysis for the role of C_{coda} at this point. However, there is one thing for sure that as Chapter 3 has shown, spearkers' sensitivity to the vowel-telicity correspondence is affected by type frequency of moraicity. As seen in Chapter 2, monomoraic and bimoraic forms are both attested in existing verbs although they differ in frequency: around 80% of the existing verb stems is bimoraic while the rest of around 20% is monomoraic. This fact raises the question as to whether sound-meaning correspondences are purely a matter of the grammar (see also McClelland and Rumelhart 1981; Rumelhart and McClelland 1982, 1986; McClelland 1987; Pinker and Prince 1988; Pinker 1991; Smolensky 1995; Pinker and Ulman 2002; McClelland and Patterson 2003; Stockall and Marantz 2006) and I leave this question open for future research.

Unlike Yamato-Japanese verb stems, loanword verb stems are derived from nouns. Thus, the vowel quality within the noun is not directly associated with inner Asp. The noun differentiates the telicity of loanword verb stems only if it combines with the verbalizer such as /- si/ and /-r/. I leave open the question of how loanword verb stems are formed and how the noun plays a role in determining the telicity (see also Sato 1975, 1985; Grimshaw and Mester 1988;

³⁷ Arad (2003) argues that the result of first merge may not be fully compositional but instead may give rise to an idiomatic interpretation (see also Marantz 2001, 2008). Nevertheless, what is crucial in the present context is that the root does have a core meaning in common, independent of the templatic pattern it associates with. See also Jackendoff 1995; Marantz 1997; Harley and Noyer 2000; for discussion of how to give rise to the idiomaticity.

Uchida and Nakayama 1993; Poser 2002; Tsujimura and Davis 2008) (cf. Hale and Keyser 1993, 2002; Harley 2005 for English denominal verbs).

5.3. Polyfunctional vowels

The finding of the correspondence between vowel quality and verbal telicity suggests that Japanese is a language of one-to-one sound-meaning correspondence. We may therefore expect that Japanese will show one-to-one sound-meaning correspondences in other categories besides inner aspect such as v, T, and COMP. If this is so, the specific question arises as to what sound patterns correspond to a categorial meaning. I now show that there are two types of sound patterns which correspond to a categorial meaning in all heads in the verbal domain:

i) a single vowel corresponds to a categorial meaning or

ii) a single open syllable CV corresponds to a categorial meaning.

We begin with the first type. As we have seen, vowel quality corresponds to verbal telicity in inner Asp. Vowels also correspond to [+/-cause] in *v* which introduces the causer of an eventuality. As (274) shows, /e/, the causativizer, corresponds to [+cause]. In contrast, /a/, the decausativizer, corresponds to [-cause], as in (275) (cf. Okutsu 1967; Inoue 1976; Teramura 1982; Nishio 1988; Noda 1991; Morita 1994; Suga and Hayatsu 1995; Nishiyama 1998; Alexiadou 2010; among many).

- (274) a. Taro-ga hito-o atum-<u>e</u>-ru T.-NOM people-ACC gather-CAUS-PRES 'Taro gathers people.'
 - b. *hito-ga atum-<u>e</u>-ru people-NOM gather-CAUS-PRES intended 'People gather.'
- (275) a. *Taro-ga hito-o atum-<u>a</u>-ru T.-NOM people-ACC gather-DECAUS-PRES intended 'Taro gathers people.'
 - b. hito-ga atum-<u>a</u>-ru people-NOM gather-DECAUS-PRES 'People gather.'

Moreover, in T, /u/ corresponds to [+present], as in (276a). In contrast, a single syllable in CV template is used as the past tense morpheme in T: /ta/ corresponds to [-present], as in (276b) (see also section 2.2.3).

(276) a. Yoko-ga zyuu-de ittou-no kuma-o ut-u Y.-NOM one.CL-GEN bear-ACC gun-at shoot-PRES 'Yoko shoots one bear with a gun.' b. Yoko-ga zyuu-de ittou-no kuma-o ut-ta Y.-NOM gun-at one.CL-GEN bear-ACC shoot-PST 'Yoko shot one bear with a gun.'

