CROSS-LINGUISTIC DIFFERENCES IN ENCODING OF CAUSALITY: HOW ENGLISH AND JAPANESE CHILDREN LEARN FORM-MEANING MAPPING DURING DEVELOPMENT

A thesis submitted to The University of Manchester for the degree of Doctor of Philosophy in the Faculty of Biology, Medicine & Health

2017

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Abstract

Languages differ in how they encode causal events, placing greater or lesser emphasis on the agent or patient of the action. Little is known about how these preferences emerge and the relative influence of cognitive biases and language-specific input at different stages in development. This thesis presents an attempt to investigate whether there is a difference between English and Japanese people in how they map form to meaning; how these form-meaning mappings are learned; what is the relative influence of cognitive-general bias and language-specific input on children’s developing linguistic representation; and whether transfer effects of syntactic or form-meaning mapping in Japanese-English bilingual speakers are observed.

To answer these questions, a corpus study and three experimental studies were conducted. In the corpus study, we examined the relative use of transitive/intransitive sentences of causative alternation verbs in child-directed speech and children’s speech (around age 3) in English and Japanese. Further, we investigated the relationship of animacy of agent and patient to the choice of causative alternation sentences (transitives or intransitives). The proportion of transitive usage (‘transitivity bias’) was calculated and 14 verbs were selected to directly compare between Japanese and English. Our results show that Japanese adults and children tended to produce more intransitive constructions than English adults and children. Children at around age 3 learned usage from their caregivers, and had already started showing language-specific patterns. In addition, animacy of patients seemed not to determine the choice of transitive/intransitive constructions by Japanese and English caregivers.

Using the 14 comparable causative alternation verbs identified from our corpus study, we conducted three experimental studies. In a comprehension task, we investigated the emergence of sentence preferences to describe causal events in English- and Japanese-speaking children (aged three and five years) and compared this to preferences displayed by adults. We studied two factors suggested to influence this choice: Animacy (Study 1) and Intentionality (Study 2). Participants watched animations (Study 1) or videos (Study 2) depicting familiar and novel causal actions, and made a best-match choice between a transitive and intransitive description. We found no effect of patient animacy on sentence selection with familiar verbs at any age in either language. However, with novel verbs, English and Japanese three-year-olds were influenced by patient animacy, but in contrasting ways which mirror aspects of their linguistic input. For intentionality, with familiar verbs both Japanese and English speakers selected fewer transitive sentences for accidental than intentional scenes, but this pattern was more pronounced in Japanese speakers. However, with novel verbs, only adults showed this preference.

In a production study (Study 3), we aimed to investigate whether there were transfer effects of syntactic or conceptual representations. As a procedure, English-monolingual and Japanese-English bilingual children (at age 5) described accidental/intentional causal events in English. We also examined whether in a production task, English-monolingual children (aged three and five years) and adults would replicate the results of the comprehension task. We found that there was no transfer effect on the use of any sentence constructions on the Japanese-English bilinguals, but there was a transfer effect on frequency of omission of the agent, in both accidental and intentional scenes. These results suggest that the knowledge of Japanese interferes not with their use of English sentence constructions, but by encouraging omission of the agent (as occurs frequently in Japanese). Also, with regard to the English monolingual use of causative alternation verbs, the production task replicated the results of the comprehension task. In this thesis, we will discuss important new information to constrain theories about the process of learning to map event structure to language, and its interdependence with concepts of animacy, intentionality and the distributional properties of linguistic input to children.
Declaration

No portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning;

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Acknowledgements

First of all, I would like to thank my supervisors Prof. Anna Theakston and Dr. Thea Cameron-Faulkner for giving me the opportunity to write this thesis. Thank you so much for your intellectual guidance and support that you have given me throughout the last 4 years and particularly throughout the last period of thesis writing.

To my Japanese family: Thanks for all the love and (financial) support you have given throughout my life. I am so grateful to have such a wonderful family. Arigatou.

Very special thanks to Andrew and Anna Charlton who supported me as English parents over the last five years.

Thanks to the LuCiD staff and colleagues for being such a lovely bunch of people.

Mickie Glover and Anna Coates: Thank you so much for helping me with organising participants as well as running my experiments.

Very special thanks to Mariko and Tim who performed wonderfully for my experimental videos.

Thank you so much for relaxing me to my lovely animals: Mika, Ginger & Pepper, Juniper & Rosemary, and Harvest mice!

Finally, very special thanks to all schools and nurseries, and participants who helped my experiments.
List of Abbreviations

NOM: Nominative case marker
ACC: Accusative case marker
CAU: Causative
PAST: Past tense
Chapter 1. Introduction

Causal events occur throughout our daily lives, for example when we open the door to leave our house, or observe a harassed waiter bump into a table and break a vase. Understanding causal relations is universal. However, different languages may map semantic elements in the causal event onto different lexical and syntactic structures (Talmy, 1985; Muentener & Lakusta, 2011). In English, we could choose to express the causal event of breaking the vase using a simple non-causal intransitive (“The vase broke”), a simple transitive causative (“He broke the vase”), a periphrastic causative (“He made the vase break”), or even causal conjunctions (“He knocked the table and the vase broke”). Goldberg (2003) argued that argument-structure constructions have a direct link between the form and the general aspects of the interpretation. For example, an intransitive construction is interpreted as something changing state, while a transitive construction is interpreted as something acting on something else.

Between languages, there are often differences in how particular aspects of events are encoded. For example, motion events may be encoded differently between languages according to whether the “Path” (trajectory) or “Manner” (the way the motion is performed) is typically encoded in their verbal forms (Talmy, 1985; 2000; c.f. Allen, Ozyurek, Kita, Brown, Furman, Ishizuka & Fujii, 2007; Engemann, Hendricks, Hickmannm Soroli & Vincent, 2015).

Goldberg (2003) also pointed out that constructions are learned from input and are often not strictly identical across languages. Children are required to learn language-specific form-meaning mappings. For example, Allen et al., (2007) showed that English, Turkish and Japanese children have begun to develop sensitivity to their language’s manner and path mappings at the age of three. Goldberg (2003) further argues that in comparing constructions between languages we should therefore refer to ‘construction types’. Thus, when children learn sentence constructions, their generalisation of the constructions emerges only slowly with the ability to record transitional probabilities and statistical generalization in the input (Goldberg, 2003).

In order to make adult-like and language-specific use of constructions describing causal events, children need to acquire knowledge about the form-meaning mapping between events and conventional choice of linguistic structure for their languages. There has been little cross-linguistic research published on form-meaning mapping, especially focusing on children. This thesis aims to increase our understanding of how and when English-monolingual and Japanese-monolingual (and Japanese-English bilingual) children learn the use of transitive and intransitive sentence constructions.

This thesis is organised as follows:

Chapter 1 provides an overview of the Japanese and English languages and transitivity. It also discusses how English and Japanese speakers choose an appropriate sentence construction, based on a review of the literature.
Chapter 2 presents a corpus study of child-directed and children’s speech to examine the input and output of verbs. This aims to investigate the patterns of child and adult usage in both Japanese and English, to see whether there are differences in input-output and whether language-specific differences exist in usage of transitive and intransitive constructions.

Chapter 3 presents two experimental studies of the preferences of English and Japanese children and adults for transitive or intransitive constructions in a comprehension task controlling animacy and intentionality.

Chapter 4 presents a similar experimental study of Japanese-English bilingual and English monolingual adults and children, using a production task. We examine whether there is any transfer effect on production of transitive and intransitive constructions between Japanese and English.

Chapter 5 discusses the key findings of the studies and makes suggestions for future research.

Now we move on to discuss in more detail of the background of this research.

1.1. Definition of semantic transitivity

Transitive and intransitive constructions are common sentence structures in most languages (Luk, 2012), and are amongst the first structures children need to acquire. Considerable research on children’s acquisition of transitive and intransitive structures has been undertaken (e.g. Gertner, Fisher, & Eisengart, 2006; Chan, Lieven, & Tomasello, 2009; Abbot-Smith & Serratrice, 2013).

In formal approaches, the number of arguments determines whether a structure is transitive or intransitive (Luk, 2012). For example, in the sentence “The man hit the ball” there are two arguments (one agent, the man and one patient, the ball), which makes it a transitive frame. On the other hand, an intransitive sentence contains one argument e.g. ‘The ball rolled’. Tsunoda (1991, p.72) defined the transitive prototype as having “…. two (or more) participants: the agent’s action impinges on the patient and causes a change of state in it.” In the above example, the man caused a change of state in the ball by hitting it.

1.1.1. Properties of transitivity (Hopper & Thompson, 1980)

Traditionally, the definition of transitivity was “a global property of an entire clause, such that an activity is ‘carried over’ or ‘transferred from’ the agent to a patient” (Hopper & Thompson, 1980, p.251). However, in the early 1980s, Hopper and Thompson (1980) suggested that actually this is more complex, and proposed parameters of “transitivity” ranging from high to low (see Table 1.1).
Table 1.1.
Ten Properties of Transitivity (Hopper & Thompson, 1980, p.251)

<table>
<thead>
<tr>
<th></th>
<th>High transitivity</th>
<th>Low transitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>2 or more participants, A and O</td>
<td>1 participant</td>
</tr>
<tr>
<td>Kinesis</td>
<td>Action</td>
<td>Non-action</td>
</tr>
<tr>
<td>Aspect</td>
<td>Telic</td>
<td>Atelic</td>
</tr>
<tr>
<td>Punctuality</td>
<td>Punctual</td>
<td>Non-punctual</td>
</tr>
<tr>
<td>Volitionality</td>
<td>Volitional</td>
<td>Non-volitional</td>
</tr>
<tr>
<td>Affirmation</td>
<td>Affirmative</td>
<td>Negative</td>
</tr>
<tr>
<td>Mode</td>
<td>Realis</td>
<td>Irrealis</td>
</tr>
<tr>
<td>Agency</td>
<td>A high in potency</td>
<td>A low in potency</td>
</tr>
<tr>
<td>Affectedness of O</td>
<td>O totally affected</td>
<td>O not affected</td>
</tr>
<tr>
<td>Individuation of O</td>
<td>O highly individuated</td>
<td>O non-individuated</td>
</tr>
</tbody>
</table>

Note. O: Object, A: Agent

For example, (a) “Jerry knocked Sam down” has higher transitivity than (b) “Jerry likes beer”, because kinesis, punctuality, aspect, affectedness and individuation are higher (Hopper & Thompson, 1980, p.253). Regarding (a), the action ‘knocking down’ is punctual and is completed. ‘Sam’ is totally affected by the action (the action was carried over). Moreover, individuation is high because referential, animate and proper nouns were used.

However, in practice, using this system to numerically quantify transitivity is problematic. For example, in the English sentence “He bumped into Mika”, “bump” is used in an intransitive sentence, although the patient (Mika) would be directly affected by the action, and two animate participants got involved (Tsunoda, 1991). This suggests that each property may not be equally treated to define high transitivity. Moreover, Kittila (2002) pointed out that the parameters of transitivity suggested by Hopper and Thompson (1980) were mainly derived from English or other Indo-European languages, and that their theory was not sufficient for other “exotic” languages which differ from Indo-European ones. Therefore, different languages may possibly weigh parameters of high transitivity differently.

This classification of transitivity by Hopper and Thompson (1980) does not deal well with the case of causative alternations. Causative alternation linguistically permits both transitive (“She closed the box”) and intransitive sentences (“The box closed”) to describe the same scene of box closing. However, coding reflects the conceptualisation speakers want to express. The choice of sentence construction is determined by the speaker’s intention to highlight the agent or not (Wang, 2016). When speakers have the choice of using either intransitive or transitive sentences to describe the same action (e.g. “close”), it is interesting to consider how they make such a choice and whether there is any cross-linguistic difference.
1.2. Cognitive grammar

How people use transitive constructions may be affected by their perception of events. Langacker (1986; 2008), promoting the idea of "Cognitive Grammar" argues that linguistic structure emerges as a result of reinforcement from common patterns encountered during multiple instances of language use. This relies on general cognitive abilities, which derive structures by schematization and categorization. Moreover, he argued that the perspective speakers take can affect how they construct an event and how they express the construal. Langacker analyses such constructions according to what the speaker focuses on and which elements (s)he wants to give prominence to by using the terms "trajectory (the figure within a relational profile)" and "landmark (other salient entity)". For example, in Figure 1.1, sentence (a) "I opened the door" gives prominence both to the agent 'I' and patient, the door, focusing on "my" action on the door. In contrast, sentence (b) "The door opened easily" is a middle construction in which the adverb easily implies a volitional exertion of force by an agent. Sentence (c) "The door opened" focuses only on "the door" and the door's change of state, whereas sentence (d) "The door was opened" focuses only on the final state of the door (Langacker, 2008, p.385, see Figure 1.1).

![Diagram of different constructions](image)

**Fig. 1.1. Profiling of different constructions (taken from Langacker, 2008, p. 385)**

NB: thickened lines indicate the aspect of the event being profiled. The single arrows indicate the change of state. The double arrows indicate the exertion of force (tr = trajectory, which is the main focus, lm = landmark, the second focus).

Where speakers of two languages demonstrate a preference for choosing different grammatical structures (which highlight different aspects) to describe the same events, it may be impossible to determine which comes first, a primary difference in perception of events, or language usage constraints. Japanese and English languages show such different preferences.

1.3. Linguistic Relativity

This theory proposes that languages determine, limit or shape people’s thinking or cognition (Sharifian, 2017). Thus there is a possibility that different languages can constrain mental representation. For example, languages differ in their representation of time. English and Swedish speakers tend to use distance-based metaphor (e.g. "long" and "short") to represent time duration, while Spanish and Greek speakers prefer amount-based metaphor ("big" and "small") (Casasanto,
Interestingly, a study testing bilingual speakers also supports the finding that different languages can trigger different mental representation. Bylund and Athanasopolulos (2017) showed that Swedish-Spanish speakers changed the patterns of time-representation depending on which language (Swedish or Spanish) was prompted. This theory raises the possibility that English and Japanese speakers will show different mental representations when describing the same scenes, determined by the constraints of their own language.

1.4. Japanese and English languages

The different preferences seen in English and Japanese for reporting causal events is of considerable interest and is well-documented.

Kittilä (2002) argued that since it is the Indo-European languages such as English that have contributed most to the study of transitivity, comparisons with more ‘exotic’ languages would provide a wider view of transitivity. English and Japanese are very different typologically. For example, these languages have verb positions which are different. English is verb-initial (Subject-Verb-Object: SVO) while Japanese is a verb-final language (Subject-Object-Verb: SOV). Japanese and English have different restrictions on the use of transitive and intransitive constructions. For example, Japanese is able to describe the action of finding intransitively (e.g. “The key found”), while English is not. In English if speakers want to focus on “the key”, the passive construction (e.g. “The key was found”) is preferred. In the next section, we present a more detailed description of how English and Japanese differ.

1.4.1. Syntactic Properties of Japanese

1.4.1.1. Word order

Japanese is a nominative-accusative head final Subject-Object-Verb (SOV) language (Shibatani, 1990). To describe highly transitive events, both Japanese and English use the basic transitive. Some studies suggest that before the age of three, Japanese children are sensitive to the basic word order in which an object is placed before a verb, according to Sugisaki (2007) from a corpus study, and comprehend the basic order from very early (Clancy, 1985). Japanese speakers use SOV (the canonical order) which appears most frequently, but word order is flexible unlike in English. It is possible to use OSV (scrambling), and SV, O and OV, S, which are called extrapositional (Matsuo, Kita, Shinya, Wood, & Naigles, 2012).

1.4.1.2. Case-markers

Generally, subject Noun Phrases (NPs) are marked with a post-position (-ga) nominative marker and object NPs are marked with a post-position (-o) accusative marker (Shibatani, 2001). For example:
(1) Ken-ga Hanako-o oshi-ta.
   Ken-NOM Hanako-ACC push-PAST
   “Ken pushed Hanako.”

However, Japanese case-makers are very often omitted (Kurumada & Jaeger, 2012; Matsuo et al., 2012). In a corpus study of conversation between a boy (1;10.27 to 2;2.20) and his father (Matsuo et al., 2012), case markers were dropped more often in contexts of given information than in contexts of new information. In an experimental situation, Japanese adults tended to produce an object NP without a case-marker in a transitive sentence, when the grammatical function of the noun is predictable in context by the animacy and meanings of the nouns (Kurumada & Jaeger, 2012).

1.4.1.3. Argument ellipsis

Japanese also allows omission of argument NPs when the argument NPs are predictable in a context (e.g. Rispoli, 1989). Examples are:

(2) a. Nezumi-ga kinomi-wo mitsuke-ta
   The mouse-NOM nuts-ACC find-PAST
   “The mouse found nuts.”

b. Nezumi-ga mitsuke-ta
   The mouse-NOM find-PAST
   “The mouse found (something).”

c. Nezumi-ga hashi-tta
   The mouse-NOM run-PAST
   “The mouse ran.”

Example (2a) shows a transitive sentence with both the overt subject and object (SOV). However, the object can be omitted in the transitive sentence [S(O)V], like (2b), which is apparently of the same appearance as an intransitive form (2c).

1.4.2. Animacy: hierarchy of noun phrase

Tsunoda (1991) proposed a hierarchy of noun phrases based on Silverstein (1976), Dixon (1979, p.85), and Zubin (1979). The highest level of the hierarchy is the pronoun followed by kin terms and proper nouns, human nouns, animal nouns and inanimate nouns (see Figure1.2). In Japanese, in an active transitive sentence, the animacy level of the subject tends to be higher than that of the object. For example, in (3a) the subject is an animate noun and the object is inanimate, thus (3a) is correct. However, in the transitive construction (3b), the subject is inanimate and the object is animate, indicating that the level of subject is lower than that of the object. In this case, (3b) is unnatural in Japanese, although the English sentence is acceptable (Kindaichi, 1981). In Japanese, an intransitive sentence like (3c) or a passive sentence is natural and preferred, while the English translation sounds unnatural (However, if the difference in level is smaller, both active and passive voices can be used).
In English, there are two types of intransitive, which have structural and semantic differences: Unspecified Object Intransitive and Patient Intransitive verbs (Scott & Fisher, 2009; Kline & Demuth, 2014).

Unspecified Object Intransitive verbs, such as eat and paint, can have a corresponding transitive sentence (4a), but it is possible to omit the object and use the intransitive construction (4b). Here, it is ungrammatical to produce an intransitive with the patient in subject position as in (4c)

(4) a. Kim is painting the box.
    b. Kim is painting.
    c. *The box is painting.

English Unspecified Object Intransitive verbs are equivalent to Japanese transitive verbs with omitted objects. Japanese speakers very often omit arguments in both transitive and intransitive sentences. Therefore, it is not clear whether they actually are using the Japanese verbs which are
equivalent to English Unspecified Object Intransitive verbs with transitive constructions or intransitive constructions.

In contrast, the Patient Intransitive verbs, such as *drop* and *break*, can have the patient of a corresponding transitive sentence (5a) as the subject of the intransitive sentence (5b). However, English is unable to omit the object as in (5c). This is known as the causal/inchoative alternation, which means “the semantics of the transitive variations indicate that the effect or event taking place with the patient of the transitive is brought about by the subject of the sentence” (Kline & Demuth, 2014, p.3).

(5) a. Kim is dropping the box.
   b. The box is dropping.
   c. “Kim is dropping.

Japanese allows the production of transitive and intransitive constructions similar to English (5a & b). However, Japanese can omit objects, so (5c) is also possible. However, importantly from a research perspective, Patient Intransitive verbs which have transitive counterparts can be distinguished by the verb forms (see below for examples), which follow phonological rules (as do agent-implying verbs, explained later). For this class of Japanese verbs, it is easy to identify the constructions from the verb-forms even when arguments are omitted.

### 1.5.2. Japanese Causative Alternation Verbs

While both Japanese and English have causative alternation, some Japanese verbs work in a different way from English verbs. For example, in English, ‘find’ is used as the active transitive verb (6a) or passive form (6c), while in Japanese a transitive verb ‘find’ (mitsukeru) has an intransitive counterpart ‘find’ (mitsukaru). Thus, both (6a) the transitive form and (6b) the intransitive form are grammatical. In addition (6c), the passive form, is also used by adding the causative case-marker (although this use is rare).

(6) a. Taro-ga kagi-o mitsuke-ta
Taro-NOM the key-ACC find(tr)-PAST
   “Taro found the key.”

b. Kagi-ga mitsuka-tta
The key-NOM find (int)-PAST
   * “The key found.”

c. Kagi-ga mitsuke-rare-ta
The key-NOM find-CAU-PAST
   “The key was found.”

As with ‘find’ in Japanese, there are many verb pairs such as “mitsukeru (transitive verb)” and “mitsukaru (intransitive verb)”. These transitive/intransitive pairs follow basic phonological rules. Usually, transitive verbs, which have intransitive counterparts, end with either an “eru” or a “su” sound (e.g. okosu: wake somebody up). The intransitive counterparts tend to end with an “aru”, “ru” or “eru” sound (e.g. okiru: wake up on your own). However, there are exceptions such as warenu (intransitive) and waru (transitive) which means ‘break’. As this “eru” sound can appear in both transitive and intransitive verbs, Japanese children have to remember a transitive/intransitive pair.
for some verbs and not rely exclusively on the sounds.
In English causative alternation verbs, intransitive verbs cannot describe actions that involve an agent when the speaker wants to mention the agent (Levin, 1993), while in some languages such as Japanese, the intransitive verbs can do this (Luk, 2012). Taking an example of the (causative alternation) non-agent-implying verb ‘break’ in English and Japanese:

(7) a. Josie-ga mado-o kowashi-ta
Josie-NOM the window-ACC break-PAST
"Josie broke the window."

b. Mado-ga Josie-ni kowas-are-ta
the window-NOM Josie-by break-PASS-PAST
"The window was broken (by Josie)".

c. *Mado-ga Josie-ni koware-ta
the window-NOM Josie-by break-(int)-PAST
"*The window broke by Josie".

the plate-NOM by itself break-(int)-PAST.
"The plate broke by itself (Levin & Rappaport-Hovav, 1995, p.88)"

*The equivalent translation is unnatural.

(7a) is transitive. (7b) is passive and also is allowed to include ‘by Josie’ because the sentence can imply the external causer. (7c) and (7d) are intransitive forms, but the former is not grammatically correct, while the latter is correct because ‘by itself’ is not an external causer. Thus, while Japanese and English languages have similarity in the causative alternation verbs, there is a difference: in English, intransitive verbs cannot imply an ‘external’ agent. The following section also introduces more differences between the two languages.

1.5.3. Agent-implying Intransitive Verbs

In English, the change of state of an object caused by an animate (external) agent is usually described only transitively. However, in some languages such as Japanese, it can be described intransitively.

An example is the use of ‘catch’. All sentences of example (8) are grammatically correct in Japanese. The transitive verb ‘tsukamaeru’ (8a) has a passive form. However, the intransitive counterpart ‘tsukamaru’ (8b) shows that Japanese ‘catch’ is used as an ‘Agent-implying’ intransitive verb, in this case with the event of catching (by the agent - the police) being caused by the criminal. This Agent-implying intransitive verb can have the agent marked with -ni (by), although in English (and some Japanese alternation) intransitive verbs cannot have the agent in intransitive sentence constructions. This situation is described only by a passive form in English (c).

(8) a. Keisatsu-ga hannin-o tsukamae-ta
the police-NOM the criminal-ACC catch(tr)-PAST
"The police caught the criminal".
b. Hannin-ga keisatsu-ni tsukamattta
the criminal-NOM the police-by catch(int)-PAST
“The criminal was caught by the police”

c. Hannin-ga keisatsu-ni tsukamaer-are-ta
the criminal-NOM the police-by catch-PASS-PAST
“The criminal was caught by the police.”