The morphemes associated with COMP are also in CV template. COMP introduces a sentential complement and it denotes whether the subject of the matrix clause is certain that the eventuality denoted by the embedded clause happens or has happened. In COMP, therefore, syllables in CV form correspond to [+/-certain]. As (277) shows, the complementizer /-to/ which is originally a quotative marker corresponds to [+certain]. Thus, the subject of the matrix clause must be associated with the event denoted by the embedded clause, regardless of whether the event is presupposed to be true or is newly-learned information (cf. Kuno 1973; Akatsuka 1985). In contrast, the question marker /-ka/ corresponds to [-certain], as in (278). Thus, the causer of the matrix clause must be dissociated from the event denoted by the embedded clause.

- (277) a. Takasi-wa [Meari-ga Taro-ni at-ta]-<u>to</u> sit-ta T.-TOP M.-NOM T.-DAT see-PAST-COMP know-PST 'Takashi knew that Mary met Taro.'
 - b. *Takasi-wa [Meari-ga Taro-ni at-ta]-<u>to</u> sir-anakat-ta T.-TOP M.-NOM T.-DAT see-PAST-COMP know-NEG-PST Intended. 'Takashi did not know that Mary met Taro.'

(278) a. *Takasi-wa [Meari-ga Taro-ni at-ta]-<u>ka</u> sit-ta T.-TOP M.-NOM T.-DAT see-PAST-Q know-PST Intended. 'Takashi knew if Mary met Taro.'

b. Takasi-wa [Meari-ga Taro-ni at-ta]-<u>ka</u> sir-anakat-ta T.-TOP M.-NOM T.-DAT see-PAST-Q know-NEG-PST 'Takashi did not know if Mary met Taro.' The single vowels and the single syllable in CV form which are the morphemes of inner Asp, v, T and COMP are summarized in (279).³⁸ It is further expected that such one-to-one sound-meaning correspondences will also be observed in the nominal domain and I will leave this for future research (cf. Kuno 1973; Aoyagi 2006).

Vowel	COMP	Т	ν	inner Asp
/e/			/e/ [+cause]	/e/ [+telic]
/u/	/to/ [+certain]	/u/ [+present]		/u/ [+telic]
/i/				/i/ [-telic]
/0/				/o/ [-telic]
/a/	/ka/ [-certain]	/ta/ [-present]	/a/ [-cause]	/a/ [µtelic]

(279) Forms of categories in the verbal domain

Given that in many cases a single vowel functions as a morpheme, the question arises as to whether a single syllable in CV template is a morpheme or further decomposable (i.e., a vowel within the syllable corresponds to a meaning). Although nothing is conclusive yet, the

³⁸ Outer aspect which views an eventuality as part or whole (Smith 1991; Demirdache and Uribe-Etxebarria 1997, 2007) could be another instance of syntactic terminals where vowels correspond to a meaning, namely, /i/ which is in the progressive form *-te-i-* corresponds to an imperfective interpretation. This is shown in (i).

(i)	Takasi-ga	puuru-de	oyoi-de- <u>i</u> -ru
	TNOM	pool-at	swim-de-i-PRES
	'Takashi is sw	vimming in the po	ool.'

However, note that the progressive form *-te-i-* presumably originates from the conjunction *-te* and the verb *-i* 'exist'. If so, the structure of the progressive aspect is parallel to that of coordination which is exemplified in (ii) (cf. Matsumoto 1997).

- (ii) a. [tabe-te-sima]-u eat-and-finish-PRES lit. 'eat and finish' 'finish eating'
 - b. [it-te-kur]-u go-and-come-PRES 'go and come'
 - c. [yon-de-kak]-u read-and-write-PRES 'read and write'

latter view is supported by the fact that the above two types of sound patterns contain a vowel (in V or CV template) while a single consonant does not correspond to a meaning of any category, as summarized in (280). In other words, vowels play a crucial role in all the heads.

	Correspondence	attested
Pattern 1	a single vowel – categorical meaning	YES
Pattern 2	a single syllable (CV) – meaning	YES
Pattern 3	a single consonant – meaning	NO

(280)	Possible soun	d patterns	which	associate	with	meanings
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If a single vowel corresponds to different meanings across the categories, the question arises as to how the multiple correspondences relate to each other. There are two logical possibilities as to the nature of such multiple correspondences:

i) multiple correspondences share a meaning (the 'polysemy' hypothesis) and

ii) multiple correspondences do not share a meaning at all (the 'homophony' hypothesis).