Thus, according to Luk (2012), in Japanese, there are two types of intransitive verbs: Non-agent-implying and Agent-implying verbs. While Non-agent-implying verbs can have the agent marked with –ni (by), Agent-implying verbs cannot. Therefore, Japanese intransitive verbs describe situations which are described in English transitively.

### 1.6. Difference in use of sentence constructions between Japanese and English

As the previous section demonstrates, although Japanese and English differ in typology and the means available to talk about causal events, they both have the availability of using transitive and intransitive sentences with causative alternation verbs. Thus, comparison between Japanese and English could be useful in expanding research on transitivity. The difference between the languages raises the possibility of differences in how speakers describe causal scenes.

Alfonso (1966) studied English and Japanese speakers’ use of active transitive and passive constructions, and found that English speakers have less or little preference between the two constructions, while the Japanese prefer passive constructions. It is not clearly mentioned how he observed English and Japanese speakers’ use, but his study is extensively quoted by other researchers. For example, this different preference is described in Ikegami’s discussion (1981, 1999). Ikegami suggests that English is a “Do language” focusing on the agent, while Japanese is a “Become language” avoiding the agent. Ikegami also argued that transitive constructions highlight both agent and patient. Both passive and intransitive constructions highlight only the patient. However, the passive structure implies the agent, but the intransitive does not. His opinion was also supported by data from Fausey, Long, Inamori & Boroditsky (2010). They asked Japanese and English speakers to watch some causal events. In a memory task, Japanese speakers were less able to remember the agent of an accidental causal action than were English speakers. This suggests the possibility of a difference in attentional or perceptual focus between different language speakers.

### 1.7. How do children map causal meanings into sentence constructions?

Clark (2004) proposed that in the first year of the life (that is, before they acquire language), children learn to organise and categorise their experience. They can, for example, remember, recognise and sort objects, understand spatial relationships, and draw inferences about events without the use of language. Infants seem ready to make these distinctions irrespective of their ambient language. Choi (2006), for example, showed that both English and Korean five-month-olds can form tight- and loose-fit categories when they view non-linguistic events (though only Korean children maintain these distinctions into the third year of life).
Languages provide additional schematic maps to categorize and communicate information about experiences. These do not necessarily coincide with the categorizations first acquired by pre-verbal infants. Such categorization can be seen to differ from that employed in language. For example, Malt, Sloman, Gennari, Shi and Wang (1999) have shown common patterns of categorisation of a set of objects (containers) but substantially different patterns of naming across three languages (English, Spanish and Chinese).

The categorisation options offered by a language are limited by its lexical and grammatical structures. Each language may offer different options, emphasising different aspects of the experience or event and children learn to map the various forms and structures peculiar to their own languages onto common conceptual domains. For example, Korean speakers need to distinguish in language between spatial categories denoting tight vs. loose fit containment relations, whereas English speakers do not. The persistence of this distinction in three-year old Korean children (but not English children) presumably reflects a growing sensitivity to the form-meaning mappings of their particular language (c.f. Choi & Bowerman, 1991; Bowerman & Choi, 2003; McDonough, Choi, & Mandler, 2003).

Understanding of causal events is one of the earliest aspects of general cognitive ability which can be demonstrated (Oakes & Cohen, 1990). So, in terms of causality, what do we know about pre-verbal children's perception and discrimination of the elements of causal interaction (agent, patient, etc)? Many studies have shown that children can understand causality when they are very young (Oakes & Cohen, 1990; Saxe & Carey, 2006; Muentener & Carey, 2010). For example, Muentener & Carey (2010) studied 8 month-old infants. They first had a habituation session to see a potential causal agent moved entirely behind a screen toward a box, and the box moved away from the screen to the end of the stage. Their looking time was measured from the beginning of the box’s launching to the end of the trial, when they looked away for two consecutive seconds. They then had a familiarisation session to see the agent and the box in position without motion. In the test session, infants observed an event in which the agent moved the box with contact (contact condition) or without contact (gap condition). Infants were found to look longer at the gap condition than the contact condition. Moreover, when the agent was a hand or a novel self-moving entity with eyes which changed the box’s physical state (e.g. broke it into pieces), the infants looked longer at the gap condition. These results suggest that 8 months-old infants are able to discriminate the causality of patient motion and change of state at the pre-linguistic stage.

For mapping causal meanings into syntactic (transitive sentence) structures, children also need to learn syntactic structures. Young children are fairly sensitive to syntactic structure (in English, Gertner et al., 2006; in Cantonese, Chan et al., 2009; in German, Dittmar, Abbot-Smith, Lieven, & Tomasello, 2008). For example, Gertner et al. (2006) showed that, by around age 2, English children can be shown to pick the correct syntactic structure, by using the looking-preference comprehension task. The children firstly had a character identification session and then heard transitive sentences with familiar verbs describing the events before and during watching two presentations of the video clips. They had to identify matching screens with transitive sentences. In the test sessions, the children heard the transitive sentences with novel verbs describing the
scenes as in the practice sessions. The results showed that 2yr-old children looked longer at the matching screens with novel verbs (even when the agent and patient were animals/humans/pronouns), suggesting that young children already have the syntactic knowledge of transitive sentences and formulate the form-meaning mappings.

Different languages have individual preferences for emphasising different perspectives on each element of the same event, for example, focusing on the agent with transitive constructions and the patient with intransitives. Clark (2004) argued that at the pre-linguistic stage, all infants have general cognitive skills (e.g. discriminating spatial relations), whereas languages differ in their encoding. Infants learn the constructions in their own languages from the input they hear in child-directed speech. The ‘usage-based approach’ also proposes that children first learn constructions tied to individual words or phrases, and only gradually acquire abstract constructions and their associated form-meaning mappings, driven by the distributional properties of the input (Ambridge, Kidd, Rowland, & Theakston, 2015).

Do English and Japanese children have different input of the usage of transitive/intransitive sentence constructions? Various corpus studies have suggested that Japanese children have more input of intransitive constructions than transitives, compared to English children. For example, Fukuda and Choi (2009) showed that in child-directed speech Japanese caregivers used more intransitive constructions than transitives [four children (1;11-2;2)]. In contrast, Cameron-Faulkner, Lieven and Tomasello (2003) analysed the child-directed speech of twelve English speaking mothers (1;9-2;6), and indicated that the simple transitive construction was more used than intransitives. (See more detail about this Corpus Study in Chapter 2). Thus, in relation to causal events, English and Japanese children may develop form-meaning mapping differently and encode causality into different sentence constructions.

1.8. Possible factors affecting the preference for causative sentence constructions

Several researchers have looked for the factors which lead children to a particular choice of sentence construction. Two important aspects are animacy and intentionality.

At the pre-linguistic stage, young children already develop the general cognitive skills of discriminating animacy and intentionality. Some studies showed that infants can distinguish between animate and inanimate entities (e.g. Poulin-Dubois & Heroux, 1994; Poulin-Dubois, Lepage, & Ferland, 1996; Rakison & Poulin-Dubois, 2001). Poulin-Dubois et al. (1996) studied 9 and 12-month-olds. The infants were exposed to autonomous motions by an animate / inanimate object and their response to each object observed. They more frequently showed negative responses (e.g. fussing, fretting, crying, or clinging to their mother) when a radio-controlled robot (inanimate object) seemed to move independently than when the same robot was stationary. However, when an adult stranger moved independently, they did not change the response compared to when the adult was stationary.
Young children are also capable of distinguishing between intentional and accidental actions (e.g. 3yr-old children: Shultz, Wells, & Sarda, 1980; Shultz & Wells, 1985; Smith, 1978) and use the information about intentionality for moral judgement (5yr-old children: Karniol, 1978; Bian, Wang & Zhong, 2017). Even 14- through 18-month old infants can detect intentionality. Carpenter, Akhtar, and Tomasello (1998) tested 20 infants and showed a series of adults performing two step (causal) actions on objects with the adult’s verbal reaction (“There!” with intentional; “Woops!” with accidental). After each demonstration, children were asked to make the results occur themselves. The results indicated that they imitated the adult intentional actions almost twice as often as the adult accidental actions, suggesting that at around 18-month infants seem to be able to detect intentionality in other people’s actions.

Cross-linguistically, in transitive sentences, a subject tends to be animate (and more often human), while an object tends to be inanimate (Givón, 1983; Du Bois, 1987; Dowty, 1991; Langacker, 1991). Slobin (1982, 1985) suggested that children have a bias towards agent-patient relations in which an animate agent causes some change of state to an inanimate patient in their acquisition of transitive sentences. This bias may also be seen in Japanese. When using a sentence recall task of transitive sentences with familiar verbs, Japanese adults tended to produce animate nouns as subject and inanimate nouns as object (Tanaka, Branigan, Maclean, & Pickering, 2011). In child-directed speech, if Japanese adults use animate agent and inanimate patient, Japanese children may also acquire this mapping of the animate agent-inanimate patient relations.

However, there are possibly differences in encoding the entities (agent and patient) between Japanese and English related to animacy and intentionality. Nishimitsu (2010) showed that in Japanese more transitive constructions are used to describe events involving an animate agent and patient, but more intransitive constructions to describe events with inanimate patients. On the other hand, in English he observed no influence of the animacy of the participants, with transitives used for both. Jacobsen (1992) also suggested that transitive constructions are preferred in English, but in Japanese intransitive constructions are used to describe the same situations. Japanese speakers tend to avoid mentioning the agent or to prefer intransitive constructions, probably because they want avoid any culturally unacceptable implication of culpability (Yoshinari, Pardeshi & Chung, 2010). These studies suggest that animacy and thematic role associations may also influence choice of syntactic construction. Chan et al. (2009) showed that children are sensitive to the animacy of the participants in sentence comprehension, but speakers of different languages rely on animacy as a cue to understanding transitive sentences to a different degree. They studied Cantonese, German and English children’s comprehension of transitive subject-verb-object sentences with cues of word order and agent-patient animacy contrast, by using an act-out task. They showed that English speakers at age 2;6 correctly (over 85%) interpreted prototypical transitive constructions (in which the subject is animate and the object is inanimate). However, in the conflict condition in which the sentence type is inanimate noun-verb-animate noun, they struggled to comprehend SVO structures (less than 60% correct interpretation). This suggests that at around two years of age English children know the prototypical association between animate entities and the agent and assume that the animate noun must refer to the agent of the action. Interestingly, Chan et al. (2009) also showed that German and Cantonese children at age 2;6 comprehend less correctly (respectively 71 and 65%) a prototypical sentence than English.
children. In the conflict condition, Cantonese children showed the lowest comprehension of the transitive sentence at age 3 and 4 (following by German children), suggesting that Cantonese children do not use the word order as a cue to understanding transitive sentences, unlike English children, so they are more sensitive to animacy contrast at all three ages, compared with English and German children. Chan et al. (2009) revealed that, in their child-directed speech corpus data, the availability of word order cue in transitive sentences was the lowest in Cantonese (33%), while in German and English it was over 80%. English children can use word order as a reliable cue, so they associate the animacy of entities with the agent, and have preference for interpreting the first noun of the transitive sentences as agent. On the other hand, for Cantonese children word order is not always reliable, so they rely on animacy for longer. Thus, animacy might be an important cue for processing sentences for Japanese children.

In fact, Japanese children also receive input with different properties from that of the English. Tanaka and Shirai (2012) examined what kind of cue distribution (word order, case-marker, animacy) Japanese children were exposed to, how children learned the relevant cues from the input they received, and how they use such information in their own production. They analysed two children [3;0 (years;months)-5;0] and their caregivers’ corpus (total 1,837 utterances). By calculating the cue availability in the child-directed speech and child-speech, they found that Japanese children have the strongest preference for animacy, followed by word-order and case-markers, which differs from adults (case-marker > animacy > word order), probably because argument and case-marker are not always reliable. Overall these results suggest that children learn the association between animacy and the agent-patient relations differently in different languages, and interestingly they use cues differently from adults during this development.

Intentionality may also influence choice of syntactic constructions. Kanero, Hirsh-Pasek & Golinkoff (2015) studied the effect of three factors (animacy, intentionality and level of energy generation) on English and Japanese-speaking 3yr- and 4yr olds’ sentence structure preferences. Animations were presented, showing a human agent either using or not using a tool to cause a change of state either intentionally or accidentally. Children were asked for a forced-choice best match of two descriptive sentences: ‘explicit causer’ / active transitive (e.g. The girl broke the tower) or ‘non-causer’ / passive (e.g. The tower was broken). They found that both Japanese and English children showed a greater preference for ‘explicit causer’ (transitive) sentences in intentional scenes than for accidental events. In addition, English-speaking children were prepared to accept inanimate energy-generating items (e.g. a microwave) as causers of events evidenced through their more frequent choice of a transitive sentence for these events in comparison to Japanese-speaking children. Similarly, Fausey et al. (2010) also studied Japanese and English adults’ sentence description of causative events. With intentional scenes, both English and Japanese speakers produced agentive-description such as transitives. However, with accidental events Japanese speakers used less agentive-description than English.

Thus, both animacy and intentionality have been shown to influence sentence construction preferences when describing causal events, and this influence may differ in degree between languages.
1.9. In Summary

Causal events occur frequently in our daily life, and people describe the events with language. Hopper and Thompson (1980) proposed the properties of events that they considered to correspond to events of high transitivity. However, their theory was established mainly from English or Indo-European languages. Thus, studying Japanese will be beneficial because English and Japanese are typologically different (also in terms of transitivity), so it will give more insight to research on transitivity.

In this study, we focus on causative alternation, because speakers always have two choices; intransitive and transitive constructions to describe the same scenes, and there can be cross-linguistic and developmental differences.

According to “Cognitive Grammar” (Langacker, 1986; 2008), depending on how people construe events, they can focus on a different aspect of the event (e.g. agent, consequence of the action) and use different sentence constructions to highlight their focus of attention. Linguistic form, or sentence structures are related to meanings, and this form-meaning mapping can vary according to the input speakers hear. Ikegami (1981; 1999) stated that Japanese speakers prefer focusing on the consequences of events and use intransitives, while English speakers focus on the agent and use transitives. Thus, there is a possibility that different language speakers encode the information differently into different sentence constructions.

A key task for young language learners is to discover the appropriate form function mappings of their target language. Therefore, English and Japanese children have to learn which type of construction is preferable when describing causal scenes in their language. If children acquire the use of sentence constructions according to the input they hear, over development a cross-linguistic difference would emerge, because both groups of children have different input. Some corpus studies (e.g. Choi, 2006; Cameron-Faulkner et al., 2003) showed transitive constructions are more often used by English caregivers, but in Japanese, intransitive constructions are more used in child-directed speech.

When people choose a suitable construction, several factors may affect their choice. In this study, we focus on animacy and intentionality. Animacy is an important cue for the interpretation of the transitive construction, but children appear to rely on this cue to differing degrees depending on which language they are learning (Chan et al. 2009; Tanaka & Shirai, 2012). Nishimitsu (2010) also argued that animacy of agent / patient can affect the use of transitive or intransitive sentences in adults. However, as Nishimitsu’s (2010) observations of animacy are based on literature translations, it is unclear how generalisable the findings are to adult speech, or whether they are in any way applicable to the early stages of language acquisition.

Furthermore, it is not clear to what extent intentionality can affect children’s learning of sentence constructions and form-meaning mappings. Fausey et al. (2010) showed that English people more
often used transitives, or mentioned the agent for describing intentional causal scenes, and Japanese adults more often avoided transitives when they described accidental scenes than the English. However, it was not clear whether English and Japanese children show the adult tendency.

1.10. Research Question

My research question is whether there is a difference between English and Japanese people in how they map form to meaning; how these form-meaning mappings are learned; and what is the relative influence of cognitive-general biases and language-specific input on children’s developing linguistic representation.

In this thesis, we firstly studied corpora of child-directed speech to investigate both what kind of input and output Japanese and English children receive, and also to identify verbs for our experiments. Then we conducted experimental studies which investigate how 3yr- and 5yr-old children, learning two very different languages (English and Japanese), acquire the form-meaning mappings to describe causal events. Using the same forced-choice comprehension task, we collected comparable data from adults and aimed to establish how these mappings might change developmentally. We examined the influence of patient animacy and agent intentionality on the choice between transitive and intransitive constructions. Importantly, we controlled for any possible effects of verb-bias, which has been overlooked in previous studies. In addition, we studied how English monolingual and Japanese-English bilingual children learn the form-meaning mappings in accidental and intentional scenes using a production task.

These findings will contribute towards the development of more sophisticated models of linguistic representation and processing in which the relative weightings of conceptual vs. linguistic connections across the system are subject to change, and that can be applied throughout development and into adulthood.
Chapter 2.
Corpus Study: Children's Input and Output of Causative Alternation in Japanese and English

Abstract
Some studies (e.g. Jacobsen, 1992; Ikegami, 1981; 1991) report that Japanese adults use more intransitive constructions than English adult speakers. According to usage-based theory, children first learn constructions tied to individual words or phrases, then only gradually acquire abstract constructions with their associated form-meaning mappings, driven by the distributional properties of the input (Tomasello, 2003). Learning more abstract construction-level meanings is dependent on the frequency of abstract patterns observable across the language (such as the tendency for transitive subjects to be animate), and the verb-specific patterns of use present in the input received by children (Ambridge, Kidd, Rowland & Theakston, 2015). However, few studies have directly compared the input and output of children at the level of individual verbs. In this study, we firstly aimed to examine the relative use of transitive/intransitive frames with causal verbs in child-directed speech in English and Japanese. Secondly, we examined whether children show language-general or adult usage patterns. Thirdly, we determined the relationship between animacy of agent and patient and the choice of construction. We analysed the frequencies of transitive/intransitive usage of causative alternation verbs in English and Japanese corpora of child-directed speech. The proportion of transitive usage (‘transitivity bias’) was calculated and 14 verbs were selected to directly compare between Japanese and English. Our results show that Japanese adults and children tended to produce more intransitive constructions than English adults and children. This suggests that Japanese and English speakers use the constructions differently; that children around age 3 years learned usage from their caregivers; and by 3 years they have already started showing language-specific patterns. In addition, animacy of patients seemed not to determine the use of constructions by Japanese and English caregivers. Compared to the English, the Japanese frequently omitted the arguments (subjects/objects).

Keyword: Corpus study; Causative alternation verb; Animacy; Japanese and English; Child language acquisition
2.1. Introduction

Language, by offering a choice of constructions, allows us the flexibility when reporting causal events to focus on either the agent or the change of state. It is intriguing that adult speakers of different languages, when reporting the same event, may exercise this choice differently. Jacobsen (1992), for example, discussing the difference between English and Japanese, suggested that English adults, in general, prefer using transitive sentences (e.g. “He opened the door”/ “Kare-ga doa-o aketa”), while Japanese adults prefer an intransitive sentence (“The door opened”/ “Doa-ga alta”).

Sensitivity to causal relations emerges early in infancy (Saxe & Carey, 2006). Six-month infants, who observe specific causal interactions between two objects (which the authors refer to as “launching”, “entraining” and “expulsion”), can perceive spatial and temporal contiguity of the two motions. They can also integrate other causal information about the phenomenal and ontological aspects of objects (such as the effect of different sizes) with mechanical causality, and differentiate between causal and non-causal events. Assuming all children are born with the same cognitive apparatus, we need to explain how such adult differences in the choice of syntactic construction to denote causal events emerge. In trying to do so, we must acknowledge the limitation of not knowing whether differences in perception lead to language differences, that the reverse is true (that language factors lead to a difference in perception), or whether perception could be the same, but the mapping of event to construction is different.

Ikegami (1981; 1991) suggested that English speakers are likely to concentrate on the human agent, but Japanese speakers prefer to focus on the event as if it happened spontaneously. Alfonso (1966) studying the use of active transitive and passive constructions, found that Japanese speakers preferred constructions which backgrounded the agent (e.g. passives), whereas English speakers did not. It is interesting to consider not only why such choice is exercised differently cross-linguistically, but also what factors are used by children in learning these adult differences.

In this paper, the focus is on the role of distributional information in the input to children in order to assess whether these reported differences in adult usage actually occur in child-directed speech describing causal events, and could therefore drive different learning trajectories in different languages.

Japanese and English are languages with huge syntactic differences which make direct comparison somewhat complex. In particular, in Japanese, subjects, objects and/or case-markers are often omitted in speech (e.g. Tanaka & Shirai, 2012) making accurate study of corpora difficult because correct interpretation of meaning frequently relies on understanding the context. However, studying causative alternation verbs (described below) overcomes this problem because morphological changes between transitive and intransitive forms allow them to be identified when other key components of the sentence are omitted.

The aim of this study is therefore to investigate the input and output of causative alternation verbs in order to understand more about how children might learn form-function mappings between
events and the choice of linguistic structure (transitive or intransitive sentences) appropriate for their own language.

### 2.1.1. Causative alternation

Causative alternation verbs can be used both transitively and in transitively, usually in order to place emphasis on different aspects of the events. For example, in the English sentences (a) and (b) and their Japanese counterparts (c) and (d):

(a) *The door opened.* (intransitive construction)

(b) *He opened the door.* (transitive construction)

(c) *Doa-ga ai-ta.* (intransitive construction)

   "The door opened."

(d) *Kare-ga doa-o ake-ta.* (transitive construction)

   "He door opened."

(a) and (c) indicate a simple change-of-state event in English and Japanese respectively, but (b) and (d) denote that the subject (*He*) is causing the change-of-state in the door (Schäfer, 2009). In English, causative alternation verbs such as "open" can have two syntactic (transitive and intransitive) frames (a) and (b). Thus, in English the causative alternation relies on the choice of sentence construction to express transitivity. On the other hand, in Japanese, verbs take different morphological forms depending on whether they are used to mark causal or non-causal events, as in (c) and (d) resulting in a one to one mapping between morphological forms and their meanings. Japanese causative alternation verbs require affixation on verbal roots to express transitivity, and exist as alternation in pairs such as *shimeru* (transitive) and *shimaru* (intransitive) meaning ‘to close’. Thus, it is possible to identify transitive or intransitive usage even when agent, patient and/or case-markers are omitted.

### 2.1.2. Children’s learning of use of sentence constructions from their input

The usage-based approach to language acquisition theory proposes that children first learn constructions tied to individual words or phrases, and only gradually acquire abstract constructions and their associated form-meaning mappings, driven by the distributional properties of the input (Tomasello, 2003). Learning more abstract construction-level meanings is dependent on the frequency of abstract patterns observable across the language (e.g. the tendency for transitive subjects to be animate), and the verb-specific patterns of use in the input to children (Ambridge et al., 2015).

Some corpus studies have shown different input and output patterns of sentence constructions between English and Japanese. Fukuda and Choi (2009) analysed the child-directed speech of four Japanese-speaking caregivers and their four children’s speech, and simply coded intransitive and transitive usage following morpho-syntactic criteria (classifying verbs based on inflection on morphemes; explanation in Procedure, Japanese corpus section). They showed that the caregivers used more intransitive sentences than transitives to the children aged from 1;11 (years;months) - 2;2. Also, they found correlations between children’s speech and caregivers’ speech in use of both transitive and intransitive token frequencies (respectively, $r = .41$ & .47). However, their study did
not detail the numbers of utterances analysed, and so their sample sizes are not clear. Tsujimura (2008) focused on transitive-intransitive pairs such as “open”; _aku_ (intransitive) and _akeru_ (transitive). She studied 14,553 utterances from a Japanese child’s input and output (1;6-3;0). She showed that the caregivers produced more intransitive verb tokens than transitives. The child also showed the same pattern except in the initial study period (1;6-1;11). However, in Rispoli’s (1987) study, the Japanese children showed the reverse patterns. Studying 225 sentences in the speech of two children (1;10-2;0) months, although the sentence numbers were very small, he showed that when both children were expressing requests, desire and prohibiting actions, they used more transitives than intransitives.

In English, Cameron-Faulkner, Lieven and Tomasello (2003) analysed 16,903 items of child-directed speech (children’s age: 1;9-2;6) from twelve English speaking mothers. Out of the twenty-four percent of utterances which contained both a subject and full lexical verb, simple transitive sentences (10%) were produced more often than intransitives (3%). Valian (1991) compared 5 children aged 1;10-2;2 (Group 1) with 5 children aged 2;3-2;8 (Group 2) and analysed 3,725 utterances. She showed that the use of pure transitive verbs increased from 45% in Group 1 to 59% in Group 2, while the proportion of pure intransitive verbs decreased from 20% in Group 1 to 11% in Group 2. Theakston, Lieven, Pine and Rowland (2001) also analysed 15,909 utterances from nine children’s longitudinal corpora (from children’s age 1;10-2;0) and showed their use of pure transitive verbs increased from about 40% to 50%, while their use of pure intransitive verbs decreased as their Mean Length of Utterance (MLU) grew over the one-year study period. They also studied the relationship for individual verbs between the use of verb frame in the input and the children’s use of verb frame for five dyads, suggesting that there was a strong correlation between children’s input and output. They found individual verbs to have bias towards transitive or intransitive use, but did not attempt to generalise this finding across all verbs.

These corpora studies indicate that, overall, Japanese adults prefer intransitives whilst English adults prefer transitive usage; and their children tend to show the same patterns. However, some studies showed the reverse pattern, as we discussed above. One possible reason for this inconsistent result for Japanese is that these Japanese studies analysed ‘general’ input and output of sentence constructions and verbs types, rather than targeting specific verbs. Theakston et al. (2001) discovered that individual English verbs have bias towards transitive or intransitive use, so if by chance these studies’ samples included verbs requiring different usage patterns, this may account for anomalous results. It has not been reported whether such individual verb bias occurs in Japanese, but this may explain the contradictory findings of Rispoli (1987). There is furthermore no report of direct comparison between individual English and Japanese verbs.

A further possible reason for the finding of an overall difference between adult and children’s transitive preference in both English and Japanese may be that the Japanese and English studies examined different age groups. Children may have different input and output at different stages of development. For example, in the study of Valian (1991), the younger group (Group 1) used fewer transitives than the older group (Group 2). Fukuda and Choi (2009) showed that Japanese caregivers in toy car/train situations produced more intransitives for children 1;11 and 2;1 but the reverse at 2;4.
Several researchers working on this area have argued for the existence of language-general patterns such as an intransitive bias in children (Valian, 1991; Fukuda & Choi, 2009), though these authors do not postulate a basis for this in such factors as cognitive focus or performance limitations in length of utterances that can be produced.

Also, some researchers have proposed a general “intention-to-cause bias” which favours children’s use of causal description (transitive constructions) in intentional causal events (Muentener & Lakusta, 2011). As these authors state:

“….the nature of the agent in the event (human acting intentionally vs. human acting unintentionally and object acting) seems to influence the perspective children have of an event, leading children to show an intention-to-CAUSE bias in mapping conceptual representations of causal events into linguistic structure” (p.352).

Children may thus have a different pattern of using sentence constructions from adults. Other authors have disputed this, suggesting that it relates not to performance limitation but to input of transitive and intransitive structures. As we have discussed in this section, Japanese and English children appear to have different input of transitive and intransitive constructions. Since they have different input from their caregivers they may show the language-specific patterns. On the other hand, they may show children’s general patterns such as intransitive-bias or intention-to-CAUSE bias.

In previous published work, there has been no direct comparison of the use of transitive and intransitive construction with causative alternation verbs between English and Japanese. Our corpus study aimed to investigate firstly whether there was a language-specific difference in the use of constructions with causative alternation verbs between English and Japanese adults. Secondly, we examined whether English- and Japanese-speaking children showed the same (i.e. language-general) patterns as each other. Thirdly, we examined whether adult patterns (language-specific difference) were seen in children’s usage.

2.1.3. Factors potentially influencing the choice of transitive/intransitive sentences

In order to make a detailed comparison of transitive/intransitive choices between adults and children, it is necessary to examine which aspects of the event structure contribute to this choice.

Nishimitsu (2010) observed from linguistic studies of Japanese and English translations that Japanese speakers used more transitive constructions with an animate agent and patient, but more intransitives with inanimate patients. On the other hand, English speakers appeared less influenced by animacy, preferring transitives for both event types. However, Rispoli (1987), studying two Japanese children aged 1;10-2;0, also showed that 81% of their transitive sentences had inanimate theme referents, while intransitive (78% and 59% for each child) verbs were more likely to have animate theme referents. These studies may imply that the English and Japanese adults have different patterns of transitive/intransitive sentence constructions depending on animacy, but when both young English and Japanese children begin to learn the transitive
construction, they initially favour animate agents and inanimate patients (e.g. Bowerman, 1973; Chan, Meints, Lieven, & Tomasello, 2010; Theakston, Maslen, Lieven & Tomasello, 2012). Subsequently during language development Japanese children may learn the Japanese adult patterns.

Our study aimed to investigate whether there is a difference between English and Japanese in the animacy of the patient in transitive and intransitive frames. Japanese speech often omits arguments, reducing the children’s input of arguments compared with English in causative alternation, possibly making it more difficult for them to learn to use animacy as a cue to determine transitive/intransitive constructions. That may be why Japanese children prefer animate agent and inanimate patient initially, showing a different use of animacy cues to produce sentence constructions from that of adults. Therefore, it is important to check the extent to which Japanese children hear animacy cues from their caregivers.

Nishimitsu’s work (2010) and other corpus studies did not take account of the possibility that there are verb-specific differences in the frequencies of transitive and intransitive use. There are possibly also verb-specific differences in the likelihood of events having animate vs. inanimate patients. For example, the verb “stop” can have both animate and inanimate patients in transitive/intransitive constructions (e.g. She stopped him/the clock; He/The clock stopped), while “break” sounds less natural with animate patients (e.g. *She broke him / He broke). So it is not clear whether his conclusion can be applied to all verbs. Both of these issues require more detailed investigation.

It is unclear how robust any difference in construction choice between languages might be, and therefore what the available evidence is concerning language-learning children in these two languages. We have tried to quantify any differences and examine both verb-specific effects and the role of animacy.

For direct comparison between English and Japanese, a small group of verbs, which can alternate in both languages and can appear with animate and inanimate patients, was deliberately selected. We calculated the relative use of transitive and intransitive frames in both languages for each verb to ascertain whether there is a difference in usage. A corpus study was undertaken as a pre-requisite for experimentally controlled studies (Okuno, Cameron-Faulkner & Theakston, in progress), and with these aims:

1. to determine the relative use of transitive and intransitive frames with causal verbs in child-directed speech in English and Japanese and to examine whether there is verb-specific difference in adult usage;

2a. to examine whether English and Japanese children show language-general patterns;

2b. to compare directly between children’s and adults’ patterns of use to examine whether the children show adult usage;
3. to determine the relationship of animacy of agent and patient to the choice of construction using causative alternation verbs;

4. to derive a measure of the distributional characteristics of common verbs to enable their differing properties (which we refer to as ‘transitivity bias’) to be taken account of in experimental studies.

2.2. Methods

2.2.1. Data

Japanese

Data for this study was obtained by analysis of the Miipro corpus of four children (two girls and two boys; ArikaM, Asato, Nanami and Tomito), part of the Child Language Data Exchange System (CHILDES, MacWhinney, 2000) database of spontaneous speech (Miipro corpus; Miyata, 2012). Their corpora consist of a series of sound-recorded conversations between Japanese caregivers and their monolingual children collected from the interactions between a caregiver and a child (and others) at their homes in Tokyo, using a video camera or voice recorder, monthly or bimonthly from the child’s age of 3 to 5 years. The caregiver was asked to play with the child as she would normally do, and stay within the camera view. The child was not allowed to eat, drink, use noisy toys, TV or TV games during the session. Each session lasted up to 75 minutes. The investigator was not present during the observation period.

English

Data for the English study was obtained by analysis of the follow-on Manchester corpus (Theakston & Rowland, 2009). Twelve monolingual English-speaking children (7 girls and 5 boys) living in northwest England participated in this study. The children were recruited through newspaper advertisements and local nurseries. The children were approximately 2;10 at the beginning of the study (range: 2;8.26–2;11.07). They were audiotaped in their homes for an hour on two separate occasions in every 3-week period for 8 months, with an additional three hours of recordings made at the beginning, middle and end of the period. For the first 30 minutes of each hour they played with their own toys whilst for the second 30 minutes, toys provided by the experimenter were available to the child. For the duration of the recordings, the experimenter attempted as far as possible to remain in the background to allow contextual notes to be taken.

2.2.2. Procedure

Adult use of causative alternation

Japanese corpus

Japanese data recorded between ages 3;0 and 3;11 were extracted. Firstly, computerized language analysis (CLAN; MacWhinney, 2000) was used to identify all verbs only from all caregivers’ utterances in the consecutive dialogue transcriptions of the Japanese corpora (4 children). Each occurrence from a list of verb types was inspected individually, and all Japanese causative alternation verbs were extracted. The propensity for Japanese speakers to omit subjects, objects and particles adds complexity to corpora-based studies. However, the characteristic of
Japanese causative alternation verbs in having two distinct transitive and intransitive forms [e.g. “open”: akeru (transitive), aku (intransitive)] enables this problem to be overcome and instances of either form extracted by CLAN. These transitive/intransitive pairs follow basic phonological rules. Usually, transitive verbs, which have intransitive counterparts, end with either an “eru” or a “su” sound (e.g. okoso: wake somebody up). The intransitive counterparts tend to end with an “aru”, “u” or “eru” sound (e.g. okiru: wake up on your own). [This “eru” sound can appear occasionally also in a transitive verb, so unless Japanese children remember both of a transitive/intransitive pair, it could be confusing for children to distinguish the forms only based on the sounds].

Next, occurrence frequencies of verbs (both transitive and intransitive forms) were counted to check the Japanese children’s input of transitive and intransitive usage of the verbs. Table A.1 (Appendix 1) shows that 134 Japanese transitive verbs which have intransitive counterparts were extracted, based on Jacobsen’s (1992) book (of English and Japanese counterparts) and a Japanese dictionary.

From these 134, 12 verbs and two substitute verbs (all being Japanese causative alternation verbs) were then selected for further study (see Table 2.1). The selected verbs all could occur in a transitive sentence with both animate and inanimate patients, and had closely equivalent meaning to the corresponding English verbs. The Japanese verb translations were made with a dictionary and cross-checked with a native English speaker (as was the potential for animacy of the patients). Also, to measure the distributional characteristics of individual verbs, ‘Transitivity Bias’ was calculated by this formula [the raw frequency of transitive verbs / (the raw frequencies of intransitive + transitive verbs)] from all instances of the 14 verbs.

Transitive usage of move was not observed in the Miipro corpus, so the frequency by caregivers was also checked from Hamasaki corpus (Oshima-Takane, MacWhinney, Sirai, Miyata, & Naka, 1998; Hamasaki, 2002) and Okamoto corpus (Okayama, 1970 & 1973; Shirai, Miyata, Naka, & Sakazaki, 2001). Transitivity bias was calculated from these corpora.

**English corpus**

After extracting 14 Japanese causative alternation verbs, the English corpora were used solely to extract instances of 14 comparable verbs identified from the Japanese data. Transitive or intransitive usage in English data corpora could not be identified automatically by extracting only verbs, so we extracted all sentences produced by caregivers. Starting from the beginning of the data set from each English child-directed speech, all occurrences of sentences including targeted verbs were identified, inspected individually and coded as transitive or intransitive. From the utterances in each child-directed speech, approximately 15 instances per dyad were extracted and analysed. When the total number of occurrences was small, all were used.
Children's use of causative alternation

After investigating children’s input, children’s utterances from both Japanese and English corpora were analysed. In Japanese, since verb forms enable identification of transitive or intransitive forms, we extracted all instances of the verbs from the entire corpus for each child as was done with the adult data.

From the English corpora, the data were extracted in the same manner as for the adult analysis, starting from the beginning of the data set, each occurrence of the verbs were coded. The occurrences of the 14 Japanese and English equivalent meaning verbs were counted, and transitivity bias calculated. Similarly, transitivity bias was calculated from the target 180 instances.

2.3. Results (Q1&2)

English and Japanese adults’ use of transitive/intransitive frames (Q1)

This analysis examined whether there was a language-specific difference in the pattern of choice of causative alternation frames between English and Japanese adults’ output (children’s input). To directly compare between English and Japanese child-directed speech, 14 matched verbs were extracted, as described above.

Table 2.1. The Frequency of Utterances by Japanese and English Caregivers, with Transitivity Bias

<table>
<thead>
<tr>
<th></th>
<th>Japanese</th>
<th></th>
<th>English</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Transitive</td>
<td>Intransitive</td>
<td>Total (n)</td>
<td>Transitivity Bias (%)</td>
<td>Transitive</td>
</tr>
<tr>
<td>Bend (Magaru/Mageru)</td>
<td>1</td>
<td>19</td>
<td>20</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>Break (Kowareru/Kowasu)</td>
<td>46</td>
<td>82</td>
<td>128</td>
<td>36</td>
<td>274</td>
</tr>
<tr>
<td>Close (Shimaru/Shimeru)</td>
<td>37</td>
<td>10</td>
<td>47</td>
<td>79</td>
<td>169</td>
</tr>
<tr>
<td>Drop (Ochiru/Otosu)</td>
<td>129</td>
<td>53</td>
<td>182</td>
<td>71</td>
<td>114</td>
</tr>
<tr>
<td>Float (Uku/ikaberu)</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>Freeze (Katamaru/Katameru)</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>33</td>
<td>1</td>
</tr>
<tr>
<td>Roll (Korogaru/Korogasu)</td>
<td>0</td>
<td>8</td>
<td>8</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Move (Ugoku/Ugokasu)</td>
<td>22</td>
<td>7</td>
<td>29</td>
<td>75</td>
<td>123</td>
</tr>
<tr>
<td>Open (Aku/Akeru)</td>
<td>4</td>
<td>92</td>
<td>96</td>
<td>4</td>
<td>197</td>
</tr>
<tr>
<td>Ring (Naru/Narasu)</td>
<td>10</td>
<td>12</td>
<td>22</td>
<td>45</td>
<td>50</td>
</tr>
<tr>
<td>Roll (Korogaru/Korogasu)</td>
<td>4</td>
<td>5</td>
<td>9</td>
<td>44</td>
<td>202</td>
</tr>
<tr>
<td>Spin (Mawaru/Mawasu)</td>
<td>8</td>
<td>19</td>
<td>27</td>
<td>30</td>
<td>32</td>
</tr>
<tr>
<td>Stop (Tommaru/Tomeru)</td>
<td>42</td>
<td>37</td>
<td>79</td>
<td>53</td>
<td>100</td>
</tr>
<tr>
<td>Tear (Yabukeru/Yabuku)</td>
<td>10</td>
<td>6</td>
<td>16</td>
<td>88</td>
<td>11</td>
</tr>
</tbody>
</table>

NB: Transitivity Bias was calculated by this formula [the raw frequency of transitive verbs / (the raw frequencies of intransitive + transitive verbs)]

The relative use was examined by ‘transitivity bias’ (the proportion of transitive usage).

33
The results of analysis of children's input are displayed in Table 2.1. The verbs displayed a wide range with regard to the transitivity bias. For example, in Japanese, the highest transitivity bias was "tear (yabukeru/yabuku)" (88%) the lowest transitivity bias was "bend (magaru/mageru)" (5%). In English, the highest was "drop" (90%) and the lowest was "freeze" (6%). The majority of verbs displayed similar degrees of transitivity bias in both languages but certain verbs (e.g. "break") diverged. For instance, the transitivity bias for the verb 'break' in Japanese was 36%, while in English it was 85%. A Mann-Whitney U test was conducted to determine whether there was a difference in the proportion of transitivity bias between English and Japanese adults. The result showed that there was a marginally significant difference (z= -1.68, p=.093) suggesting that English adults used more transitive frames (Mdhn=17.11) than Japanese adults (Mdhn=11.89).

**English and Japanese children’s use of transitive/intransitive frames (Q2a)**

This analysis examined whether there was a language-specific difference in the pattern of choice of causative alternation structures between English and Japanese children.

Table 2.2 indicates the frequency and transitivity bias of the target verbs in the children’s output. In Japanese, the verb with highest transitivity bias was "tear (yabukeru/yabuku) " (88%), and the lowest was “float (uku/ukaberu) ” and “ring (naru/narasu) ” (0%). In English, the highest was “tear” (100%) and the lowest were "float" and “freeze” (0%).

**Table 2.2. The Frequency of Utterances by Japanese and English Children’ with Transitivity Bias**

<table>
<thead>
<tr>
<th>Japanese</th>
<th>English</th>
<th>English/Japanese (Intransitive, Transitive)</th>
<th>Transitive</th>
<th>Intransitive</th>
<th>Total (n)</th>
<th>Transitivity Bias (%)</th>
<th>Transitive</th>
<th>Intransitive</th>
<th>Total (n)</th>
<th>Transitivity Bias (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bend (Magaru/Mageru)</td>
<td>0</td>
<td>15</td>
<td>15</td>
<td>0</td>
<td>13</td>
<td>6</td>
<td>19</td>
<td>68</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Break (Kowarenu/Kowasu)</td>
<td>50</td>
<td>70</td>
<td>120</td>
<td>42</td>
<td>159</td>
<td>40</td>
<td>199</td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Close (Shimaru/Shimeru)</td>
<td>32</td>
<td>15</td>
<td>47</td>
<td>68</td>
<td>83</td>
<td>7</td>
<td>90</td>
<td>92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drop (Ochiru/Otosu)</td>
<td>23</td>
<td>86</td>
<td>109</td>
<td>21</td>
<td>75</td>
<td>6</td>
<td>81</td>
<td>93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Float (Uku/Ukaberu)</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>20</td>
<td>20</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freeze (Katamaru/Katameru)</td>
<td>2</td>
<td>8</td>
<td>10</td>
<td>20</td>
<td>0</td>
<td>8</td>
<td>8</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roll (Korogaru/Korogasu)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>n/a</td>
<td>7</td>
<td>16</td>
<td>23</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Move (Ugoku/Ugokasu)</td>
<td>11</td>
<td>24</td>
<td>35</td>
<td>31</td>
<td>135</td>
<td>70</td>
<td>205</td>
<td>66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open (Aku/Akeru)</td>
<td>81</td>
<td>77</td>
<td>158</td>
<td>51</td>
<td>191</td>
<td>21</td>
<td>212</td>
<td>90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ring (Naru/Narasu)</td>
<td>0</td>
<td>10</td>
<td>10</td>
<td>0</td>
<td>14</td>
<td>3</td>
<td>17</td>
<td>82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roll (Korogaru/Korogasu)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>33</td>
<td>3</td>
<td>2</td>
<td>5</td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spin (Mawaru/Mawasu)</td>
<td>5</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>12</td>
<td>18</td>
<td>30</td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stop (Tommaru/Tomeru)</td>
<td>36</td>
<td>19</td>
<td>55</td>
<td>65</td>
<td>125</td>
<td>83</td>
<td>208</td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tear (Yabukeru/Yabuku)</td>
<td>15</td>
<td>2</td>
<td>17</td>
<td>88</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NB: Transitivity Bias was calculated by this formula [the raw frequency of transitive verbs/ (the raw frequencies of intransitive + transitive verbs)]

The Japanese children did not use “melt (tokkeru/tokasu)” either transitively or intransitively, nor used “float (uku/ukaberu)”, “ring (naru/narasu)” and “bend (magaru/mageru)” transitively, though their caregivers did. English children also did not produce ‘float’ and ‘freeze’ in transitive sentences. One possible reason why children did not use some verbs transitively is that they did not hear them
often from their caregivers [e.g. “float (uku/ukaberu)” in Japanese], so the very low frequency of children' use mirrored that of caregivers. A second possible reason is that verbs such as “freeze” in English and “bend (magaru/mageru)” in Japanese are not so often used in a causal situation and have strong intransitive bias.

A Mann-Whitney U test was conducted to determine whether there was a difference in the proportion of transitivity bias between English and Japanese children. The result showed that there was a significant difference ($z = -2.33, p = .020$) suggesting that English children used more transitive frames ($Mdn = 18.11$) than Japanese children ($Mdn = 10.89$).

Analysis also showed that very few individual verbs within the vocabulary at this age are completely equivalent in usage between English and Japanese, in terms of transitivity bias. For this reason, we cannot draw a general conclusion about ‘intransitive preference’ from this selected verb data alone.

**Comparing adult patterns with children’s usage in both languages (Q2b)**

Correlations were performed to examine whether there is similar transitivity bias in use of our target verbs between Japanese/English adults and children, in natural settings. A Pearson product-moment correlation was computed to assess the relationship between adults and children's transitivity bias for the 14 verbs. In Japanese, there was a marginally significant correlation between transitivity bias in the children's speech and that of their caregivers [$r(14) = .53, p = .051$]. In English, there was a positive correlation between transitivity bias of the comparable verbs [$r(14) = .91, p < .001$]. These results show that Japanese adults and children showed a weakly similar pattern of transitivity bias with individual verbs, while English children showed stronger correlation with adults.

Also, Mann-Whitney tests were conducted to see whether child and adult produced transitive or intransitive constructions with causative alternation verbs in the same way in each language (reflecting overall pattern of usage across the 14 verbs, rather than relationships between input and output on a verb by verb basis). There were no significant differences in Japanese between children ($Mdn = 12.19$) and adults ($Mdn = 15.68, z = -1.14, p = .25$) and in English between children ($Mdn = 14.71$) and adults ($Mdn = 14.29, z = -1.38, p = .18$). These results suggest that for the targeted verbs, children’s usage of transitive/intransitive frames indicates similar patterns to that of adults, particularly so in English. Taken together, these results suggest that in both languages, children show a broadly similar pattern of transitivity bias across verbs as their caregivers, but three-year-old English-speaking children appear more sensitive to verb-specific differences in transitivity bias in their input than do Japanese-speaking children.

**2.4. Children’s input of animacy cues (Q3)**

This analysis examined whether children have input of animacy cues in transitive sentences and to check whether there was any different pattern in the use of animate / inanimate patients between English and Japanese caregivers.
2.4.1. Procedure

Based on Theakston et al. (2012), a strict coding scheme was adopted. Each argument for the 14 selected verbs was coded for animacy of the subject and object. In both languages, humans, human-like creatures (for example characters from children’s television programs), animals, parts of the body, animal toys and animation characters (such as Thomas the tank engine) were coded as ‘animate’. Inanimate entities were coded as ‘inanimate’, including objects such as trains or cars. Also, pronouns such as “I”, “you”, “he” and “she”, were coded as ‘animate’, although “it” was treated as ‘inanimate’. In both English and Japanese, when subjects and/or objects were not mentioned, they were coded as ‘No subject’ or ‘No object’. In English, when the sentences included “they” for the subjects, and when they included “them”, “all” or “one” for the objects, they were categorised separately from ‘animate’ and ‘inanimate’, since they were ambiguous. However, in Japanese, there were no utterances of the equivalent of “they”, “all” or “one” (due to argument omission), so they did not have these codes.