These two hypotheses make language-internal predictions about possible correspondences. Here I explore one of these predictions. That is, it appears that Japanese supports the polysemy hypothesis. These predictions tell us how to approach the issue of multiple correspondences in language.

The polysemy hypothesis claims that the association of a sound pattern (π) with a meaning (Σ) is independent of the categorial affiliation (κ). In other words, the independence of the $\langle \pi, \Sigma \rangle$ correspondence allows for category-neutral behavior; the same ($\langle \pi, \Sigma \rangle$) bundle may be applicable to multiple categories and its specific function is determined in each head, i.e., 'poly-functional' or 'polysemic' ($\langle \langle \pi, \Sigma \rangle, \kappa \rangle$). This is illustrated in (281).



(281)

This type of sound-category association is rather new to the current syntactic theory. In Distributed Morphology (Halle and Marantz 1993; Marantz 1997; Harley and Noyer 1999; among many), $\langle \pi \rangle$ of categorial heads ('morphemes') is inserted late after spelling out syntactically processed linguistic objects towards Phonological Form and Logical Form ($\langle \kappa, \Sigma \rangle$, $\pi \rangle$), as schematized in (282).



Such category-specific sound-meaning correspondences are inseparable from the categories and they cannot apply to other categories.³⁹ Thus, if the same sound pattern is used across categories, those categories accidentally have the same sound pattern (i.e., 'homophones'). In the above minimalist model, the timing of associating a form with a category is uniform across languages. However, the present polysemic hypothesis suggests that there are also languages such as Japanese where $\langle \pi \rangle$ associates with $\langle \Sigma \rangle$ early before associating with $\langle \kappa \rangle$. That is, languages may vary in timing of sound-category association (i.e., either early association or late association), as in (283) and (284).

(283) Early association of $<\pi>$ with $<\Sigma>$

LexiconSyntaxSpell-out $<\pi, \Sigma>$ \rightarrow $<\kappa>$

³⁹ The denotation of category-specific sound-meaning correspondences could also be $<<\kappa$, $\Sigma>$, $\pi>$ if we assume late association of sounds with meanings (cf. Halle and Marantz 1993; Marantz 1997).

(284) Late association of $<\pi>$ with $<\Sigma>$

Lexicon		<u>Syntax</u>		Spell-out	
<∑>	\rightarrow	< <u>K</u> >	\rightarrow	<π>	

The polysemy hypothesis or the early sound-meaning association has advantage in that it accounts for the proper assignment of the vowel quality to verbal telicity. As seen in Chapter 2, the verbal telicity is apparent only if the direct object is quantized ([+q]). If the direct object is non-quantized, the verbal telicity is opaque to the phrase-level telicity (285c). This compositionality does not affect the association of vowel quality with inner Asp, given that the sound-meaning association takes place before the telicity composition. If, on the other hand, inner Asp is assigned its form after spell-out, the form is determined based on the telicity value of the verb phrase. Thus, in (285c) where the verbal telicity is opaque to phrasal telicity, inner Asp is assigned a wrong form on the basis of the telicity value of inner AspP at spell-out.

(285)	The transparency/	opacity of	f verbal i	telicity to	phrase-lev	el telicity
< / /	1 2	1 2		2	1	2

	<u>OBJ</u>	verb	verb phrase	
a.	[+q]	[+telic]	[+telic]	(transparent)
b.	[+q]	[-telic]	[-telic]	(transparent)
c.	[- q]	[+telic]	[-telic]	(opaque)
d.	[- q]	[-telic]	[-telic]	(transparent)

If vowel quality associates with meaning before $\langle \Sigma \rangle$ associating with $\langle \kappa \rangle$, yet another question arises as to what the core meaning of the vowel quality is. There is nothing conclusive but there is one thing for sure, namely that the low vowel /a/ is used across all of the verbal domains. This differs from the non-low vowels, as seen in (279). To identify the core meaning of the vowel quality, it is worthwhile to investigate what meaning is associated with vowel quality in onomatopoeic expressions. This is because onomatopoeic expressions are also in the native lexical strata. In fact, onomatopoeia and Yamato-Japanese have long been developed in the

history of Japanese, as discussed in Chapter 2.⁴⁰ These two strata might have some meanings in common. (56) is repeated below for convenience.