2.4.2. Results

Availability of animacy cues in child-directed speech

In order to examine how frequently both English and Japanese children have input of animacy cues, the animacy of arguments was coded in both Japanese and English child-directed speech. Also, argument omission (no subject/object) was coded to check the availability of animacy cues for English and Japanese children (even though the arguments can be frequently omitted in Japanese) (Fig. 2.1)

The analysis showed that Japanese adults omitted subjects and/or objects in two of every three intransitive and transitive constructions, with all sorts of frames including imperative forms (e.g. “Don’t drop it) and declarative forms. For example, with “drop (ochiru: intransitive form)” in 41 (77%) of the caregivers’ utterances the subjects were omitted. Where subjects were stated, five were animate and seven inanimate. Also, with “drop (otosu: transitive form)” 96 subjects were omitted (75%), and 30 animate and 3 inanimate subjects were observed. Ninety-three objects were omitted (79%), and 36 inanimate objects only were stated.
Fig. 2.1. Animacy of subject and object in intransitive and transitive constructions in each language

On the other hand, English adults always mentioned objects in transitive frames, with only 13% subject omission in intransitives and 38% in transitives observed. For example, with “drop”, caregivers sometimes omitted the subject when they used imperative forms in transitive frames. Eighty animate, 3 inanimate subjects, and 31 subject omissions were observed in the transitive constructions. On the other hand, 17 animate, 78 inanimate objects and 19 pronouns (“all”, “one”, “them”) were observed. Only one animate and seven inanimate subjects and four subject omissions were observed in intransitives.

These results suggest that Japanese children had substantially less input of animacy cues (due to omission of arguments) than English children. However, for both sets of children, when they heard two arguments in transitive frames (no omission of argument), they still had a greater input of inanimate objects than animate objects. Thus, despite this large difference in input of animacy cues, Japanese children may still have sufficient exposure to learn this relationship when describing causal events.

2.4.3. Different use of animate patient in intransitive and transitive constructions between English and Japanese

Nishimitsu (2010) suggested that Japanese speakers tended to use transitive constructions only when both agent and patient are animate, otherwise they tended to use intransitives. On the other hand, the English speakers did not change the choice of sentence constructions according to the animacy of the patient. In the light of his report, it should be possible to observe that English and Japanese adults produced different sentence patterns (transitives/intransitives) according to the animacy of the patients.
Mann-Whitney tests were conducted to see whether Japanese and English patterns of transitive/intransitive usage with animate/inanimate patients were the same. As an independent variable, the percentage of inanimate patient (subject) with intransitive was calculated by this formula: the frequency of inanimate patients in intransitive sentences / the total frequencies of inanimate patients (intransitive inanimate subjects + transitive inanimate objects). The analysis showed that there was no significant difference in the transitive/intransitive use with inanimate patients between English ($Mdn=11.50$) and Japanese ($Mdn=12.55$, $z=-0.371$, $p=.71$). This suggests that Japanese speakers did not more often use transitive constructions with animate patients. Both English and Japanese speakers used intransitive and transitive constructions similarly with inanimate patients.

2.5. Discussion

Firstly, we attempted to verify the previously reported finding that Japanese adults tend to produce more intransitive constructions than do their English counterparts (Fukuda & Choi, 2009; Tujimura, 2006). So, we determined the relative use of transitive and intransitive frames with causal verbs in child-directed speech in English and Japanese and examined whether there is a verb-specific difference in adult usage. Our targeted study of comparable verbs showed that Japanese adults did indeed tend to produce more intransitive constructions than their English counterparts, although such difference was marginal ($p=.05$). The direct comparison of comparable verbs has produced one new finding, that Japanese children receive a higher input of intransitives than do the English. Because we have targeted only 14 verbs, this remains somewhat tentative evidence, but may still reflect a broader pattern if more verbs were to be considered.

Our English data showed that English caregivers produced more transitive constructions than intransitives with causative alternation verbs. Some previous studies (e.g. Cameron-Faulkner et al., 2003) showed the reverse pattern. A possible reason for our seemingly conflicting results is our finding that each verb has a different bias toward intransitive/transitive usage. When, as in our study, speakers are invited to choose between transitive or intransitive frames with causative alternation verbs, a preference may become apparent. However, when studies (such as that of Cameron-Faulkner et al., 2003) include any verbs, this preference may not be revealed. The verb-specific differences we have demonstrated have not been considered in the design of previous studies. When making general claims about cross-linguistic difference, it is important to consider exactly which verbs were included. The biases toward transitive/intransitive use of some comparable verbs differed markedly between English and Japanese (see Table 2.1 & 2.2) Also, another important finding from our study is that this difference in use of transitive/intransitive constructions was still present even when only the 14 verbs most closely comparable verbs in the two languages were selected for analysis.

Secondly, we examined whether English and Japanese children show language-general patterns of transitive/intransitive usage of causative alternation verbs. Our analysis showed, that around age 3, English and Japanese children have started showing different use of sentence constructions. English children used more transitive frames than the
Japanese. We also compared directly children’s and adults’ patterns of use to examine whether the children show adult-usage. Our result showed that both English and Japanese children tended to show similar usage to adults of transitive and intransitive sentence constructions with each verb, which is consistent with the findings of other corpus studies (Theakston et al, 2001; Fukuda & Choi, 2009). These results suggest that around 3 years of age children have started learning how their adults use transitive and intransitive sentences with causative alternation verbs, rather than retaining children’s general patterns such as “intransitive bias” (Valian, 1991; Fukuda & Choi, 2009) and “intention-to CAUSE bias” (Muentener & Lakusta, 2011). (These ‘general patterns’ are discussed in the Introduction.)

According to Usage-Based Theory, it would be expected that children’s preference for particular syntactic structures may be influenced by caregivers. Our correlation tests showed that English children’s transitivity bias with individual verbs was similar to that of their caregivers. This result was consistent with the data from Theakston et al. (2001). This suggests that English children may have learned the transitive/intransitive usage of causative alternation verbs from their input, rather than relying on cognitive general patterns. Interestingly, the use of transitive and intransitive constructions by Japanese adults and children were only moderately correlated (although the correlation testing the relationship between the transitivity bias in children and caregivers for individual verbs was marginal, a Mann-Whitney test showed there was no difference overall in the usage of transitive and intransitive constructions with the group of verbs between Japanese adults and children). It should be noted that we could not take account of possible errors by the Japanese children (e.g. they may have used a transitive verb form where they intended to use an intransitive, or vice versa) because we coded each occurrence solely according to the verb form without checking the details of the context. However, one explanation for the moderate correlation between Japanese adult and child usage remains that Japanese children may have more difficulty with form-meaning mapping than do English children.

Frequently, Japanese caregivers omitted subjects/objects in their utterances, so the children have to rely heavily on the contexts (and phonological rules) to understand the usage of causative alternation. Thus we might expect this to be more challenging for Japanese than English children. Morita (2004) has pointed out, for example, that non-native Japanese speakers have difficulty in learning the paired intransitive and transitive verbs which share a common root and attach a suffix to the root to make a transitive/intransitive form. Since transitive and intransitive forms are morphologically similar, it is confusing. It would seem reasonable to assume that Japanese children might also have the same difficulty and may need a larger amount of input to map each form with the meaning.

Animacy

We also determined the relationship of animacy of agent and patient to the choice of construction using causative alternation verbs. Nishimitsu (2010) reported that Japanese speakers tended to use transitive constructions only when both agent and patient are animate, while the English speakers did not change the choice of sentence constructions according to the animacy of the patient. We tested this claim by examining the patterns of animacy according to construction in the caregiver data. Our results suggest that animacy of the patient did not influence the Japanese
caregivers to produce different sentence constructions from the English. One explanation for this is that, contrary to the suggestion by Nishimitsu, Japanese speakers may also have the same preference as the English for using transitive constructions with animate agent and inanimate patient. Other corpus studies showed that Japanese caregivers often produced sentences with subject/object arguments which contained animacy cue (the combination of animate agent and inanimate patient) and used transitives (Tanaka & Shirai, 2012), which is in agreement with our findings.

However, we need to remember that in the setting of our corpus recordings, in which a single caregiver and a single child play together, the opportunity to talk about animate objects may be somewhat limited. As a result, the contexts in which the language was sampled may not be varied enough to determine whether animacy of patient is an important factor in this choice of sentence constructions.

We also examined how much input of animacy-cues in transitive/intransitive constructions English and Japanese children have with the targeted verbs. English caregivers always produced patients in transitive constructions. However, in Japanese, caregivers frequently omitted the arguments. Japanese children may have comparatively less input from which to learn that animacy of patient (and agent) can be used to determine the constructions. Accordingly, animacy of patient may have less effect on the Japanese children’s choice of sentence construction, as would be predicted by Usage-based theory.

2.6. Conclusion

In this study, we firstly aimed to examine the relative use of transitive/intransitive frames with causal verbs in child-directed speech in English and Japanese, and to examine whether there is a verb-specific difference. Secondly, we examined whether their children show language general patterns, irrespective of their input, or if their use mirrored adults’ usage. Thirdly, we determined the relationship of animacy of agent and patient to the choice of construction. To address these questions, we analysed the frequencies of transitive/intransitive usage of 14 matched causative alternation verbs in English and Japanese corpora of child-directed speech. Our results showed that the Japanese adults and children tended to produce more intransitive constructions than the English adults and children. Our findings suggest that Japanese and English speakers use the constructions differently, and that children around age 3 learn the usage from their caregivers, and have already started showing language-specific patterns.

The correlations between the transitivity bias of children and adults were strong in English, but somewhat weaker in Japanese. This may be because Japanese caregivers omitted subject and object arguments frequently and, as children need to learn two forms of causative alternations verbs (intransitive and transitive forms), the task of learning adult usage is more complex than for the English children.

Animacy of patients seemed not to influence the use of constructions either by Japanese or English caregivers, although Japanese caregivers frequently omitted the arguments (making the
comparison more difficult). Our findings suggest that animacy of patient may not be important in the choice of constructions, contradicting those of Nishimitsu (2010).

2.7. Future Direction of Study

In addition to animacy, the intentionality of the events has been claimed to affect Japanese and English adults’ usage of causative alternation verbs (Fausey, Long, Inamori & Boroditsky, 2010). In the subsequent study, using the 14 comparable verbs selected from the corpus study, we aimed to examine experimentally how both Japanese and English children prefer to describe events with causative alternation verbs.

By controlling animacy and intentionality, and taking account of transitivity bias, our experimental study would provide not only more specific information on the choice of sentence construction using causative alternation verbs, but allow us to directly compare children and adults.
Chapter 3.  
Cross-linguistic differences in the encoding of causality: transitivity preferences in English and Japanese children and adults

3.1. Abstract

Languages differ in how they encode causal events, placing greater or lesser emphasis on the agent or patient of the action. Little is known about how these preferences emerge and the relative influence of cognitive biases and language-specific input at different stages in development. In these studies, we investigated the emergence of sentence preferences to describe causal events in English- and Japanese-speaking children (aged three and five years) and compared this to preferences displayed by adults. We studied two factors suggested to influence this choice: Animacy (Study 1) and Intentionality (Study 2). Participants watched videos depicting familiar and novel causal actions, and made a best-match choice between a transitive and intransitive description. We found no effect of patient animacy on sentence selection with familiar verbs at any age in either language. However, with novel verbs, English and Japanese three-year-olds were influenced by patient animacy, but in contrasting ways which mirror aspects of their linguistic input. For intentionality, with familiar verbs both Japanese and English speakers selected fewer transitives for accidental than intentional scenes, but this pattern was more pronounced in Japanese speakers. However, with novel verbs, only adults showed this preference. These data provide important new information to constrain theories about the process of learning to map event structure to language, and its interdependence with concepts of animacy, intentionality and the distributional properties of linguistic input to children.

Keywords
Child language acquisition; Form-meaning mappings; Animacy; Intentionality; Cross-linguistic study; Transitive and intransitive constructions
3.2. Introduction

Causal events occur throughout our daily lives, for example when we open the door to leave our house, or observe a harassed waiter bump into a table and break a vase. We describe these events using language to communicate effectively with others. However, depending on the perspective we adopt, the same event can be described in different ways, for example by using a simple non-causal intransitive (“The vase broke”), a simple transitive causative (“He broke the vase”), a periphrastic causative (“He made the vase break”), or even causal conjunctions (“He knocked the table and the vase broke”). The focus of the current paper is on how and when children learn the form-meaning mappings between events and the conventional choice of linguistic structure for their language.

Languages often encode particular aspects of events differently, and thus children are required to learn language-specific form-meaning mappings. For example, motion events may be encoded differently between languages according to whether the “Path (trajectory)” or “Manner (the way of the motion’s performance)” is typically encoded in their verbal forms (Talmy, 1985; 2000; c.f. Allen, Ozyurek, Kita, Brown, Furman, Ishizuka & Fujii, 2007; Engemann, Hendrinks, Hickmannm Soroli & Vincent, 2015). Allen et al., (2007) showed that English, Turkish and Japanese children have begun to develop sensitivity to their language’s manner and path mappings at the age of three.

Korean speakers, in contrast, need to distinguish in language between spatial categories denoting tight vs. loose fit containment relations, whereas English speakers do not. Interestingly, infants seem ready to make these distinctions irrespective of their ambient language: Choi (2006) showed that both English and Korean five-month-olds can form tight- and loose-fit categories when they view non-linguistic events. However, only Korean children maintain these distinctions into the third year of life, presumably reflecting a growing sensitivity to the form-meaning mappings in the language they are learning (c.f. Choi & Bowerman,1991; Bowerman & Choi, 2003; McDonough, Choi, & Mandler, 2003).

In the current paper, we focus on the acquisition of another important cross-linguistic difference in the mapping of events to language, namely the differential use of simple transitive (causal) vs. intransitive (non-causal) sentences to describe causal events. Sensitivity to causal relations emerges early in infancy (Saxe & Carey, 2006), and indeed some researchers have argued for a universal ‘intention-to-cause’ bias (Muentener & Lakusta, 2011), leading children to map causal language onto intentional causal events rather than onto unintentional or object-caused events. When shown short videos of intended, unintended and object-caused events, English children preferred causal verbs in both their production and judgments of descriptions of the intentional events. However, in a corpus study, Fukuda & Choi (2009) showed that Japanese speakers more often encode events in general using intransitive constructions, suggesting there may be language-specific differences in the mapping of causal events to linguistic structure.

On the basis of a possible bias in language to event mapping for causal events, we might expect to see similarities between children learning different languages in their early choice of sentence structures to encode causal events. On the other hand, English and Japanese are languages in
which significant differences have been observed in the relative frequency of use of transitive and intransitive constructions to describe causal events (e.g. Jacobsen, 1992 for an overview), and thus are the languages of focus in our study. These reported differences in the form-meaning mappings to describe causal relations in the two languages would be expected to lead to different developmental trajectories as children gradually learn the form-meaning mappings for their language from the input they are exposed to (e.g. Ambridge, Kidd, Rowland & Theakston, 2015). We seek to understand the conditions under which English and Japanese speakers select transitive and intransitive descriptions for causal events, and to determine how sensitivity to these preferences emerges in development.

When considering why Japanese and English speakers appear to describe the same causal situations differently, a number of suggestions have been put forward. First, Ikegami (1981; 1991) suggested that English speakers are likely to focus on the human agent, but Japanese speakers prefer to focus on the event as if it happened spontaneously. Alfonso (1966) provided some support for this suggestion. In a study of English and Japanese speakers’ use of active transitive and passive constructions, he found that Japanese speakers preferred constructions which backgrounded the agent (e.g. passives), whereas English speakers did not. Furthermore, Fausey, Long, Inamori, & Boroditsky (2010) found that Japanese speakers were less able to remember the agent of a causal action than were English speakers. This suggests the possibility of a difference in attentional or perceptual focus between different language speakers. Any such difference might be expected to arise over the course of acquisition through exposure to particular sentence types in particular contexts. Second, the animacy of the agent and patient may have an impact. Nishimitsu (2010) showed that in Japanese, more transitive constructions are used to describe events involving an animate agent and patient, but more intransitive constructions to describe events with inanimate patients. On the other hand, in English he observed no influence of the animacy of the participants, with transitives used for both. Finally, the extent to which an event occurs intentionally or by accident has been suggested to influence the choice of linguistic construction. With accidental events, the likelihood of speakers using causal descriptions such as the transitive in both English and Japanese speakers is reduced (Wolff, 2003; Fausey et al., 2010; Kanero, Hirsh-Pasek and Golinkoff, 2015), and correlates with ratings of the agent’s responsibility for the event (Yoshinari, Pardeshi & Chung, 2010) where Japanese speakers utilize intransitive constructions to avoid any culturally unacceptable implication of culpability.

However, the data which suggest a greater use of intransitive descriptions for causal events in Japanese in comparison to English, and the comparative influence of animacy and intentionality on choice of sentence structure in the two languages, are largely observational, based on spontaneous adult speech or written corpora (although see Fausey et al., 2010). Further, while corpus studies of child-directed and child speech have reported a difference in transitive vs. intransitive use between Japanese and English caregivers and children (Nomura & Shirai, 1997; Fukuda, 2005; Tsujimura, 2006; Fukuda & Choi, 2009), they have not been directed at explaining why this occurs, or the particular conditions under which different sentence structures are preferred. Thus, very little is known about the comparative development of any transitive/intransitive preference in English and Japanese-speaking children. In addition, previous studies have
suggested that young children exhibit an intention-to-CAUSE bias in their early language use, such that they prefer to describe causal scenes involving an animate agent acting intentionally with causal language (e.g. The girl broke the tower, She made the tower break) when compared to events involving animate agents acting unintentionally or causal inanimate objects (Muentener & Lakusta, 2010; Kanero et al., 2015). Although the origins of this observed bias are debated, the extent to which any such bias can be observed independently of the language being learned would cast light on the relative influence of general cognitive vs. language-specific factors in the mapping of event structure to language at different stages in development.

We know of only one experimental study which explicitly aimed to investigate the acquisition of language-specific preferences in the choice of sentence construction to describe causal events in English and Japanese-speaking children. Kanero et al. (2015) studied the effect of three factors (animacy, intentionality and level of energy generation) on English and Japanese-speaking three- and four-year-olds’ sentence structure preferences. Animations were presented, showing a human agent either using or not using a tool to cause a change of state either intentionally or accidentally. Children were asked for a forced-choice best match of two descriptive sentences: ‘explicit causer’/active transitive (e.g. The girl broke the tower / Onnanoo-ga tawaa-o kowashita) or ‘non-causer’/passive (e.g. The tower was broken / Tawaa-ga kowasareta). They found that both Japanese and English children showed a greater preference for ‘explicit causer’ (transitive) sentences in intentional scenes than for accidental events, in line with similar findings for adults (Fausey et al., 2010). In addition, English-speaking children were prepared to accept inanimate energy-generating items (e.g. a microwave) as causers of events evidenced through their more frequent choice of a transitive sentence for these events in comparison to Japanese-speaking children. Note, however, that this distinction relates to the causer role in the event, and thus does not speak to sensitivity to the animacy of the patient in sentence preference, as suggested by Nishimitsu (2010).

Although previous studies from adults and children provide some initial indication of the factors that may influence a difference in preference for transitive/intransitive constructions between English and Japanese speakers, they have three limitations which we address in our study. Firstly, they did not consider verb-specific differences in sentence structure associations, or explain how test verbs were selected for experimental work, neglecting potential differences in how the target verbs are used in spontaneous speech. For example, a verb-general preference for intransitive forms in Japanese could be obscured by a choice of test verbs which includes a preponderance of verbs mainly used in transitive form, especially if the same verbs in the comparison language show different verb-specific patterns of usage. We therefore introduce the term ‘transitivity bias’ to refer to the distributional characteristics of individual verbs and take account of this in our studies.

Secondly, to understand the development of patterns of usage, it is necessary to collect data both from children at different ages and from adults to assess the end-state towards which the children are developing. However, there is little data comparing children and adults performing the same task. Fausey et al. (2010) studied only English and Japanese adults, while Kanero et al. (2015) gave statistical results comparing only three- and four-year-olds.
Thirdly, previous experimental and developmental studies have not taken into consideration whether the patients of causal actions were animate or inanimate. Nishimitsu (2010) presented corpus data from English and Japanese literature (not speech) which indicated that patient animacy is an important factor in choice of sentence structure in Japanese (but not English), with transitives preferred only for events where both agent and patient are human (for instance, "John deceived Bill" can be translated into Japanese by using the transitive construction "John-ga Bill-wo damashita"). However, as these observations are based on literature translations, it is unclear how generalisable the findings are to adult speech, or whether they are in any way applicable to the early stages of language acquisition. Experimental evidence concerning the effect of patient animacy on speakers’ sentence preferences is therefore needed to cast light on this question.

In the present study we address these limitations by: evaluating the input frequencies and distribution (transitivity bias) of our test verbs; introducing novel verbs for which no transitivity bias exists; directly comparing children with adults under a similar protocol; and designing our studies to focus on the roles of patient animacy (Study 1) and intentionality (Study 2) in speaker preferences for intransitive vs. transitive descriptions of causal events. Based on the previous literature, we predicted that in an experimental situation, Japanese adults would demonstrate a greater preference for transitive sentences to describe causal events involving both an animate agent and patient compared to events including an inanimate patient. In contrast, English adults’ sentence choice was not expected to be influenced by animacy. The age at which any language-specific differences relating to participant animacy will be observed in language learning children is unclear, and will depend on the relative influence of universal cognitive biases vs. language-specific input. With respect to event type, any preference for transitive descriptions of causal scenes should be reduced when the event is accidental in both English and Japanese adults and children.

**3.3. Corpus Study**

A corpus study was first undertaken, to determine the relative use of transitive vs. intransitive frames with causal verbs in English and Japanese child-directed speech, and to identify verb-specific differences in use.

Japanese data were obtained from the Miiro corpus of four Japanese children, part of the Child Language Data Exchange System (CHILDES) database of spontaneous speech (Miipro corpus, Miyata, 2012). The data consist of a series of conversations between Japanese caregivers and their monolingual children engaged in natural play. From this corpus, we examined all verb usage in child-directed speech between ages 3;0 and 3;11 (comprising a total of about 77 hours of conversation). All causal verbs with transitive and intransitive counterparts were then extracted. Their occurrence in simple and compound sentence structures to describe causal scenes was coded according to whether the frame was intransitive or transitive to determine the transitivity bias (percentage use in the transitive sentence structure) for each verb. Although it is common in Japanese for subjects and / or objects to be omitted in conversation, straightforward differentiation is possible between transitive and intransitive verb usage. Causative alternation verbs
transitive/intransitive pairs that follow basic phonological rules, often sharing the same stem. Usually, transitive verbs, which have intransitive counterparts, end with either an “eru” or a “su” sound (e.g. okosu: wake somebody up), whereas the intransitive counterparts tend to end with an “aru”, “u” or “eru” sound (e.g. okiru: wake up on your own), permitting straightforward differentiation between intransitive and transitive verb uses.

English data were extracted from natural play-based interactions between 12 children and their caregivers (Theakston & Rowland, 2009), recorded from age 2;10 to 3;6. This corpus was used solely to extract instances of comparable verbs identified from the Japanese data to determine their relative use in transitive vs. intransitive sentence frames in English. The target verbs appeared in the English data between 17 and more than 600 times. Approximately 180 utterances per verb were extracted equally across the dyads as far as possible, and starting from the beginning of the data set. Where the total number of occurrences was below this target of 180, all were used. Verb uses were coded as transitive or intransitive, and their transitivity bias calculated.

Fourteen Japanese causative alternation verbs were selected. These were verbs which could occur in a transitive sentence with both animate and inanimate patients, and had closely equivalent meanings to the corresponding English verbs. In both languages, these verbs encompassed wide variation in the degree of transitivity bias, and the bias of any given verb was not always the same in English and Japanese (see Table 3.1). These verbs and four novel verbs were used in the experimental studies.

Table 3.1.
The Frequency of Verb Use by Japanese and English Caregivers and Their Corresponding Transitivity Bias

<table>
<thead>
<tr>
<th>Japanese</th>
<th></th>
<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Transitive</td>
<td>Intransitive</td>
<td>Transitivity Bias (%)</td>
<td>Transitive</td>
<td>Intransitive</td>
<td>Transitivity Bias (%)</td>
</tr>
<tr>
<td>Drop (Ochiru/Otosu)</td>
<td>129</td>
<td>53</td>
<td>71</td>
<td>114</td>
<td>12</td>
</tr>
<tr>
<td>Melt (Tokeru/Tokasu)</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>Stop (Tommaru/Tomatta)</td>
<td>42</td>
<td>37</td>
<td>53</td>
<td>100</td>
<td>101</td>
</tr>
<tr>
<td>Close (Shimaru/Shimeru)</td>
<td>37</td>
<td>10</td>
<td>79</td>
<td>169</td>
<td>17</td>
</tr>
<tr>
<td>Roll (Korogaru/Korogasu)</td>
<td>4</td>
<td>5</td>
<td>44</td>
<td>202</td>
<td>41</td>
</tr>
<tr>
<td>Float (Uku/Ukaberu)</td>
<td>1</td>
<td>1</td>
<td>50</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Ring (Naru/Narasu)</td>
<td>10</td>
<td>12</td>
<td>45</td>
<td>50</td>
<td>23</td>
</tr>
<tr>
<td>Freeze (Katamaru/Katameru)</td>
<td>2</td>
<td>4</td>
<td>33</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>Spin (Mawaru/Mawasu)</td>
<td>8</td>
<td>19</td>
<td>30</td>
<td>32</td>
<td>21</td>
</tr>
<tr>
<td>Bend (Magaru/Mageru)</td>
<td>1</td>
<td>19</td>
<td>5</td>
<td>25</td>
<td>23</td>
</tr>
<tr>
<td>Break (Kowareru/Kowasu)</td>
<td>46</td>
<td>82</td>
<td>36</td>
<td>274</td>
<td>47</td>
</tr>
<tr>
<td>Open (Aku/Akeru)</td>
<td>4</td>
<td>92</td>
<td>4</td>
<td>197</td>
<td>26</td>
</tr>
<tr>
<td>Move* (Ugoku/Ugokasu)</td>
<td>22</td>
<td>7</td>
<td>75</td>
<td>123</td>
<td>57</td>
</tr>
<tr>
<td>Tear* (Yabukeru/Yabuku)</td>
<td>10</td>
<td>6</td>
<td>88</td>
<td>11</td>
<td>2</td>
</tr>
</tbody>
</table>

Mean: 43.8% (excluding ‘float’) 60.1% (43.3%) (63.8%)

NB: Transitivity Bias was calculated by this formula [the raw frequency of transitive verbs/ (the raw frequencies of intransitive + transitive verbs)]

*Move and Tear were substituted for Freeze and Float in study 2.
3.4. Study 1

In Study 1 we examined whether patient animacy affects Japanese and English speakers’ preference for transitive or intransitive sentence constructions as a description of causal events, and when in development any observed differences emerge.

3.4.1. Participants

English and Japanese monolingual adults and children aged 3 to 5 years participated in the study. English speakers were recruited in Greater Manchester (UK) and Japanese speakers in Toyama (Japan). The English and Japanese adults were all students at a Sixth-Form college and vocational training college respectively. The children were all attending nursery or pre-school and data collection for all participants was carried out in their institutions.

There were 94 English speakers in total: 29 three-year-olds (10 male, aged 3;3 to 4;6, M = 47 months), 27 five-year-olds (13 male, aged 5;0 to 5;11, M = 65 months), and 38 adults (8 male, M = 16.55 years). There were 131 Japanese speakers in total: 24 three-year-olds (10 male, aged 3;8 to 4;6, M = 49 months), 34 five-year-olds (21 male, aged 5;0 to 5;11, M = 66 months) and 61 adults (35 male, M = 20.61 years). An additional 29 participants began the study but were excluded due to failing an initial screening test (12 English 3yr-olds, one English 5yr-old, two Japanese 3-yr-olds), failing to complete both test sessions (seven Japanese 3yr-olds, five Japanese 5yr-olds) or whose responses indicated they had failed to understand the task (one English 5-yr-old, one Japanese 3yr-old). See Procedure, below, for details.

3.4.2. Stimuli

**Test items:** For the 12 causative alternation verbs identified in the corpus study, a total of 24 short computer animations were produced using Anime Studio Pro 11 (Smith Micro Software Inc.), two per verb, in which a person performed an action that led to a state change in a patient (e.g. breaking a bell). Eight animate agents (four boys, four girls) featured in the animations, but for each verb one animation depicted an animate patient, the other an inanimate patient. Each animation could be described using a transitive or intransitive sentence [e.g., ‘She stopped the man (Kanojo-ga otoko-o tometa) / The man stopped (Otoko-ga tomatta), see Appendix 2)). Since some of the test verbs (open, close, ring and break) are not used commonly with animate patients, two pseudo-animate characters, Mr. Box and Mrs. Bell (a box and a bell with faces), were created to make more animate-like patients for these verbs.

To test whether we could observe language-general transitivity preferences in the absence of verb-specific differences in input, four novel causal verbs were created and eight corresponding test animations created with both transitive and intransitive descriptions [e.g., ‘She meeked the chicken (Kanojyo-wa niwatori-o neketta) / The chicken meeked (Niwatori-wa nekitta), see Appendices 3 and 4] for the novel verb training and test sentences. For each novel verb two training animations were shown to teach the meaning of the verb, after the known verb test items but before the novel
verb test items. English novel verb forms (meek, lorp, blick and dax) were chosen from those used by Naigles, Bavin, & Smith (2005), but using different actions. Japanese novel verbs were selected from those used by Imai, Haryu, Okada, Hirsh-Pasek, Golinkoff, & Shigematsu (2008) for which easily recognizable intransitive/transitive counterparts could be created according to normal phonological rules (e.g. chimeru and chimaru). The actions represented by the novel verbs could not easily be described by a single familiar verb.

For each of the 32 test animations, an audio stimulus was created consisting of two sentences describing the scene, one transitive and the other intransitive.

**Practice and filler sentences:** Three practice and 5 filler animations were made (see Appendix 7). They were used to teach the children the task and to disrupt any preference for a single structure throughout. The practice and filler animations were presented with one obviously correct and one wrong audio sentence.

### 3.4.3. Procedure - Children

Each child was tested over two sessions (Session 1: familiar verbs, Session 2: novel verbs) each lasting approximately 20 minutes. For English children, testing was conducted by a fluent English speaker and the first author, and for Japanese children, by the first author alone. The audio stimuli were delivered through two hand puppets (teddy bear and elephant), one of which described the scene using the transitive sentence and the other the intransitive. The child was asked to choose which puppet gave the best description of what they had seen.

**Warm-up:** The two hand puppets were introduced and used to maintain the child's interest and engagement in the study. The child was then told, e.g. “Now you are going to watch some animations. Then Teddy bear and Elephant are going to tell the story about the animation. Can you choose which puppet tells the story better?” On screen, two animation characters (Mr. Box and Mrs. Bell) were introduced as Teddy Bear and Elephant’s friends. They were shown moving and with changing facial expressions. Both characters were then shown on the same screen and the child was asked to point out each character (e.g. Can you show me Mr. Box?).

Three example animations were presented to the child to teach them the task. Only example and filler animations had obvious wrong answers. If the child chose the wrong one the researcher said, “Really? Are you sure? Shall we try to watch the animation and listen to the puppets more carefully?” If the child chose the wrong sentence again, the researcher corrected the child’s answer then moved on to the next animation.

**Familiar verb session:** In the first session, 12 familiar verbs were presented with animate and inanimate patients (total 24 scenes) with three initial examples and five fillers. After every fourth familiar verb animation, one filler animation was presented. The child, together with the puppets, watched each animation on a PC screen. One puppet then produced a transitive description (e.g. “She stopped the car/ Kanojo-ga kuruma-o tometa”) and the other an intransitive (e.g. “The car stopped”/ Kuruma-ga tomatta”). The transitive/intransitive sentences were delivered in real time by
the experimenter as if voiced by the hand-puppets. Next the child was asked “Which animal/puppet said it best?/ Doocchino doubutuga jyouzuni ohanashidekitakana?” by the other experimenter, who was also controlling the videos. If the child failed to respond, they were told “Let’s watch it again. So please watch the animation and listen to the puppet carefully/ Mouikkai mitemiyo. Kondoha doubutuno ohanashio shikkarikite”. If the child again failed to respond, the researcher moved on to the next animation. After each response, the child received encouragement.

**Novel verb session**: The procedure for introducing novel verbs followed that recommended by Matsuo, Kita, Shinya, Wood, & Naigles (2012). The novel verb session consisted of two parts: the training phase and the test, for each verb in turn. In the training phase, animations presenting the novel actions were shown on the computer screen, accompanied by a recorded audio explanation. Firstly, the gerund forms of the verbs were introduced, and transitive/intransitive present continuation forms were produced as the animations took place. After the animations finished, the past tense form of the verb was used in both the transitive/intransitive frame to ensure participants were aware that the verbs can be used both transitively and intransitively. After the animation, the puppeteer repeated the transitive and intransitive past tense sentences and asked each child to repeat the sentences aloud, to enhance verb learning. The test phase used the same procedure as for familiar verbs. The patients used in test trials with the novel verbs were different from those in the training sessions.

**Counterbalancing**: To control for order effects and puppet-specific preferences in both familiar and novel verb sessions, a number of measures were taken. The position of the puppets (right or left) was changed half way through the session. Each experiment was run according to one of four counterbalanced sequences (scripts). The test verb order, which puppet spoke first and whether the first test sentence was transitive or intransitive were all randomised. The number of participants tested using each sequence was balanced.

### 3.4.4. Procedure - Adults

The same animations were presented to the adults, but the audio stimuli were pre-recorded and presented immediately following the viewing of the animation rather than by puppets. Participants indicated their preferred sentence in each pair by ticking a corresponding number on a pre-printed form (the sentences were presented only orally). Adults were tested in groups (whereas children were tested individually), and watched the novel verb test animations without a training session, as they can infer meaning from sentence structure quickly and reliably (Gillette, Gleitman, Gleitman & Lederer, 1999).

**Screening and Exclusions**

Three example animations and five filler animations were presented to check whether participants understood the task (eight screening trials in total). We also examined the data to determine if participants showed a consistent pattern of response which indicated a failure to engage with the task as intended (for children: always choosing the same puppet, the first/second speaker, or the right/left puppet; for adults: always choosing the first/second speaker).
The filler animations using *stroke* and *pull* were found to lack discrimination and were excluded from the screening analysis (by chance, the random pairing of events for the fillers resulted in these verbs being a reasonable match for both animations in the associated pair). If participants failed to score four out of the remaining six correct answers on the screening trials, their data was excluded from the analysis, as were participants who showed a consistent (but irrelevant) pattern of responses across trials.

### 3.4.5. Results

This study examined whether the animacy of the patient affects Japanese and English 3yr- and 5yr-olds’ and adults’ preference for sentence construction (transitive or intransitive) to describe causal scenes. Each participant’s responses were coded according to whether they chose the transitive or intransitive sentences as the best description of the animations, and the mean transitive preference calculated across participants for each condition.

As the task involved a forced choice paradigm, we first wanted to establish that the participants understood the task and were not choosing sentences purely at random. Although it is of course possible that participants could genuinely display an equal preference for the two sentence types, response patterns that deviate significantly from chance performance (50/50) would provide stronger evidence of having fully engaged with the task. To determine whether the proportions of transitive preference were above/below a chance level (50%), one-sample tests were conducted (Flowers, Bolton & Brindle, 2008). For familiar verbs, Japanese three-year-olds, and both Japanese and English five-year-olds and adults showed an above chance preference for the transitive sentence for both animate and inanimate patients (*p* < .01), while for novel verbs they did so for at least one patient type. Taken together, these results suggest that the observed responses were not purely guessing behaviour, with the possible exception of the English three-year-olds (although their results for novel verbs below suggest patterned rather than random responding).
Familiar verbs

Figure 3.1 shows the mean preference for transitive sentences across verbs with animate and inanimate patients, for familiar verbs. A three-way ANCOVA was conducted with animacy (animate vs. inanimate patients) as a within-subject factor, and age (age group: three-years vs. five-years vs. adults) and language (English vs. Japanese) as between-subject factors, with a covariate of percentage transitivitiy bias (as calculated from the corpus data). The covariate, percentage transitivitiy bias, was significantly related to transitive preference \([F(1, 65) = 8.63, p = .005]\). It revealed a main effect of age group \([F(2, 65) = 29.94, p < .001, \eta_p^2 = .48]\) and a significant interaction between age group and language \([F(2, 65) = 4.63, p = .013, \eta_p^2 = .13]\). There were no main effects of animacy \([F(1, 65) = 0.001, p = .98, \eta_p^2<.001]\) or language \([F(1,65) = 0.56, p = .46, \eta_p^2 = .008]\), nor a three-way interaction \([F(2, 65) = 0.46, p = .63, \eta_p^2 = .014]\).

Post hoc comparisons using T-tests with Bonferroni corrections indicated that for English speakers, the five-year-olds \((M = 79.96, SD =10.45)\) and adults \((M = 79.13, SD = 25.80)\) chose more transitive sentences than the three-year-olds \((M = 53.50, SD = 12.39, ps < .001)\). In Japanese, by contrast, adults \((M = 83.46, SD = 7.68)\) chose more transitive sentences than both three-year-olds \((M = 59.25, SD = 9.17, p < .001)\) and five-year-olds \((M = 67.71, SD = 9.68, p = .004)\). Comparing the age groups across languages revealed that English five-year-olds \((M = 79.96)\) tended to prefer transitive sentences more than Japanese five-year-olds \((M = 67.71, p = .052)\), but there were no differences in transitive preference for either the three-year-olds or the adults \((p = .077 \text{ and } .132 \text{ respectively})\).

\(^2\) The large SD reflected the fact that English adults showed a particularly weak transitive preference for the verbs ‘freeze’ and ‘float’ which are not so commonly used to describe causal scenes.
We also examined participant variability by calculating the number of transitive sentence choices out of 24 scenes with animate and inanimate patients. The number of transitive sentence choices became higher with each increasing age group in both Japanese and English groups (Table 3.2).

<table>
<thead>
<tr>
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<th>7~12</th>
<th>13~18</th>
<th>19~24</th>
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<td>7%</td>
<td>22%</td>
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<tr>
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<td>30%</td>
<td>70%</td>
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</tbody>
</table>

Novel verbs

![Graph showing transitive preference across verbs with animate and inanimate patients: novel verbs](image)

NB: In the group test of Japanese adults, the animation of lorp with an animate patient malfunctioned and was excluded from the analysis.

Fig.3.2. Mean percentage transitive preference across verbs with animate and inanimate patients: novel verbs

Figure 3.2 shows the preference for transitive sentences with animate and inanimate patients using novel verbs. A three-way ANOVA was conducted with animacy (animate vs. inanimate patients) as a within-subject factor, and age group (three-years vs. five-years vs. adults) and language (English vs. Japanese) as between-subject factors. There were main effects of language \( F(1,17) = 5.21, p = .036, \eta^2 = .24 \) and age \( F(2,17) = 32.50, p < .001, \eta^2 = .79 \), a significant two-way interaction.
between language and age \(F(2,17) = 9.32, p = .002, \eta_p^2 = .52\), and a significant three-way interaction between animacy, language and age group \(F(2,17) = 4.39, p = .029, \eta_p^2 = .34\).

To explore the three-way interaction, post-hoc comparisons using T-tests with Bonferroni corrections were applied. First, we looked at the effects of language on choice of transitive sentences for each age group and each type of patient. Results indicated that in the three-year-olds, for events with an animate patient, Japanese children chose more transitives than English children [63.25% (SD = 5.56) vs. 44.00% (SD = 6.93), \(p = .002\)], whereas there was no difference in their preference for transitive sentences with inanimate patients [53.00% (SD = 9.05) vs. 56.50% (SD = 7.51), respectively]. At age five, English children chose more transitives than Japanese children with both animate [83.25% (SD = 4.79) vs. 64.25% (SD = 10.87), \(p = .002\)] and inanimate patients [79.25% (SD =3.50) vs. 62.75% (SD = 3.77), \(p = .008\)]. However, there was no effect of language on the adults’ transitivity preference for either animate (\(p = .20\)) or inanimate patients (\(p = .26\)).

Next we tested the effects of patient animacy within each language group. At age three, English children chose more transitives for events with inanimate [56.50%, \(SD =7.51\)] than animate patients [44.00% (SD = 6.93), \(p = .017\)], whereas Japanese children chose more transitives for events with animate [63.25%, \(SD =5.56\)] than inanimate patients [53.00% (SD =9.06), \(p = .044\)]. There were no effects of patient animacy for the five-year-olds or adults.

Finally, we tested for age effects within each language group. In English, for events including both animate and inanimate patients, adults and five-year-olds chose more transitive sentences than three-year-olds [animate patients, 77.00% (SD =8.72), 83.25% (SD =4.79) and 44.00% (SD =6.93) respectively, \(ps < .001\); inanimate patients 85.50% (SD =8.89), 79.25% (SD =3.50) and 56.50% (SD =7.51) respectively, \(ps \leq .002\)]. In Japanese, for events with inanimate patients, adults [78.67% (SD =11.93)] showed higher transitive preferences than three-year-olds [53.00% (SD =9.06), \(p = .001\); and five-year-olds [62.75% (SD =3.77), \(p = .046\)]. However, there was no effect of age for events with animate patients (\(ps > .090\)).

To determine whether the participants treated novel verbs differently from familiar verbs, we ran a final analysis comparing the mean transitivity preference across verbs for each participant on the two verb types (familiar vs. novel). Two three-way ANOVAs were carried out, one for each patient type (animate, inanimate), comparing transitivity preferences in each age group, language group, and by verb type. The analyses showed no significant main effects of verb type, and no significant interactions between verb type and the other variables (\(ps \geq .16\)).

### 3.4.6. Discussion

Languages encode causal events differently, so children are required to learn their own language-specific form-meaning mappings. In this study we investigated whether there are language-specific differences in transitivity preferences to describe causal events in Japanese and English, and when
In development any differences emerge. We focused on the effect of patient animacy, taking account of the input children hear with causative (transitive/intransitive) alternation verbs.

Corpus studies (e.g. Nomura & Shirai, 1997; Fukuda, 2005; Tsujimura, 2006; Fukuda & Choi, 2009) have reported that Japanese speakers use more intransitive than transitive sentences in general in spoken language, and that sentence choice is affected by animacy in written language (Nishimitsu, 2010). However, these findings have not been verified previously experimentally, and the observed effects of animacy may not be mirrored in spoken language.

Using only obviously causal events, we found that both English and Japanese adults showed a strong overall transitive preference across all familiar and novel verbs (80.19% and 78.73% respectively), and that patient animacy was not an important factor in their sentence preferences in either language group.

In children, although in general across both languages at younger ages they showed a weaker transitive preference than the adults, in line with the adult findings, patient animacy did not affect their sentence choice with familiar verbs. In contrast to the adults, however, with novel verbs, Japanese three-year-olds chose more transitive sentences for events with animate than inanimate patients (i.e. when both agent and patient were animate), whereas English three-year-olds showed the reverse pattern.

Taken together, these results suggest that the patterns of transitivity preference observed in written language may not be readily generalized to spoken language, at least at the level of the individual verbs tested in this study. However, it is interesting that the youngest children in both language groups showed some sensitivity to patient animacy in their preference for the transitive construction with previously unfamiliar verbs, and that the pattern of results differed across language groups. One possibility is that these results reflect different trajectories of acquisition of the transitive construction in the two languages: when young English children begin to learn the transitive construction, they initially favour animate agents and inanimate patients (e.g. Brown, 1970; Bowerman, 1973; Chan, Meints, Lieven, & Tomasello, 2010; Theakston, Maslen, Lieven & Tomasello, 2012), apparently mirroring prototypical use in adult language and in child-directed speech (Cameron-Faulkner, Lieven, & Tomasello, 2003). This might mean that with unfamiliar verbs, they are more likely to select a transitive sentence when it matches the prototype, that is a sentence with animate agent and inanimate patient. In contrast, if Nishimitsu is right and in Japanese more generally (rather than only with alternating causal verbs) transitive constructions are used when both agent and patient are animate, young Japanese children may initially favour the transitive construction for events with both an animate agent and patient.

In terms of language-specific differences in the observed developmental trajectory, our three-year-olds and adults showed no overall differences across language groups in their transitivity preference, but at five-years of age, the English children had already reached the adult end-state, whereas the Japanese five-year-olds still performed like the younger children. This earlier move towards adult-like performance in the English children may reflect differences in the children’s
exposure to full transitive sentences. Because subjects and objects can and often are omitted in Japanese, it may take longer for Japanese children to work out the conditions of use of the full transitive construction, leading to a greater preference for intransitives for a longer developmental period. An in-depth examination of Japanese child- and child-directed-speech would be needed to confirm these hypotheses.

Considering participant variability, there was a range of individual 'bias' toward transitive sentences in both English and Japanese adults. Both Japanese and English children tended to show a wider range of transitive preference than adults. The high level of variation in English performance with familiar verbs reflects not strong bias by individual participants but verb variability. For example, "float" was used in intransitives (transitive preference was only 8%), while "close" was only used in transitives (transitive preference was 100%) sentences.

In conclusion, Study 1 showed that in an experimental situation the hypothesised differential overall preferences for transitive vs. intransitive descriptions, and the effects of patient animacy on choice of sentence structure to describe causal events between Japanese and English speakers could not be demonstrated consistently. However, some early language-specific effects of animacy were observed in the three-year-olds’ responses to unfamiliar verbs, and English-speaking children showed an earlier move towards adult-like levels of transitive preference than Japanese children. A second factor purported to influence choice of sentence construction is intentionality, which we investigate in Study 2.

3.5. Study 2

Study 2 examined whether intentionality affects English and Japanese speakers’ preference for transitive or intransitive constructions to describe causal events. The design and methodology was very similar to that of Study 1.

3.5.1. Participants

English and Japanese adults and children aged three- to five-years participated in the study. They were new participants, drawn from the same pool as in Study 1. The 81 English speakers comprised 21 three-year-olds (6 male, aged 3;3 to 4;6, $M = 46.56$ months), 26 five-year-olds (11 male, aged 5;0 to 5;11, $M = 66.58$ months), and 34 adults (8 male, $M = 16.65$ years). The 88 Japanese speakers comprised 25 three-year-olds (16 male, aged 3;5 to 4;6, $M = 46.33$ months), 27 five-year-olds (13 male, aged 5;0 to 5;11, $M = 64.96$ months), and 36 adults (24 male, $M = 19.58$ years).