(56)

Onomatopoeic expressions are analyzable and it appears that here too vowel quality corresponds to a meaning (Hamano 1986, 1998). In particular, the articulatory and the acoustic properties of each vowel associate with a unique meaning. Apparent cases are found with the back vowels /u, o, a/. Regarding these vowels, the tongue height (jaw aperture) associates with the size of the object. The tongue height is a locational property of the vowel articulation: the distance between the palate and the tongue. The size of the object is the distance between both ends of the object's diameter. If the two ends are close to each other, the distance is short. If the two ends are far from each other, the distance is long. The high vowel /u/ associates with the smallness of the object. The mid vowel /o/ associates with the middle size of the object. The low vowel /a/ associates with the largeness of the object. The association of tongue height with size is demonstrated in (286).

(286) a. ame-ga atama-ni <u>potu</u>-tto oti-te ki-ta rain-NOM head-to fall-and come-PST 'I felt a (small) rain drop on my head.'

⁴⁰ See Jespersen (1922) and Newmeyer (1992), for example, for a different view that onomatopoeia do not share linguistic properties with other lexical strata (see also Kita 1997; Tsujimura 2001, 2005; Kageyama 2005; Imai et al. 2008; Akita 2010; for relevant discussions).

b.	zyaguti-kara	<u>poto</u> -tto	mizu-ga	oti-ta	
	faucet-from		water-NOM	fall-PST	
	'A drop of w	ater fell fro	om the faucet.'		
c.	namida-no	tubu-ga	<u>pota</u> -tto	oti-ta	
	tear-GEN	drop-NO	M	fall-PST	
	'A (large) tea	urdrop fell a	and spread in a	large patch.'	
					(Haman a

(Hamano 1998:111 ex.17)

The meanings which correspond to the back vowels in onomatopoeic expressions are summarized in (287).

	Size (tongue height)			
Vowel quality	Small	Large		
/u/	[+]	[-]		
/0/	[-]	[-]		
/a/	[-]	[+]		

(287) Vowels and their associating meanings in onomatopoeia

As seen above, in onomatopoeic expressions a spatio-temporal notion is part of the core meaning. This spatio-temporal notion is observed not only in onomatopoeia but also in Yamato-Japanese. For example, the correspondence between vowel quality and spatio-temporality is immediately obvious in demonstratives, which belong to Yamato-Japanese. In demonstratives, /o/ associates with [+proximal] while /a/ associates with [-proximal] (see also Sakuma 1936; Hoji 1991; Kamio 1997). This is shown in the paradigm in (288).

/o/ [+proximal]	/a/ [-proximal]
k <u>o</u> re 'this'	k <u>a</u> re 'he'
	<u>a</u> re 'that'
k <u>o</u> tira 'this side'	<u>a</u> tira 'that side'
k <u>o</u> tti 'this side'	<u>a</u> tti 'that side'
k <u>o</u> ko 'here'	k <u>a</u> ko 'past'
kono 'this (GEN)'	k <u>a</u> no 'that (GEN)'
	<u>a</u> no 'that (GEN)'

(288) Vowel quality and its corresponding meaning in demonstratives

If the spatio-temporal notion is applicable to other categorical meanings such as inner Asp, v, Tense and COMP (cf. Tsubomoto et al. 2009) (see also Gruber 1965; Hale 1986; Ritter and Wiltschko 2009; for examples for cases in other languages), we can think of sound-meaning correspondence in language from the broader viewpoint.

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APPENDICES

Appendix A: Lists of monosyllabic and bisyllabic transitive verbs of Yamato-Japanese

Syllable s	structure _σ [μ]]	/i/	/e/	/u/	/0/	/a/
,	V		é- 'get'			
	m-V	mí- 'see'				
	b-V					
	w-V	n/a	n/a	n/a	n/a	
	t-V					
	d-V					
	s-V	si- 'do'				
CV	z-V					
	n-V	ni- 'simmer'				
	j-V	n/a	n/a			
	k-V	ki- 'wear'				
	g-V					
	h-V		hé- 'pass'			

(1) Monomoraic monosyllabic transitive verb stems of Yamato-Japanese (n=6)