3.5.2. Stimuli

Verbs: The same familiar verbs were used as in Study 1, except that _move_ \(^3\) and _tear_ replaced _float_ and _freeze_, because these two verbs were difficult to depict in both accidental and intentional

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\(^3\) In Japanese, transitive usage of _move_ was not observed in the Miipro corpus, so the frequency by caregivers was also checked from the Hamasaki corpus (Oshima-Takane, MacWhinney, Sirai, Miyata, & Naka, 1998; Hamasaki, 2002) and the
scenes. The novel verbs were the same as those used in Study 1, but the actions were changed to better allow depiction of intentional and accidental actions (e.g. ‘He meeked the flower / The flower meeked’) (See Appendix 3 and 6).

**Test stimuli:** Instead of using animations, the verbs were depicted by actors (one English male and one Japanese female) in short recorded scenes. Each video clip had sound effects to clarify what the performer demonstrated in each scene. Thus, the agents of the actions were animate and the same for each familiar and novel verb. All the patients were inanimate. The 12 known verbs and four novel verbs were each recorded depicting the agent accidentally or intentionally performing an action that led to a state change in an inanimate patient, resulting in thirty-two video clips in total. Each clip was presented with an intransitive and transitive descriptive sentence.

To confirm that the videos were perceived as depicting intentional/accidental actions, all test videos without accompanying sentences were rated on a seven-point scale (7 = completely intentional, 1 = completely accidental) by Japanese (n=27) and English adults (n=15). T-tests showed that both Japanese and English adults differentiated between the accidental and intentional scenes [Mean rating for accidental vs. intentional scenes = 3.26 vs. 5.45 in Japanese; 3.08 vs. 6.19 in English, t (15) = 7.96 & t (15) = 10.17, ps < .001].

**Practice and filler items:** New practice and filler videos were made (see Appendix 7), since some actions used in the corresponding animations in Study 1 were not so easily performed and recognizable in videos, and to address the issue with certain matched stimuli encountered in Study 1.

**Procedure, Counterbalancing**
Procedure and counterbalancing were the same as in Study 1.

**Screening and Exclusions**
Three example animations and five filler animations (for screening) were presented together with one correct sentence and one obviously wrong sentence describing the scenes (see Appendix 7). If participants failed to get 6 out of 8 of these correct, they were excluded. In addition, participants were excluded if they demonstrated consistent but irrelevant biases in their responding as in Study 1. The data from all adult participants was considered valid. An additional seventeen English children were tested but excluded [fourteen three-year-olds: for always choosing the first/second puppet (8), failing the screening trials (5), and not completing the novel verb session (1); and three five-year-olds who always chose the same puppet]. An additional five Japanese children were excluded [four three-year-olds: for not completing the novel verb session (3) and always choosing the same puppet (1); and one five-year-old for not completing the novel verb session].

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Okamoto corpus (Okayama, 1970 & 1973; Shirai, Miyata, Naka, & Sakazaki, 2001). Transitivity bias was calculated from these corpora.

* The difference in exclusion rates in both studies appeared to be due to less distracting test environment conditions in Japanese nurseries.
3.5.3. Results

This study examined whether the intentionality of an action influences Japanese and English three- and five-year-olds’ and adults’ sentence construction preferences (transitive or intransitive) to describe causal scenes. Each participant’s responses were coded according to whether they chose the transitive or intransitive sentences as the best description of the animations, and the mean transitive preference was calculated across verbs for each condition.

As the task again involved a forced choice paradigm, but this time using videos rather than animations, we first wanted to establish that the participants understood the task and were not choosing sentences purely at random. To determine whether the proportions of transitive preference were above/below a chance level (50%), one-sample T-tests were conducted. For familiar verbs, all groups showed a significant transitivity preference, except for Japanese three-year-olds and English and Japanese adults in accidental scenes, whereas for novel verbs, all groups showed a significant transitivity preference except the adults for accidental scenes, and the three-year-olds for intentional scenes ($p$ values < .05).Taken together, these results suggest that the observed responses were not purely guessing behaviour.

Familiar verbs

![Figure 3.3](image)

*Fig.3.3. Mean percentage transitive preference across verbs with intentional and accidental scenes: familiar verbs*

Figure 3.3 shows the transitive preference for accidental and intentional scenes with familiar verbs. The data suggest that speakers in both languages showed a similar transitive preference with
intentional scenes which increased from three-years to five-years to adulthood, whereas for accidental scenes, Japanese children showed a weaker preference for transitives which appeared to decrease further in adulthood.

To determine whether these apparent differences were significant, a three-way ANCOVA was conducted with intentionality (intentional vs. accidental scenes) as a within-subject factor, and age (age group: three-years vs. five-years vs. adults) and language (English vs. Japanese) as between-subject factors, with a covariate of transitivity bias. The covariate, the percentage transitivity bias, was significantly related to transitivity preference \( F(1, 65) = 7.24, p = .009 \).

It revealed that there were significant main effects of intentionality \( F(1,65) = 28.15, p < .001, \eta^2_p = .30 \), and age-group \( F(2,65) = 19.63, p < .001, \eta^2_p = .38 \), and significant two-way interactions between intentionality and age group \( F(2,65) = 32.02, p < .001, \eta^2_p = .50 \), and between intentionality and language \( F(1,65) = 8.93, p = .004, \eta^2_p = .12 \), but no main effect of language \( F(1,65) = 3.40, p = .070, \eta^2_p = .050 \) or three-way interaction between the variables \( F(2,65) = .94, p = .40, \eta^2_p = .028 \).

To explore the interaction between intentionality and age group, post-hoc comparisons were carried out. T-tests with Bonferroni corrections indicated that when intentional scenes were shown, each age group showed a significantly stronger transitive preference than the younger group(s), regardless of language, i.e. adults (\( M = 94.96\%, SD = 5.10, p = .001 \) for five-year-olds and \( p < .001 \) for three-year-olds) > five-year-olds (\( M = 87.42\%, SD = 6.85 \)) > three-year-olds (\( M = 66.21\%, SD = 9.30 \)). However, when accidental scenes were presented, adults showed a weaker transitive preference (\( M = 51.58\%, SD = 23.28, p = .001 \)) than the five-year-old children (\( M = 69.33, SD = 14.59 \)). All age groups showed a stronger transitive preference for intentional than accidental scenes, although this difference appears most pronounced in the adults (three-years: 66.21%, \( SD = 9.30 \text{ vs. 59.13\%, \( SD = 11.54, p = .035 \)), five-years: 87.42\%, \( SD = 6.85 \text{ vs. 69.33\%, \( SD = 14.59, p < .001 \)), adults: 94.96\%, \( SD = 5.10 \text{ vs. 51.58\%, \( SD = 23.28, p = .001 \)).

To explore the interaction between intentionality and language, post-hoc comparisons were carried out. T-tests with Bonferroni corrections indicated that, collapsing across age groups, when accidental scenes were shown, the Japanese speakers showed a weaker transitive preference (\( M = 52.92\%, SD = 16.36 \)) than the English speakers (\( M = 67.11\%, SD = 13.64, p = .011 \)), an effect which appears strongest in the adult participants. However, there was no difference between languages for the intentional scenes (\( M = 83.08\%, SD = 6.28 \) for English speakers and 82.64%, \( SD = 7.74 \) for Japanese speakers, \( p = .267 \)). Both English and Japanese participants showed a stronger transitive preference for intentional scenes than for accidental scenes (\( ps < .001 \)).
Figure 3.4 shows the transitive preference for accidental and intentional scenes with novel verbs. It appears that unlike with familiar verbs, the children have a tendency towards preferring transitive descriptions for accidental scenes over intentional scenes, although the adults show the reverse pattern as with familiar verbs. Transitive preferences for intentional scenes appear to increase over development in both language groups.

To determine whether these patterns were significant, a three-way ANOVA was conducted with intentionality (intentional vs. accidental scenes) as a within-subject factor, and age (age group: three-years vs. five-years vs. adults) and language (English vs. Japanese) as between-subject factors. It revealed that there were main effects of intentionality \( F(1,18) = 50.46, p < .001, \eta^2_p = .74 \) and age \( F(2,18) = 9.62, p = .001, \eta^2_p = .52 \), and a significant interaction between intentionality and age \( F(2,18) = 27.74, p < .001, \eta^2_p = .76 \), but no effect of language \( F(1,18) = .196, p = .66, \eta^2_p = .011 \) and no interactions involving this variable.

Post hoc comparisons using T-tests with Bonferroni corrections indicated that when accidental scenes were presented, three- and five-year olds showed a significantly higher transitive preference than adults (\( M = 61.38\% \) & \( SD = 8.12, 73.13\% \) & \( SD = 11.10 \) and \( 48.00\% \) & \( SD = 12.14 \), respectively). However, with intentional scenes, three-year-olds showed a significantly lower transitive preference than five-year-olds and adults (\( M = 62.38\% \) & \( SD = 9.83, 80.75\% \) & \( SD = 3.92 \) and \( 87.63\% \) & \( SD = 7.82 \), respectively). Comparing the rates of transitivity preference for intentional vs. accidental scenes in each age group, only the adults showed a significant difference,
preferring transitive descriptions for intentional events more than for accidental events (87.63% vs. 48.00%, $p < .001$); there were no effects of intentionality in the children at either age (three-years $p = .802$, five-years $p = .068$).

To determine whether the participants treated novel verbs differently from familiar verbs, we ran a final analysis comparing the mean transitivity preference across verbs for each participant on the two verb types (familiar vs. novel). Two three-way ANOVAs were carried out, one for each event type (accidental, intentional), comparing transitivity preferences in each age group, language group, and by event type. For intentional events, there was a main effect of verb type such that all participants favoured transitive descriptions more with familiar ($M = 82.9\%$) than novel verbs ($M = 76.9\%$, $F(1,160) = 10.908$, $p = .001$), but no interactions between verb type and the other variables. For accidental events, there was a significant interaction between verb type and language ($F(1,160) = 9.391$, $p = .003$), but no other effects of verb type. Comparing the two language groups, for familiar verbs, English speakers favoured transitive descriptions ($M = 66.99\%$) more than Japanese speakers ($M = 51.61\%$, $p < .001$) but no difference was observed for novel verbs (English = 61.22\%, Japanese = 58.24\%, $p = .879$). Comparing verb types within each language, while Japanese speakers favoured transitive descriptions for novel verbs over familiar verbs, a pattern driven by the children’s data ($p = .013$), English speakers did not differentiate the two verb groups ($p = .068$). Thus, it appears that speakers’ processing of novel verbs is impacted when attention is drawn to the intentionality or otherwise of an event, but this varies as a function of the language spoken.

### 3.5.4. Discussion

In Study 2, we investigated whether intentionality affects English and Japanese adult speakers’ preferences for transitive vs. intransitive sentences to describe causal scenes, and whether any effect can be seen in children.

Our results revealed a similar pattern in both language groups for intentional actions. In general, all speakers preferred transitive descriptions for intentional actions over accidental actions (although the children did not show this effect for novel verbs), but the youngest children (three-years) showed a weaker transitive preference with intentional scenes than the older children (five-years) and adults. This increase in the preference for transitive descriptions of intentional causal scenes across age groups broadly mirrors the pattern of results reported for English speakers in Study 1, where the actions were also depicted as intentional. It is interesting to note, however, that whereas we found language group differences at five-years of age in Study 1 with English children selecting transitive descriptions more often than Japanese children, no such effects were observed for intentional scenes in Study 2. This suggests that something about the contrast of intentional and accidental scenes led children in both language groups to select the transitive description more often for intentional scenes in Study 2, whereas when all scenes were intentional and the contrast involved patient animacy, Japanese children were less likely to make this choice.
With accidental scenes, however, there were some interesting effects of language. Although in general speakers preferred transitive descriptions for intentional over accidental scenes, this difference was most marked in the adult participants. Although adults chose more transitives for intentional scenes than the children, they chose fewer transitive sentences for accidental scenes than both child groups. Moreover, although there were no effects of language on sentence choices for intentional scenes, with familiar verbs Japanese speakers at all three ages chose fewer transitive descriptions for accidental actions than English speakers.

Taken together, these results suggest that although speakers of both Japanese and English prefer transitive sentences for intentional, causal events, children learning these languages are sensitive to language-specific differences in the use of transitive sentences to describe accidental scenes by three-years of age. However, this sensitivity does not equate to adult-like knowledge as children in both language groups demonstrate different preferences than their adult counterparts for both event types, in general failing to differentiate the two events to the same extent as adults.

Fausy et al. (2010) asked English and Japanese adults to describe test scenes freely. They noted that in both languages, adults used transitive descriptions with intentional scenes to a similar degree, but with accidental scenes they produced fewer transitive constructions (with greater reduction in the Japanese than English speakers). Our study (which takes account of transitivity bias) confirms this, and extends these findings by demonstrating how children learning these two languages prefer to describe events. We found that even three-year-olds are sensitive to intentionality in their choice of sentence for causal scenes, but that this sensitivity is more apparent with familiar than with unfamiliar verbs, and is weaker than in adult speakers.

3.6. General Discussion

In these studies, we investigated experimentally the emergence of sentence structure preferences in the encoding of causal events in English- and Japanese-speaking children (aged three- and five-years) and the corresponding preferences in adults. These two languages have been reported to differ in how causal events map onto syntactic structure. In Study 1 we focused on the role of patient animacy and in Study 2 on intentionality.

Previous studies have suggested that patient animacy influences Japanese speakers’ tendency to describe causal scenes using transitive structures (Nishimitsu, 2010). Study 1 showed that with familiar verbs, patient animacy had no effect on the preference for transitive descriptions of causal events at any age in either language. However, with novel verbs, our youngest children (three-year-olds) showed language-specific sensitivity to patient animacy. Japanese three-year-olds showed a stronger transitive preference with animate than inanimate patients whereas English three-year-olds showed a stronger transitive preference with inanimate patients. Thus, only the data from Japanese three-year-old children’s preferences with novel verbs provide support for Nishimitsu’s suggestion that Japanese speakers prefer to use transitive constructions with events involving both an animate agent and patient. Beyond the age of three years, however, our results do not show animacy of the patient to be a critical factor in choice of sentence constructions. In addition, we observed a different developmental trajectory in the two languages, irrespective of
patient animacy. At age 5, English children showed a stronger transitive preference than Japanese children, and while Japanese five-year-olds were similar to three-year-olds, English five-year-olds were similar to adults.

The intentionality of an action is also thought to determine choice of sentence construction and use of causal language in adult speakers (e.g. Wolff, 2003), although in Japanese there may be a more general bias towards intransitive, non-causal structures (Fukuda & Choi, 2009; Nishimitsu, 2010). In Study 2, for intentional scenes, both Japanese and English speakers preferred transitive constructions. For accidental scenes with familiar verbs, both Japanese and English speakers selected fewer transitives than for intentional scenes, the difference being larger in the Japanese group, and in the adults. However, with unfamiliar verbs, only adults showed this preference. Moreover, although Japanese speakers are reported to favour intransitive descriptions in written language (Nishimitsu, 2010), we observed an effect of language only for familiar verbs used to describe accidental actions.

Taken together, our results suggest that children’s developing knowledge of the language-specific contexts for use of the intransitive and transitive constructions to describe causal events is influenced by both the animacy of the referents and the degree of intentionality on the part of the agent. However, the influence of these two sources of information differs in line with their broader relevance for sentence processing in each language, and the ease with which the information can be integrated with sentence representations. Animacy information provides a relatively straightforward cue as it operates at the level of the identity of a referent, and appears to be most important when children are presented with novel verbs. This is likely to be because children have limited experience with the specifics of use for these verbs and weaker sentence representations than adults, and therefore fall back on broader processing strategies relevant for their language. In contrast, information about intentionality may be harder to detect from the visual scene, and requires children to integrate more information than that needed to determine whether a referent is animate (e.g. Gelman, Spelke & Meek, 1983). In fact, animacy can be distinguished by 9-month-olds (Poulin-Dubois, Lepage & Ferland, 1996) while, intentionality can be distinguished by 12-month-olds (Carpenter, Akhtar & Tomasello, 1998). Thus, animacy seems to be understood earlier than intentionality.

In our data, children were initially sensitive to this cue only with familiar verbs whereas adults were able to utilise this information in the processing of novel verbs, suggesting that intentionality cues may be more dependent on the familiarity of a particular event structure for their interpretation.

In both Study 1 and 2, there were significant effects of transitivity bias showing that the transitivity of the verbs did influence responses, although our experimental variables also influenced responses after controlling the effects. This result suggests that speakers’ transitive preference could be influenced by general patterns in the two languages leading to broadly different kinds of responses, and in each language the precise distributional characteristics of verb use are also important.
By comparing familiar and novel verbs with ANOVA, we also examined similarities and differences between familiar and novel verbs, and how these might arise. With animate patients, there was no effect of verb type (familiar/novel). However, with intentionality, there were differences in the patterns of transitive preference between familiar and novel verbs. Regardless of verb type, with intentional scenes, English speakers preferred transitive sentences more than did the Japanese. On the other hand, Japanese speakers (children) favoured transitive descriptions with novel verbs more than with familiar verbs. These results suggest that novel verbs probably draw on broad cues across verbs in the language, whereas familiar verbs draw on verb-specific information as well as these broader cues.

Our findings suggest that learning language-specific biases in the matching of sentence structure to event structure is a rather subtle process. How children learn language-specific sentence construction semantics has attracted attention from language acquisition theorists. For example, the usage-based approach proposes that children first learn constructions tied to individual words or phrases, and only gradually acquire abstract constructions and their associated form-meaning mappings, driven by the distributional properties of the input (Tomasello, 2003). From this perspective, preference for particular sentence structures may vary by verb as a function of how that verb is used in the input to children, and learning more abstract construction-level meanings is dependent on the frequency of abstract patterns observable across the language (e.g. the tendency for transitive subjects to be animate), and the verb-specific patterns of use in the input to children (Ambridge et al., 2015). Thus, it is clear that understanding how children map linguistic structure to event structure requires consideration of both cognitive factors such as an intention-to-CAUSE bias, which might be expected to hold across languages (to the extent to which they can be considered independent of language), and the language-specific factors which interact with them. To that end, it would be informative to determine to what extent the observed animacy and intentionality-related transitivity preferences for individual verbs in the two languages reflect the broader patterns of usage in child directed speech. However, this is a far from simple issue due to the widespread occurrence of argument omissions in Japanese, difficulties in assigning an accurate or meaningful animacy status to many references in the child’s environment, and determining the mapping of causal and non-causal language to events in (often audio-recordings of) child-directed speech.

Another interesting finding in our data is the developmental change in sensitivity to intentionality, with adults displaying a more marked differentiation of accidental and intentional actions than children. Previous studies have argued for an intention-to-CAUSE bias in children’s early mappings of linguistic structure to event structure, with three- to four-year-olds favouring causal descriptions for intentionally caused events carried out by animate agents over those unintentionally caused or caused by inanimate objects (Muentener & Lakusta, 2010; Kanero et al., 2015). Our data also suggest that children show a similar bias (for familiar verbs), but that this preference is less pronounced than in adult speakers. This is likely to reflect a number of aspects of complexity, including children’s knowledge of alternative sentence structures that could be used to describe these scenes (e.g. the periphrastic causative), their depth of understanding of the form-meaning mappings of the contrasted sentence constructions, and their metalinguistic awareness and ability to explicitly contrast the sentence choices.
3.7. Conclusion

In these studies, we examined the role of patient animacy and agent intentionality on sentence structure preferences in Japanese- and English-speaking children and adults. We found effects of both patient animacy and intentionality on sentence selection, but there were complex language-specific and developmental differences. We conclude that when Japanese and English children hear familiar verbs used to describe causal actions, intentionality is important in their choice of sentence construction. However, when children hear new verbs, they initially use animacy as a cue to sentence selection, whereas for adults, intentionality is more important. This suggests that animacy is a cue available to young children, but that interpreting intentionality and its mappings into language is more complex and takes longer to learn. These findings have important implications for our understanding of how children’s developing representations of causality map onto their developing knowledge of linguistic structure, and point to the need for further detailed study of the precise properties of the language that children are exposed to. This will allow the development of theoretically motivated predictions about the acquisition of causal language, and more sophisticated models of linguistic representation, processing, and its interplay with other aspects of human cognition over development.
Chapter 4.
Study 3: Are there any transfer effects of form-meaning mappings? Comparing English monolingual and Japanese-English bilingual speakers in a production task

Abstract

The learning of two languages simultaneously has long been known to give rise to potential interference between them in many different aspects of language (e.g. pronunciation, vocabulary and the process of sentence comprehension). However, the use of transitive/intransitive frames has not been studied in this regard. With a comprehension task, Okuno, Cameron-Faulkner, and Theakston (in progress) have demonstrated differences between Japanese and English speakers’ preference for these structures when describing causal events, with Japanese speakers choosing fewer transitives for accidental scenes than their English counterparts. In this study, we investigated whether we could identify any transfer effect of this preference in Japanese-English bilingual speakers, and whether we could replicate our previous results with English-monolingual speakers in a production task. We used a video task to elicit English descriptions of accidental and intentional causal events. We studied four groups: English monolingual children and adults, Japanese-English bilingual children (aged five years) and adults. We compared their transitive preference and the extent to which they mentioned the agent of the action in English. We found that there was no transfer effect on the use of the sentence constructions in the Japanese-English bilinguals, but there was on production of the agent. The Japanese-English bilingual speakers avoided producing the agent more than the English-monolingual speakers. Interestingly the bilingual children did this by dropping the agent from transitive sentences, while the bilingual adults produced other sentences which did not include agents especially with accidental scenes. In addition, the bilinguals tended to use more adverbs to indicate an “accidental” situation. These results suggest that there is a syntactic transfer effect on the bilingual children, but form-meaning mapping transfer on the bilingual adults. Moreover, our production task also replicated our comprehension task results: English monolingual speakers selected fewer transitives for accidental than intentional causal scenes.

Keywords
Child language acquisition; Form-meaning mappings; Intentionality; Cross-linguistic study; Transfer effect; Production task
4.1. Introduction

Over half the world's population speaks more than one language in daily life (Grosjean, 1994). Studies of monolingual children demonstrate that the language environment, including the amount and quality of input, affects their language acquisition (Ambridge, Kidd, Rowland & Theakston, 2015). Bilingual children may show wider variation in their patterns of language development because they have input in two languages which may differ in both quantity and quality (Grüter & Paradis, 2014). They may also experience their different languages in different social environments, for example in the home vs. at school, or speaking to one parent vs. the other (Bialystok, 2012).

Exposure to a second language may be either simultaneous or sequential. Sequential learning has been shown to enhance general linguistic skills. For example, Verhoeven (2007), studying sequential learners, found that from 75 Turkish-Dutch 5yr-old bilingual children, those who showed both Turkish (L1) and Dutch (L2) proficiency produced higher scores on phonological awareness at the end of the kindergarten year. This study suggests that knowledge of L1 and L2 languages can enhance the children’s pragmatic skills (e.g. utterance length), phonological skills (e.g. phoneme discrimination) and literacy skills. Most data on the specific interaction between two individual languages has been acquired from studies of simultaneous learners.

First language can influence second language acquisition, a phenomenon called “language transfer”. Transfer effects can be seen in lexical, phonological, representation or processing of words, and syntactic processes in sentence production (e.g., Loebell & Bock, 2003; Meijer & Fox Tree, 2003; Hartsuiker, Pickering, & Veltkamp, 2004; Kootstra, Van Hell, & Dijkstra, 2010). As an example of syntactic transfer, Nitschke, Kidd & Serratrice (2010) showed first language (L1 = English) transfer effects on second language (L2 = either German or Italian) sentence comprehension in adult speakers, when presented with ambiguous relative (RC) clauses in the L2 language. For example, In German, “Hier ist die Frau, die das Mädel küsst” (Here is the woman [Subj/Obj] that the girl [Obj/Subj] kisses). “Woman” can be interpreted as subject or object, a similar pattern occurs in Italian. English speakers learning German showed a greater preference for object reading (OR) decisions than native German speakers, which the authors argued was because English allows only OSV (Object Subject Verb) reading in NNV (Noun-Noun-Verb) RCs whereas native Germans prefer SOV (Subject Object Verb) reading. Conversely, both the L1 and L2 Italian speakers showed a lower preference for OR, because OR is less preferred in Italian NVN RCs and is not allowed in English NVN RCs. Also, priming with sentences with a clear OR reading, resulted in increased OR reading in ambiguous RCs in the L1 & 2 German and L2 Italian participants. These results (a higher proportion of OR readings in the L2 Germans than in the L1 Germans, and the OR proportions of L1 and L2 Italians converging on a low level) showed the L1 transfer effect. Thus participants’ interpretation of ambiguous RC constructions was influenced by the form-meaning mappings present in their first language. Döpke (2000), in a study of German-English simultaneous learners, observed that the 2-4yr-olds used –Verb-Object (VO) word order much more frequently in all verbal clauses in German than monolingual Germans. In English, –VO order is used in both main and subordinate clauses. In German, both –VO and -OV word order is used in subordinate clauses. These suggest, as –VO order was more often used from English into German for the English-German bilingual children, there was a syntactic transfer.
In language acquisition, form-meaning mapping is “a situation in which a form encodes some kind of referential meaning” (Van Patten, Williams, & Rott, 2004, p.16). While one form may have just one corresponding meaning, sometimes one form needs to encode multiple meanings depending on the context. Van Pattern et al. (2004) suggest, that in the form-meaning mapping process, a learner makes a connection between a form and meaning and strengthens it by further input. Studies indicate that cross-linguistic differences in form-meaning mapping are attested not only at the lexical level but also at the structural level. For example, Okuno et al. (in progress) identified systematic differences in the preference for transitive and intransitive constructions between Japanese and English when encoding intentionality. Previous studies by Okuno et al. (in progress) have focused on the development of language-specific preferences for transitive or intransitive descriptions of causal events between Japanese and English children and adults. Participants watched videos of causal actions, and made a best-match choice between a transitive and intransitive description. In their studies, animacy of patient (animate/inanimate patient conditions) and intentionality (accidental/intentional conditions) were controlled. For intentionality, with verbs both Japanese and English speakers selected fewer transitives for accidental than intentional scenes, but this pattern was more pronounced in Japanese speakers. However, with novel verbs, only adults showed this preference. They also found no effect of patient animacy on sentence selection with familiar verbs at any age in either language. However, with novel verbs, English and Japanese three-year-olds were influenced by patient animacy, but in contrasting ways which mirror aspects of their linguistic input. These data provide important new information to constrain theories about the process of learning to map event structure to language, and its interdependence with concepts of animacy, intentionality and the distributional properties of linguistic input to children.

Previous studies, which focus on development in monolingual speakers, demonstrate cross-linguistic differences in the form-meaning mapping of causal events. An important question arising from this work is whether speakers of more than one language display transfer effects in their form-meaning mappings. A transfer effect on the form-meaning mapping to describe causal events may be seen in bilingualism. Based on Talmy (1985;1991;1996) and Slobin (1996a and 1996b), Cardierno and Lund (2004) hypothesised that “independently of the typological patterns of the L1 and L2, the learner will tend to transfer the L1 form meaning patterns into the L2” (p.192). Therefore, we might expect that Japanese-English bilingual speakers may transfer the Japanese form-meaning patterns, which Okuno et al. (in progress) have reported, into English.

From this work (Okuno et al., in progress) two types of transfer in encoding causal events might be expected in the linguistic representations of Japanese-English bilinguals. Firstly, simply for the accidental scenes, Japanese-English bilingual speakers may show more usage of intransitive sentence constructions in English than English monolingual speakers. This is because Japanese speakers appear to focus more on the outcome rather than the cause of an accidental event in their choice of linguistic descriptions for these events, and this Japanese process of transitive/intransitive usage may interfere with their use of English.
Secondly, Japanese-English bilinguals may avoid the mention of agents when they describe causal events (especially accidental events). Japanese-speakers quite often avoid mentioning or omit the agent. For example in our corpus study reported in Chapter 2 omission of the agent occurred in 78% of transitive usage. Furthermore, Japanese people may focus on different aspects of causal scenes. Ikegami (1981; 1991) suggested that English speakers are likely to focus on the human agent, but Japanese speakers prefer to focus on the event as if it happened spontaneously. Fausey, Long, Inamori, & Boroditsky (2010) found that Japanese speakers were less able to remember the agent of a causal action than were English speakers. This suggests the possibility of a difference in attentional or perceptual focus between different language speakers. Alfonso (1966) studied English and Japanese speakers’ use of active transitive and passive constructions, and found that Japanese speakers preferred constructions which backgrounded the agent (e.g. passives), whereas English speakers did not. Therefore, these two processes of Japanese form-meaning mapping may influence the process of English form-meaning mapping. As form-meaning mappings are thought to be acquired during the process of language acquisition, we might expect there to be differences in the degree of transfer between languages observed in bilingual speakers at different ages.

One possible prediction is that the bilingual speakers may show a transfer effect that increases during development. Input (what children hear) is important in the development of form-meaning mapping. When the bilingual children begin acquiring form-meaning mappings, their mapping is partial and incomplete. However, the more they are exposed to the linguistic environment (over development), they strengthen and integrate the form-meaning connection. Thus, Japanese-bilingual adults may show a stronger transfer effect on form-meaning mapping when describing the causal events than do children.

An alternative explanation for such a prediction might be that the bilingual children may not yet be aware of the subtle differences in usage of transitive/intransitive constructions between Japanese and English, since this is explicitly when they learn. In fact, our comprehension task showed that Japanese and English monolingual 5yr-old have not yet fully understood the form-meaning mapping with intentionality.

An alternative prediction is that bilinguals may not show any transfer effect on production at any age. According to Jarvis and Pavlenko (2008), if L2 is similar to L1, speakers comprehend L2 more easily by recognising the language structures and familiar form-meaning mappings compared to those who study a distant language. Jarvis and Pavlenko (2008) also argued that ‘language similarity’ is one of the important factors in causing a transfer effect, with transfer effects occurring in instances where similarity leads L2 learners to judge that a form, structure, meaning, function, or pattern from their input corresponds to features of their L1. Laufer and Eliasson (1993) tested Hebrew or Swedish speaking L2 learners of English by using multiple choice and description tasks. They were asked to select or write correct verbs in English sentences. The researchers reported that Hebrew speakers more frequently avoided using a phrasal verb and used a single word verb which has an equivalent meaning, whereas Swedish speakers were more likely to use phrasal verbs. They argued that this was due to the fact that Hebrew does not have the categories of
phrasal verbs. Their study suggests the possibility that a big difference between L1 and L2 forms underpinned the Hebrew speakers failure to establish the form-meaning connection across languages. On the basis of this study, we might then hypothesise that as Japanese and English have different features (e.g. different word order) (see Chapter 1), the bilinguals may not mix up L1 and L2 language knowledge, thus no transfer effect on form-mapping may occur at all.

The previous work by Okuno et al. (in progress) examined transitive / intransitive choices using a forced-choice description experimental study, using causative alternation verbs. While this method has clear merit in producing unambiguous responses, it cannot necessarily be assumed that this represents the most favoured construction employed by children when describing causal events. Children may employ a much wider range of structures in normal speech. Not only simple transitive causative and non-causal intransitive constructions exist, but there are other constructions such as periphrastic causative and causal conjunctions. In order to confirm whether our previous findings are reflective of the choices made in spontaneous speech, a further experiment involving an ‘elicited production task’ was undertaken with three age groups (English 3yr, 5yr and adults), using the same causative alternation verbs. This production task was also intended to show whether they (de)focus on the agent or not, by recording whether they mention agent/patient in their description.

The focus of the current paper is on how and when Japanese-English bilingual children learn the form-meaning mappings to describe intentional and accidental causal events. By using a production task, we aimed to check what kind of linguistic structures were used in description, and the extent to which a bilingual speaker’s L1 influences their sentence choice in their L2 as compared to monolingual speakers.

In particular, we investigated the following questions in relation to speakers’ descriptions of simple causal actions in English;

1. Do monolingual English and Japanese-English bilingual speakers prefer using transitive constructions to describe causal actions over intransitives or other constructions?
   - Are there any age (child vs. adult) and group differences (monolingual vs. bilingual)?

2. Is there any transfer effect of form-meaning mapping on Japanese-English bilinguals’ English descriptions?
   - Does any effect occur with respect to the choice of sentence structure or the extent to which the agent is mentioned?

3 Do monolingual English speakers produce replicable results to those of Okuno et al (in progress) using a comprehension task.
4.2. Method

4.2.1. Participants

English monolingual and Japanese-English bilingual adults and children aged 3 to 5 years participated in the study. English speakers were recruited in Greater Manchester and Japanese-English bilingual speakers in Greater Manchester and London (UK).

The children were all attending nursery or pre-school and data collection for all participants was carried out in their institutions. Japanese bilinguals were recruited through toddler groups, a kindergarten and school for Japanese children who live in the UK, by email and in person. Whether both children and adults are bilingual or not was decided by the experimenter speaking to them in both Japanese and English and checking their understanding of the researcher’s conversation.

The 63 English speakers comprised 21 ‘three-year-olds’ (aged 3;3 to 4;8, \(M=45.36\) months), 26 five-year-olds (aged 5;0 to 5;11, \(M=65.45\) months), and 16 adults (8 male, \(M=16.65\)yr). The 32 Japanese-English bilingual speakers comprised 16 children (aged 3;2 to 5;11, \(M=56.21\) months), and 16 adults (2 male, \(M=42.69\)yr). We aimed to compare 5yr-old bilinguals with 5yr-old English children, because in Okuno et al. (in submission), at around 5 years of age, children showed a different transitive preference from adults and at that age are more capable of producing sentence constructions than 3yr-olds. However, it was difficult to recruit 5yr-old Japanese-English bilingual children due to time limitations and the practicalities of accessing this population, so we widened the age range from 3- to 5yr-olds. The 5yr-old monolingual and bilingual groups were not exactly the same in terms of age structure, but we had nine 5yr-old bilingual children out of 16. Thus we decided to still compare Japanese-English bilingual children with English 5yr-old monolingual children. The bilingual adults started learning English at \(M=11.56\) (\(SD=2.94\)). Their length of speaking English was 25.19 years (\(SD=12.48\)) and length of living in English-speaking countries was \(M=12.34\) years (\(SD=7.91\)).

In our study, the ability of the bilingual children to communicate was verified by the experimenter according to their ability to answer questions in English. The bilingual adults had generally spoken English while living in English-speaking countries for several years.

4.2.2. Stimuli

Test items: For the 12 causative alternation verbs identified in the corpus study (Chapter 2), a total of 24 short video clips were produced. The verbs were depicted by actors (one English male and one Japanese female) in short recorded scenes. Thus, the agents of the actions were animate and the same for each verb. All the patients were inanimate. The 12 verbs were each recorded.

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5 We tried to collect data about the bilingual children’s ability by using “BabyLab Language Exposure Questionnaire (LEQ)” produced by Plymouth University. However we were unable to collect this data for practical reasons. The bilingual adult participants were mainly second-language English learners, due to the difficulty in recruiting true bilingual speakers.
depicting the agent accidentally or intentionally performing an action that led to a state change in an inanimate patient. Each video clip had sound effects to clarify what the performer demonstrated in each scene (e.g. when the man pressed a doorbell with his head accidentally, a ‘ding-dong’ sound was added). Each video could be described using a transitive or intransitive sentence (e.g. “She stopped the man/ The man stopped”, see Appendix 5).

Practice and filler sentences: Three practice and 5 filler video clips were made (see Appendix 7). They were used to teach the children and adults the task and to disrupt any preference for a single structure throughout. The three short computer animations were produced using Anime Studio Pro 11 (Smith Micro Software, Inc.). The scenes involved the actions of ‘freezing’ and ‘floating’, which were not used in the test-session and can be described both transitively and intransitively. In the videos of five fillers, the performers also demonstrated actions in each scene, which cannot be easily described with causative alternation verbs.

Counterbalancing: Each experiment was run according to one of four counterbalanced sequences (scripts). The number of participants tested using each sequence was balanced.

4.2.3. Procedure

Children: Each child was tested by the first author, over a period of approximately 20 minutes. Twelve verbs were presented with accidental or intentional scenes (total 24 scenes) with a further three initial examples and five fillers.

Warm-up: One hand-puppet was introduced and used to maintain the child’s interest and engagement in the study. The child were then told, e.g. “Teddy Bear loves listening to stories. Now we are going to watch some animations. Can you tell what happened on the videos to Teddy Bear?”

Three example animations were presented to the children to give some suggestions how to describe the videos for the task. Firstly, after showing the “Freeze” animation, the experimenter said e.g. “What happened? For this animation, we could say ‘The water froze’ or we could also say ‘He froze the water’. We can tell a story in a lot of different ways”. Then the second animation of freezing the snowman was shown giving example descriptions using transitive and intransitive sentences. In the third animation, the child was asked to tell a story after watching the ‘floating the boat’ animation. The experimenter acknowledged the child’s story by saying “That’s a good story” and also gave two example explanations “He floated the boat” and “The boat floated”. The orders of transitive and intransitive sentences on each video were counter-balanced.

Test session: The 12 target verbs were presented with inanimate patients (total 24 scenes) with 5 fillers. The child, together with the puppet, watched each animation on a PC screen. Next the child was asked to describe the video, “What happened?” If the child failed to respond, the experimenter said, ” Can you tell any stories about videos. Let’s watch it again”. If the child still failed to respond, the experimenter described the video using the example transitive and intransitive answers, then moved on to the next video clip. After each response, the child received encouragement.
**Adults:** Each adult was tested by the first author, for approximately 20 minutes. The same three practice animations with transitive and intransitive descriptions were presented as for the children, but without the puppet. For the test animations, the adults were asked to write a sentence in English on an answer sheet. Several adults participated in the experiment at the same time.

### 4.2.4. Coding

The first author and a trained research assistant transcribed the children’s utterances for each video clip. Transcription was subsequently checked by native English speakers. Both the children’s and adults’ responses were then coded for sentence construction and verb choice. Firstly, we coded whether participants produced transitive (for verbs which could undergo causative alternation), intransitive (for verbs which could undergo causative alternation) or other constructions (e.g. transitives and intransitives with non-causative alternation verbs, passives). When they used causative alternation verbs which accurately described the causal events, their utterances were coded as “transitive” or “intransitive” regardless of whether they consisted of simple or complex constructions. Other sentence constructions such as passives and the utterances with non-causative alternation verbs describing the events (e.g. “He threw the ball”) which cannot take an intransitive form and utterances which did not describe the targeted causal actions, e.g. describing the colour of the patient or irrelevant things) were coded as “Other”. Example sentences were “When he walked side, the van kicked his shoe” and “The car bumped into his foot”, and “they were broken into pieces”.

Secondly, we coded whether they produced the agent and the patient in their utterances for each video, irrespective of whether the two roles were encoded in a single clause (e.g. “The man [agent] rolled the ball [patient]”) or across clauses (e.g. “He just threw on the floor then they (the LEGO, patient) just broke”).

### 4.2.5. Analysis

This study examined how English monolingual and Japanese-English bilingual children and adults describe causal scenes in English and whether the intentionality of the agent affects their sentence choice. Each participant’s utterances were coded according to (1) the type of construction used, and (2) whether they mentioned the agent of the action.

Three-way ANOVAs were conducted with intentionality (intentional vs. accidental scenes) as a within-subject factor, and age (age group: children vs. adults) and language (monolingual vs. bilingual) as between-subject factors. We compared the English 5yr-old monolingual group with the bilingual children.

Since we had been able to recruit a larger sample of English monolingual children we were able to conduct an additional analysis in which we divided the children’s sample into two groups (3yr and 5yr olds), and separately performed two-way ANOVAs with intentionality (intentional vs. accidental scenes) as a within-subject and age (3yr vs. 5yr vs. adults) in the English groups.
4.3. Results

4.3.1. Comparison of English transitive sentence production between monolingual English and bilingual Japanese-English children and adults

Our first set of analyses addressed our first two research questions: (1) Do monolingual English and Japanese-English bilingual speakers prefer using transitive constructions to describe causative actions over intransitives or other constructions? and (2) Is there any transfer effect of form-meaning mapping on Japanese-English bilinguals’ English descriptions?

First, we focused on the relative use of transitive vs. intransitive constructions to describe causal scenes. Production of transitive sentences was calculated by this formula: [the raw frequency of transitive sentences/ (the raw frequencies of intransitive + transitive sentence constructions)]. ‘Other’ constructions were excluded from this analysis because we aimed to examine which of the two constructions (transitive/intransitive constructions) was chosen in instances where there was an available choice to make, the event being able to be described in either way with the same verb.

![Fig. 4.1. Production of transitive sentences (%): English monolingual vs. Japanese-English bilingual](image)

Figure 1 shows the mean percentage of producing transitive sentences to describe accidental and intentional scenes. A three-way ANOVA was conducted with intentionality (accidental vs intentional scenes) as a within-subject factor, and age (age group: 5yr vs adults) and language (monolingual English vs bilingual Japanese-English) as between-subject factors. It revealed a main effect of intentionality \(F(1,44)=.69, p=.00\), but there were no significant main effects of age \(F(1,44)=.08, p=.96\) or language \(F(1,44)=.41, p=.53\), no interactions between intentionality and age \(F(1,44)=.68, p=.42\), intentionality and language \(F(1,44)=.02, p=.89\), age and language \(F(1,44)=.28, p=.60\), age and intentionality \(F(1,44)=.28, p=.60\), nor a three-way interaction \(F\)
Post hoc comparisons using T-tests with Bonferroni corrections indicated that transitive constructions were more often used to describe intentional scenes ($M=87.3\%, SD=16.3$) than accidental scenes ($M=59.7\%, SD=29.6$), irrespective of age or language group.

### 4.3.2. Comparison of English 'other construction' production between English monolingual and Japanese-English bilingual children and adults

Although we observed no difference in the choice of transitive vs. intransitive descriptions between the English monolingual and the Japanese-English bilingual speakers when participants used the target alternating verbs, a further possibility is that there might be language group differences in how often participants used other kinds of verbs in their responses. Production of other constructions was calculated by this formula: [the raw frequency of other constructions/ (the raw frequencies of intransitive + transitive and other sentence constructions)]. Figure 4.2 shows the mean percentage of producing other sentences to describe accidental and intentional scenes. A three-way ANOVA was conducted with intentionality (accidental vs intentional scenes) as a within-subject factor, and age (age group: 5yr vs adults) and language (English monolingual and Japanese-English bilingual) as between-subject factors.

![Fig. 4.2. Production of other constructions (%): English monolingual vs. Japanese-English bilingual](image)

It revealed a main effect of intentionality [$F(1,44)=55.8$, $p=.00$], but there were no significant main effects of age [$F(1,44)=1.83$, $p=.18$], language [$F(1,44)=.51$, $p=.48$], or interactions between intentionality and age [$F(1,44)=1.83$, $p=.18$], intentionality and language [$F(1,44)=1.60$, $p=.21$], age and language [$F(1,44)=.43$, $p=.52$], nor a three-way interaction [$F(1,44)=.36$, $p=.55$]. Post hoc comparisons using T-tests with Bonferroni corrections indicated that other constructions were more often used to describe accidental scenes ($M=55.3\%, SD=28.3$) than intentional scenes ($M=25.1\%, SD=21.9$).
4.3.3. Comparison of producing the agent in English sentences between English monolingual and Japanese-English bilingual children and adults

Omission of the agent in sentence constructions is a more common feature of Japanese than English (see Chapter 2). So, although we observed no difference between English monolingual and Japanese-English bilingual speakers in the choice of sentence constructions, we also checked for language group differences in how often participants produced the agent in their responses. Production of the agent was calculated by this formula: [the total number of constructions specifying the agent / the total number of scenes]. Figure 4.3 shows the mean percentage of utterances containing the agent of the action in accidental and intentional scenes.

![Graph showing production of agent (%): English monolingual vs. Japanese-English bilingual](Image)

Fig. 4.3. Production of agent (%): English monolingual vs. Japanese-English bilingual

A three-way ANOVA was conducted with intentionality (accidental vs intentional scenes) as a within-subject factor, and age (age group: 5yr vs. adults) and language (English monolingual and Japanese-English bilingual) as between-subject factors. It revealed main effects of intentionality \( F(1,44) = 7.90, \ p=.007 \), age \( F(1,44) = 4.11, \ p=.049 \), and language \( F(1,44) = 6.93, \ p=.012 \). There was also a two-way interaction between intentionality and age \( F(1,44) = 7.45, \ p=.009 \), but there were no interactions between intentionality and language, and age and language \( F(1,44) = 1.45, \ p=.235 \), nor a three-way interaction \( F(1,44) = .28, \ p=.603 \).

The main effect of language indicates that English speakers produced the agent \( (M=92.44, \ SD=10.72) \) more often than Japanese-English bilingual speakers \( (M=85.38, \ SD=11.34) \) irrespective of their age. The main effect of age indicated that adults produced the agent \( (M=91.63, \ SD=8.59) \) more often than children \( (M=86.19, \ SD=13.19) \).
To explore the two-way interaction between intentionality and age, post hoc comparisons using T-tests with Bonferroni corrections were carried out. These indicated that for intentional scenes, regardless of language, adults more often mentioned the agent of the action ($M=95.9\%, SD=7.47$) than children ($M=86.3\%$, $SD=11.1$, $p=.000$). However, for accidental scenes, children and adults showed similar frequencies in producing the agent (respectively, $M=86.1\%$, $SD=15.3$; $M=87.3\%$, $SD=9.7$, $p=.741$).

Furthermore, children did not show a difference in frequencies of production of the agent between intentional scenes ($M=86.3\%$, $SD=11.1$) and accidental scenes ($M=86.1\%$, $SD=15.3$, $p=.955$). However, adults produced the agent more often with intentional scenes ($M=95.9\%$, $SD=7.47$) than accidental scenes ($M=87.3\%$, $SD=9.7$, $p=.000$).

In coding the data, it appeared that Japanese-English bilingual adults seemed to produce more frequently different sentence constructions which don’t include the agent with complete sentences (using intransitives), especially with accidental scenes. In contrast, Japanese-English bilingual children seemed to omit the agent with accidental/intentional scenes (using incomplete sentences), although English 5yr-olds did not often omit the agent. Japanese adults avoided the agent by producing different constructions which don’t include the agent especially with accidental scenes, but Japanese children omitted the agent in incomplete sentences.

Within this data, we observed an interesting difference in how adults and children omitted the agent (Table 4.1). The Japanese-English bilingual adults chose constructions which are complete without reference to the agent, whereas the bilingual children much more frequently simply omitted the agent (e.g. in simple transitive structures). Figure 4.1 shows that English speakers more frequently produced the agent than the Japanese-English bilingual speakers. When we also checked how they omitted the agent, both English monolingual children and adults tended to choose constructions which are complete without reference to the agent.