Syllable	structure	/;/	101	/11/	101	/0/
stem	_σ [μμ]]	/1/	/e/	/u/	/0/	/a/
VC	V-t	ít- 'fry'		út- 'hit', ut- 'sell'	ót- 'bend', ot- 'chase'	
	V-n			un- 'bear'		án- 'knit'
	m-V-t				mót- 'carry', mot- 'heap'	mát- 'wait', mat- 'dance'
	b-V-t					
	w-V-t	n/a	n/a	n/a	n/a	wat- ' break'
CVC	t-V-t			tsut- 'pull up'	tót- 'take'	tát- 'depart'
	d-V-t					
	s-V-t	sit- 'know'	sét- 'bid'	sút- 'strike', sut- 'suck'	sót- 'shave'	sát- 'leave'
	z-V-t			zút- 'drag'		
	n-V-t		nét- 'knead'	nút- 'sew', nut- 'rub'		
	y-V-t	n/a	n/a	yút- 'do up one's hair', yut- 'utter'		yat- 'do/send'
	k-V-t	kít- 'cut'	két- 'kick'	kút- 'devour'		kat- 'buy'
	g-V-t					
	h-V-t	hit- 'fart/ excret'		hut- 'swing'	hót- 'dig'	hát- 'creep', hat- 'post'
	m-V-n				mon- 'massage'	
	b-V-n				Ŭ	
	w-V-n	n/a	n/a	n/a	n/a	
	t-V-n			tsun- 'stack'	ton- 'fly'	
	d-V-n					
	s-V-n					

(2) Bimoraic monosyllabic transitive verb stems in Yamato-Japanese (n=48)
Syllable structure		/;/	101	/11/	101	/0/
$[_{\text{stem }\sigma}[\mu\mu]]$		/1/ /6/	/ u/	/0/	/ d/	
	z-V-n					
	n-V-n				nón- 'swallow'	
CVC	y-V-n	n/a	n/a		yón- 'read', yon- 'invit'	yán- 'suffer'
	k-V-n			kun- 'scoop'		kán- 'bite'
	g-V-n					
	h-V-n			hun- 'tread'		hán- 'browse'

(2) Bimoraic monosyllabic transitive verb stems in Yamato-Japanese (n=48)

Bisyllabic verbs		Vowel 2						
Syllable s	tructure	/i/	101	/11/		/a/		
$[\text{stem } \dots \sigma [[\mu]]]$		/ 1/	/0/	/ u/	/0/	/ d/		
V.V		oi- 'put'						
	CiV	kii- 'listen to' sii- 'lay' hii- 'pull' síi- 'force'						
	CeV							
CV.V	CuV	súi- 'plow' sui- 'like' nui- 'unplug' húi- 'blow' hui- 'sweep' mui- 'face' mui- 'peel/show one's fangs' kúi- 'regret'						
	CoV	kói- 'excrete' tói- 'dissolve/melt' dói- 'pull away' nói- 'pull away'						
	CaV	ka-1- 'write' sá-i- 'tear' ta-i- 'make a fire' na-i- 'cry' há-i- 'sweep'						

(3) Bisyllabic transitive verbs in Yamato-Japanese ([$_{stem} \dots \sigma[\mu]$]) (n=36)

Bisyllabic verbs		Vowel 2					
stem ····	. σ[[μ]]	/i/	/e/	/u/	/0/	/a/	
CV.V	CaV	ma-i- 'roll' má-i- 'seed' ya-i- 'burn'					
	iCV						
	eCV						
	uCV						
V.CV	oCV	óbi- 'take on/carry'					
	aCV	abi- 'bathe'					
	CiCV						
	CeCV						
	CuCV	músi- 'steam'					
	CoCV						
CV.CV	CaCV	kasi- 'lend' sási- 'stub' tasi- 'add' dási- 'put out' nási- 'perform' házi- 'be ashamed of' wabi- 'apologize' kari- 'borrow'					

(3) Bisyllabic transitive verbs in Yamato-Japanese ([$_{stem} \dots \sigma[\mu]$]) (n=36)