<table>
<thead>
<tr>
<th>Table 4.1. Patterns of Omission of Agent by Language Group and Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japanese-English bilingual</td>
</tr>
<tr>
<td>Children</td>
</tr>
<tr>
<td>Complete sentences without the agent</td>
</tr>
<tr>
<td>Incomplete sentences omitting the agent</td>
</tr>
</tbody>
</table>

4.3.4. Use of accidental and intentional adverbs

Analysis of participants’ utterances revealed an interesting pattern of use of adverbs describing intentionality. We therefore also examined how they were used in producing sentences in response to accidental and intentional scenes, as a function of language and age. Table 4.2 shows the frequencies of “accidental” and “intentional” adverbs. The use of “intentional” adverbs were not as often used as “accidental” adverbs by either bilingual or monolingual speakers. However, bilingual adults used “accidental” adverbs twice as frequently as English monolingual adults and bilingual children produced “accidental” adverbs more often than monolingual children.
Table 4.2. 
**Occurrences (n) of Accidental and Intentional Adverbs**

<table>
<thead>
<tr>
<th></th>
<th>Bilingual Adult</th>
<th>English Adult</th>
<th>Bilingual Children</th>
<th>English Children</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accidental adverb</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accidentally</td>
<td>25</td>
<td>18</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>By accident</td>
<td>12</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>By mistake</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unexpectedly</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inadvertently</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>By itself</td>
<td></td>
<td>2</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>40</td>
<td>21</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td><strong>Intentional adverb</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On purpose</td>
<td>2</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Purposely</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deliberately</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intentionally</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

4.3.5. **Comparison of producing transitive sentences between English monolingual 3yr-, 5yr-olds and adults**

This analysis was conducted to address our third research question: Do monolingual English speakers produce replicable results to those taken from a comprehension task (Okuno et al., in progress)? We studied the same three groups: 3yr-, 5yr-olds and adults, to investigate whether they also have a preference for using transitive constructions over intransitives to describe accidental and intentional causal scenes; whether they prefer using different constructions; and how often they produce the agent.

First, we focused on the relative use of transitive vs. intransitive constructions to describe causal scenes. Figure 4.4 shows the mean percentage of transitive construction production in the accidental and intentional scenes. A two-way ANOVA was conducted with intentionality (accidental vs intentional scenes) as a within-subject factor, and age (age group: 3yr vs. 5yr vs. adults) as between-subject factors. It revealed a main effect of intentionality [$F (1,33) = 18.31$, $p=.000$] and age [$F (2,33) = 12.01$, $p=.000$], but no significant interaction between intentionality and age [$F (2,33) = .24$, $p=.79$].
This showed that the frequency of production of transitive constructions by English 3yr-olds was lower (M=42.4%, SD=24.7) than 5-year olds (M=76.1%, SD=15.0) and adults (M=73.9%, SD=33.2). Participants also produced more transitive constructions for intentional scenes (M=76.8%, SD=27.2) than accidental scenes (M=51.4%, SD=31.9).

### 4.3.6. Comparison of producing other constructions between English 3yr-, 5yr-olds and adults

We analysed whether there might be age group differences in how often participants used other kinds of verbs in their responses. Figure 4.5 shows the mean percentage of producing other sentence constructions with accidental and intentional scenes. A two-way ANOVA was conducted with intentionality (accidental vs intentional scenes) as a within-subject factor, and age (age group: 3yr vs. 5yr vs. adults) as between-subject factors. It revealed a main effect of intentionality \([F(1,33) =46.36, p=.000]\) and a significant interaction between intentionality and age \([F(2,33) =3.36, p=.047]\), but no main effect of age \([F(2,33) =2.05, p=.15]\).

Fig. 4.4. Production of transitive sentences (%): English 3yr, 5yr and adult
This showed that English 3yr- and 5yr-old children produced more other sentence constructions ($M=38.7, SD=21.2, p=.003; M=31.5\%, SD=22.7, p=.029$ respectively) than English adults ($M=9.3\%, SD=14.5$) with the intentional scenes. However, there was no age difference with the accidental scenes.

### 4.3.7. Comparison of producing the agent between English 3yr-, 5yr-olds and adults

We examined whether there might be age or event type differences in how often participants produced the agent in their responses. Figure 4.6 shows the mean percentage of producing the agent with accidental and intentional scenes. A two-way ANOVA was conducted with intentionality (accidental vs intentional scenes) as a within-subject factor, and age (age group: 3yr vs. 5yr vs. adults) as between-subject factors. It revealed a main effect of intentionality [$F(1,33) = 6.13, p=.000$] and age [$F(1,33) = 6.13, p=.019$], and an interaction between intentionality and age [$F(2,33) = 4.11, p=.026$].

Post hoc comparisons using T-tests with Bonferroni corrections indicated that for both accidental and intentional scenes respectively, 5yr-olds ($M=90.9\%, SD=16.3; M=91.8\%, SD=9.94$) and adults ($M=88\%, SD=10.5; M=99.0\%, SD=2.3$) mentioned the agent of the action more often than 3yr-olds ($M=64.3\%, SD=14.3; M=65.0\%, SD=10.5$). Post hoc comparisons using T-tests with Bonferroni corrections also showed that 3yr-and 5yr-olds did not show differences in the production of the agent between accidental and intentional scenes (3yr-old: $M=64.3\%$ vs. $M=65.0\%$; 5yr-old: $M=90.9\%$ vs $M=91.8\%$), but adults produced the agent more often with the intentional ($M=99\%$) than the accidental scenes ($M=88.1\%$).
In summary, by testing English monolingual and Japanese-English bilingual children and adults, we aimed to answer these two questions: (1) Do monolingual English and Japanese-English bilingual speakers prefer using transitive constructions to describe causative actions over intransitives or other constructions? (2) Is there any transfer effect of form-meaning mapping on Japanese-English bilinguals’ English descriptions?

The data showed that both English monolingual and Japanese-English bilingual speakers prefer using transitive constructions over intransitives at intentional scenes, while using other sentence constructions when describing accidental scenes. We found that there was no transfer effect on the relative use of transitive vs. intransitive sentence constructions on the Japanese-English bilinguals as compared to monolingual speakers, but there was a transfer effect on frequency of omission of the agent, in both accidental and intentional scenes. These results suggest that the knowledge of Japanese does not interfere with speakers’ use of English sentence constructions, but leads to avoidance of production of the agent (as occurs frequently in Japanese). Interestingly, Japanese-English bilingual children omitted subjects in (transitive) sentence constructions, whereas the adults avoided transitives and thus avoided mention of the agent altogether.

Next, we aimed to answer question (3): Do monolingual English speakers produce replicable results to those we obtained from our comprehension task (Okuno et al., in progress)? Our results in the production task agreed with the comprehension task results: English 3yr-olds showed lower transitive preference than the older groups. Whereas all three groups produced more transitive constructions with intentional scenes than with accidentals scenes, English 3yr- and 5yr-olds also used more other constructions with intentional scenes than did the English adults. In terms of mention of the agent, 3yr-olds had lower frequencies than the older groups. Only adults mentioned the agent more often with intentional scenes than accidental, although there was no scene difference in mentioning the agent for 3yr- and 5yr-olds.
4.4. Discussion

This study aimed to investigate how monolingual English and Japanese-English bilingual children encode elements (agent/patient) into sentence constructions to describe intentional/accidental causal situations. To examine it, we answered three questions: (1) Do monolingual English and Japanese-English bilingual speakers prefer using transitive constructions to describe causative actions over intransitives or other constructions? (2) Is there any transfer effect of form-meaning mapping on Japanese-English bilinguals' English descriptions? Does any such effect occur with respect to the choice of sentence structure or the extent to which the agent is mentioned? (3) Do monolingual English speakers produce replicable results to those of Okuno et al. (in progress) obtained from a comprehension task.

Before discussing our findings in detail, we must acknowledge that the standard deviations in the sentence production data are large, we believe because of differences in ease of interpretation of causality with some of the verbs. For example, interpreting some accidental scenes such as “melting ice-cream by hairdryer” produced a wider variety of descriptions than more everyday events such as “dropping the keys”. Nevertheless, the data showed interesting results.

Q1. Do monolingual English and Japanese-English bilingual speakers prefer using transitive constructions to describe causative actions over intransitives or other constructions?

Firstly, by using the production task, we were able to analyse what kind of sentence constructions English monolingual and Japanese-English bilingual speakers prefer when describing causal actions. Both the English monolinguals and Japanese-English bilinguals used fewer transitive constructions when describing the accidental causal scenes than intentional scenes. Instead of transitive constructions with accidental scenes, they produced more different types of constructions or non-causative alternation verbs. However, both English monolinguals’ and Japanese-English bilinguals’ transitive preference was stronger in the intentional scenes than accidental scenes.

From the perspective of language development, there was also no difference between children and adults in their use of transitive / intransitive constructions, which is broadly in line with the findings from Okuno et al.’s (in progress) comprehension study, which observed similar patterns of sentence choice between 5yr-old children and adults. Thus, our production and comprehension task suggest that around age 5, children start showing the adult pattern of producing sentence constructions depending on the context (accidental/intentional scenes).

The age structure of the Japanese-English bilingual children’s group did not permit a direct comparison between 3yr-old bilinguals and 3yr-old English monolinguals. The bilingual group was more similar to the 5yr-old monolinguals. However, as we have already shown there are differences in the preference for transitive constructions over intransitive sentences between 3yr- and 5yr-old English children (Okuno et al., in progress), so to elucidate this further would require comparison of homogeneous 3yr- and 5yr-old groups to examine their form-meaning mapping.
In terms of producing the agent, there was an age group difference between English monolingual and Japanese-English bilingual children and adults. In particular, with intentional scenes, adults more often mentioned the agent of the action. Moreover, only adults produced the agent more often with intentional scenes than accidental scenes. Both English monolingual and Japanese-English bilingual adults focus more on and describe the agent with intentional scenes than accidental scenes, while adults with accidental and children with both scenes showed a similar percentage of mentioning the agent. This suggests that adults may have some association between production of the agent and intentional scenes, and choose the agent as an important element describing the intentional scenes.

Q2. Is there any transfer effect of form-meaning mapping on Japanese-English bilinguals' English descriptions?

We examined whether there was any transfer effect on bilinguals and what kind of transfer was seen. If there is a transfer effect on production of sentence constructions and/or agent, we predicted that, for the accidental scenes, Japanese-English bilingual speakers might show more usage of intransitive sentence constructions in English than English monolingual speakers. Our second prediction was that Japanese-English bilinguals might avoid the mention of agents when they describe causal events (especially accidental events).

Our results showed that there was no transfer effect on the relative use of transitive vs. intransitive sentence constructions on the Japanese-English bilinguals as compared to monolingual speakers, but there was a transfer effect on frequency of omission of the agent, in both accidental and intentional scenes. When we looked at Japanese-English bilingual children’s and adults’ utterances, interestingly, the Japanese-English bilingual children omitted the agent (subject) in transitives or other sentences, while the Japanese-English bilingual adults produced different constructions which don’t include the agent especially with accidental scenes. This implies that there is a transfer effect of syntax (omission of subjects in Japanese) for the children, but that of form-meaning mapping in the adults. Some bilingual children tended to omit the agent (in the transitive constructions) as Japanese monolinguals frequently omit it in daily conversation. Thus, their habitual usage of omitting the agent in Japanese may affect how they speak English. This subject omission was also seen in other studies (e.g. around aged 3: American-Italian children, Serratrice, 2001; English-Italian children, Valian, 1991). However, interestingly, Japanese-English bilingual adults tended to focus on the events as a monolingual speaker of Japanese may have done, even when they needed to produce English. Thus the Japanese way of perceiving causal events or form-meaning mapping may interfere with the production of English sentences by the bilinguals.

Japanese form-meaning mapping also could affect Japanese-English bilingual adults’ use of adverbs. Japanese-English bilingual speakers, especially adults, still quite often used transitive sentences. However, importantly the bilinguals added adverbs such as “accidentally” to emphasise intentionality or the lack of it in transitive sentences. Although there was no difference in the use of sentence constructions, this may indicate a greater sensitivity to accidentality than the English-monolinguals. In Japanese culture, linguistic constructions correlate with ratings of the agent’s
responsibility for the event (Yoshinari, Pardeshi & Chung, 2010). Therefore, while the bilinguals produced transitive sentences similarly to the English monolinguals, the addition of adverbs emphasising “accident” could reduce implication of the agent’s responsibility.

Q3. Do monolingual English speakers produce replicable results to those of Okuno et al. (in progress) taken from the comprehension task?

In Okuno et al.’s study (in progress), the forced-choice transitive/intransitive description task (comprehension task) showed that transitive preference was stronger in intentional scenes than accidental scenes. However, it is uncertain whether 3yr- and 5yr-old children actually have the same patterns of transitive preference in production. By using the production task, we are able to examine more deeply whether each age group prefers to produce different constructions over transitives, and whether it is more important to investigate their production of the agent than sentence constructions. Firstly, we investigated whether, as in comprehension, the participants produced more transitive sentences in intentional scenes than in accidental scenes. When the participants were able to describe the events freely, the English monolinguals, especially adults, preferred using other constructions for accidental scenes, more than in intentional scenes. With the intentional scenes, in the monolingual group, 5yr-olds and adults showed stronger transitive preference than 3yr-olds in the study, a pattern of age difference which was the same as in Okuno et al.’s (in progress) comprehension task. These results suggest that generally the English speakers (5yr-olds and adults) described the agent in the intentional causal scenes, using transitives. On the other hand, with accidental scenes, they often avoided directly talking about the causal relationship and used conjunctions for describing each action (e.g. “He was reading the newspaper and it ripped”).

However, the production task in 3yr-olds showed a different result from their comprehension task. In the comprehension task (Okuno et al., in progress), English 3yr-olds showed transitive preference in both accidental and intentional scenes. However, in this production task, three-year old monolinguals produced more intransitive constructions than transitives. Since 3yr-old monolinguals produced more intransitive constructions than other age groups, this may account for their lower production of the agent, compared with children at 5yrs and adults. Corpus studies have also shown (Valian, 1991; Theakston, Lieven, Pine and Rowland, 2001) that younger children tended to produce more intransitives than the older children and adults. In the current study, this may be explained by 3yr-olds focusing on the final state of the patient rather than the initial cause. For example, in the scene “ringing a bell”, the agent stumbles against a wall, pushing a doorbell button. 3yr-olds tended to describe the end result (“it’s ringed”) rather than the start of the sequence. For this tendency, we could assume that 3yr-olds may perceive the final state of the patient as the most important element to describe the scenes, or it could be just working memory limitation that they cannot remember the causes of the actions.
4.5. Conclusion

By using the production task, we aimed to check what kind of linguistic structures were used in description of accidental and intentional causal scenes, and the extent to which a bilingual speaker’s L1 influences their sentence choice in their L2 as compared to monolingual speakers. We found that there was no transfer effect on the use of sentence constructions on the Japanese-English bilinguals, but effects were found on mentioning of the agent. There was a transfer effect on frequency of omission of the agent, in both accidental and intentional scenes. When we looked at Japanese-English bilingual children’s and adults’ utterances, interestingly, the Japanese-English bilingual children omitted the agent (subjects) in transitive or other sentences, while the Japanese-English bilingual adults produced different constructions which don’t include the agent especially with accidental scenes. This implies that there is a transfer effect of syntax (subjects are optional in Japanese) for the children, but that of form-meaning mapping in the adults. In addition, both groups of adults were more sensitive to intentionality so that they can construe an important element to describe each scene by selecting appropriate sentences and producing the agent. With a production task, our results also replicated our previous results in a comprehension task that English monolingual speakers tend to use transitive constructions with intentional scenes more than with accidental scenes, a tendency which is stronger with English monolingual adults.
Chapter 5. Overall Discussion

5.1. Key Findings

This thesis presents an attempt to investigate whether there is a difference between English and Japanese people in how they map form to meaning: how these form-meaning mappings are learned; and what is the relative influence of cognitive-general bias and language-specific input on children’s developing linguistic representation. The data were collected from a corpus study and three experimental investigations, focusing on causal alternation. Further, we analyse how English monolingual and Japanese-English bilingual children learn form-meaning mappings, and, by using a production task, investigate whether there is a transfer effect on the production of sentence constructions discernible in bilinguals.

5.1.1. Corpus Study

A corpus study (Chapter 2) was conducted to examine (1) the relative use of transitive/intransitive frames of causative alternation with causal verbs in child-directed speech in English and Japanese; (2) whether children show language-general/specific or adult usage patterns; (3) the relationship of animacy of agent and patient to the choice of construction; (4) the frequencies of transitive/intransitive usage of causative alternation verbs in English and Japanese corpora of child-directed speech at around age 3. The proportion of transitive usage (‘transitivity bias’) was calculated for each verb and 14 were selected to directly compare between Japanese and English.

Our results show:

(1) that Japanese adults and children tended to produce more intransitive constructions than English adults and children. We found that English speakers tend to use transitive constructions with causative verbs more frequently than Japanese speakers, and that Japanese speakers more often omit subject and object arguments;

(2) that children at around age 3 learned usage from their caregivers, and have already started showing language-specific patterns. Furthermore, at around 3 years of age Japanese and English children received different input of sentence constructions, and their sentence production was found to be similar to their input, a finding which supports the Usage-based theory;

(3) that animacy of patients seemed not to determine the use of constructions by Japanese and English caregivers. However, children’s usage was not analysed because of subject and object omission in Japanese and the resulting difficulty in identifying the dropped arguments from audio recording. Within transitive/intransitive frames, the animacy of the arguments was not different between English and Japanese children. However, in child-directed speech, it is difficult to conclude that animacy is not an important factor in the choice of sentence constructions, because the opportunity to talk about animate objects may be somewhat limited in the situation in which a single caregiver and a single child play together. Thus, the contexts in which the language was sampled may not be varied enough to determine whether animacy of the patient is an important factor in this choice of sentence constructions;
(4) that Individual verbs were found to have a wide range of transitivity bias both in Japanese and English. So we believe it crucial to use the same verbs when we compare the use of sentence constructions between different languages. In constructing an experimental study into usage of sentence constructions care must be taken to analyse selected closely-comparable verbs.

Accordingly, based on the findings of our corpus study, we selected 14 causative alternation verbs and used these to conduct three experimental studies.

5.1.2. Experimental Studies

**Comprehension**

A comprehension task was used in the first two studies (Chapter 3). We investigated the emergence of sentence preferences for describing causal events in English- and Japanese-speaking children (aged three and five years) and compared this to preferences displayed by adults.

We studied two factors suggested to influence the choice of transitive/intransitive frames for description of causal events: Animacy (Study 1) and Intentionality (Study 2). Participants watched animations (Study 1) or videos (Study 2) depicting familiar and novel causal actions, and made a best-match choice between a transitive and intransitive description.

We found no effect of patient animacy on sentence selection with familiar verbs at any age in either language. However, with novel verbs only the English and Japanese three-year-olds were influenced by patient animacy, but in contrasting ways which mirror aspects of their linguistic input.

With regard to intentionality, with familiar verbs both Japanese and English speakers selected fewer transitives for accidental than intentional scenes, but this pattern was more pronounced in Japanese speakers. However, with novel verbs, only adults showed this preference.

These data provide important new information to constrain theories about the process of learning to map event structure to language, and its interdependence with concepts of animacy, intentionality and the distributional properties of linguistic input to children.

**Production**

In a production study (Study 3, Chapter 4) we aimed to investigate how English-monolingual and Japanese-English bilingual children (aged five years) described accidental/intentional causal events in English, comparing them with English-monolingual and Japanese-English bilingual adults. The reason we tested bilingual speakers was to investigate further whether they show any transfer effects of form-meaning mapping. Additionally, we used the production task to check whether English-monolingual children (aged three and five years) and adults would reproduce the results of the comprehension task described in Chapter 3. No transfer effect on the choice of sentence constructions was shown in the Japanese-English bilinguals. However, effects were found on the
frequency of production of the agent. In accidental and intentional scenes combined, all English monolingual speakers produced the agent in 92% of instances compared with 85% for the Japanese-English bilinguals. Interestingly, the bilingual children and adults chose to omit the agent in different ways. The Japanese-English bilingual children omitted the agent (subject) in transitive or other sentences, while the Japanese-English bilingual adults chose alternative constructions which do not include the agent, especially with accidental scenes. This implies that there is a transfer effect of syntax (optional subjects in Japanese) apparent in the children, but an effect on form-meaning mapping in the adults. In addition, both groups of adults were more sensitive to intentionality than children so that they can include this as an important element in describing each scene by selecting appropriate sentences and producing the agent.

When given freedom to choose any construction to describe our test causal scenes in the production task, where transitive / intransitive frames were used (see Chapter 4), participants replicated the transitive preference results of our comprehension experiments. English speakers’ transitive preference with intentional scenes was 83% vs. 63% for accidental scenes (in the production task 77% and 51% respectively). This tendency of transitive preference with intentional scenes was stronger with English monolingual adults than English monolingual children. Moreover, the English monolinguals’ data showed that 3yr-old children tended to produce fewer transitive constructions and less often mentioned the agent than 5yr-olds and adults. The two child groups did not change the frequencies of production of the agent between intentional and accidental scenes, while only adults more often produced the agent with intentional scenes than with accidental scenes.

5.2. Form-meaning mapping in English monolingual, Japanese monolingual, and Japanese-English bilingual adults

We have studied three groups of adults: English monolingual, Japanese monolingual, and Japanese-English bilinguals. We have found that animacy does not affect the choice between transitive/intransitive constructions to describe causal scenes in these groups when using familiar verbs, and in the case of novel verbs only in the three-year-old children. However, intentionality is a significant factor revealing language-specific differences.

Our studies show that, with accidental causal scenes, usage of transitive constructions was highest in English-monolinguals and Japanese-English bilinguals and lowest in Japanese-monolinguals. Importantly, English monolinguals included the agent information with other sentence constructions, but the Japanese-English bilingual adults avoided producing it. We believe this is compatible with a form-meaning mapping transfer from Japanese to English in the Japanese-English bilingual adults.

While this difference could simply be a function of the language currently being spoken (or other languages they might know), there is evidence that mapping of intentionality/responsibility to transitive constructions varies significantly across language groups. Yoshinari, Paradeshi, and Chung (2010) asked Japanese, Korean, and Marathi native speakers to imagine some events (e.g. at a party, a dish was broken under different situations: the agent was drunk, careless, or dizzy or there was an earthquake). Then the participants were asked to rate how responsible the agent was,
and how capable the agent was of avoiding causing the event. Their study showed that all three
groups allocated similar levels of responsibility to the agent for the intentional scenes, but mapped
this meaning to constructions differently. The Japanese speakers produced the most transitive
verbs, indicating a stronger mapping of intention/responsibility to this construction. Our study
demonstrates, with accidental scenes, Japanese-monolingual speakers’ reluctance to encode the
agent into sentence constructions (because in Japanese producing the agent highlights the agent’s
responsibility), compared to English.

Interestingly this Japanese mapping between the agent and the responsibility appears to influence
the English encoding by the Japanese-English bilingual adults. In our Study 3 (Chapter 4) we
showed a form-meaning mapping transfer effect, that is, that the Japanese-bilingual adults avoided
producing the agent with accidental scenes in English, when compared with the English-
monolingual adults. This result suggests that Japanese-English bilingual adults extended their
knowledge of Japanese form-meaning mapping (the association between transitive constructions
and intentionality) to their English form-meaning mappings. According to other studies (Ellis &
Beaton, 1993; Kroll & Tokowicz, 2001; Jiang, 2002), when people learn words in a second
language, they initially map the second language words into the first language concept, and then
they are likely to share the conceptual features from the first language with the second language.
Therefore, in our study, Japanese-English bilingual adults may map English/Japanese transitive
constructions into the other language’s form-meaning mappings, with the result that they may
share both the English and