Bisyllabic verbs		Vowel 2						
Syllable structure		/i/	/e/	/11/	/0/	/a/		
$[\operatorname{stem}\ldots_{\sigma}[\mu\mu]]$		/ 1/	/0/	/ u/	707	/ a/		
V.VC	iVC							
	eVC							
	uVC							
	oVC				oot- 'cover'			
	aVC				aót- 'agitate'			
	CiVC					miát- 'look at each other'		
<u>anna</u>	CeVC				seót- 'shoulder'			
CV.VC	CuVC							
	CoVC							
	CaVC				haót- 'put on'			
	iCVC	izít- 'finger'			inót- 'wish' idón- 'challenge'	iwát- 'celebrate' ibát- 'be proud of'		
	eCVC			egút- 'gouge'		erán- 'select'		
	uCVC			00				
V.CVC	oCVC			okut- 'send'	ogot- 'be proud' osot- 'strike' odot- 'dance' omót- 'think'	ogán- 'worship'		
	aCVC			abút- 'roast'		asat- 'hunt for' arat- 'wash'		
CV.CVC	CiCVC	tigít- 'cut into pieces' sikít- 'compart /partition' mikít- 'forsake' misít- 'acquaint'	hinét- 'twist'	tikút- 'inform' sikún- 'plan'	kikón- 'wear (extra clothes)' sikón- 'train' nikón- 'stew' mikon- 'estimate /expect'	mihat- 'keep an eye on' miyát- 'gaze' simát- 'finish, put away' ninát- 'take (on oneself)'		

(4) Bisyllabic transitive verbs in Yamato-Japanese ([$_{stem...}$ [µµ]]) (n=120)

Bisyllabic verbs		Vowel 2					
$[\text{stem}{\sigma}[\mu\mu]]$		/i/	/e/	/u/	/0/	/a/	
	CiCVC					sikat- 'scold' sibát- 'tie' sitat- 'yearn for' tikat- 'swear'	
CV.CVC	CeCVC	segít- 'dam/stem' negít- 'beat down' nezít- 'twist'	sesét- 'fool/pick'	kezut- 'whittle' mekut- 'leaf (a page)' megut- 'go round' megun- 'give generously'	metót- 'marry'	negát- 'wish' nerat- 'target' netán- 'begrudge' segán- 'nag'	
	CuCVC	musit- 'pluck'	tunét- 'pinch'	kukut- 'tie together' susut- 'sip' tukút- 'make' tudut- 'spell' yusut- 'swing' sukut- 'scoop' nugut- 'wipe' tutún- 'wrap' nusún- 'rob' kurún- 'roll' musun- 'connect'	tunót- 'collect'	susan- 'avoid'	
	CoCVC	kogít- 'cut into small pieces' kozít- 'gouge'		kosút- 'scrub'			

(4) Bisyllabic transitive verbs in Yamato-Japanese ([$_{stem...}$ [µµ]]) (n=120)

Bisyllabic verbs		Vowel 2					
[_{stem} σ [μμ]]		/i/	/e/	/u/	/0/	/a/	
CV.CVC	CaCVC	kagít- 'limit' kazít- 'gnaw' nazít- 'rebuke' hasít- 'run on'	syabét- 'chatter'	kasút- 'graze' sagut- 'search' sasut- 'rub' nagút- 'punch' nasút- 'rub on' nabút- 'mock at' makut- 'roll up' matut- 'offer (honorific)' tagut- 'haul' hazun- 'bound'	nanót- 'give one's name' mamót- 'guard' tamót- 'hold' kamót- 'pull a fast one on' tadót- 'track back' satot- 'realize' tayót- 'rely on' nazót- 'trace' kakot- 'enclose' sasot- 'entice' matót- 'robe' yatót- 'hire' kakon- 'enclose' nagón- 'relax'	kagat- 'darn' katat- 'speak' nasát- 'do (honorific)' mawat- 'turn over' watat- 'cross over' harát- 'sweep off/pay' kabát- 'shield' kamát- 'care about' sarat- 'snatch away' narát- 'learn/copy' kazat- 'decorate' sawat- 'touch' warat- 'laugh at' hakát- 'plan' manan- 'study/ imitate' tatan- 'fold' nayán- 'sandwich' habán- 'block'	

(4) Bisyllabic transitive verbs in Yamato-Japanese ([$_{stem...}$ [µµ]]) (n=120)

Appendix B: F1 and F2 values of vowels in monosyllabic nonce verbs



(1) The five vowels in *V*-da template (25% (tablet) and at 75% (triangle) of vowel duration)

(2) The five vowels in *sV-ta* template



(3) The five vowels in *bVt-ta* template



(4) The five vowels in *nVn-da* template



(5) The five vowels in *Vd-da* form

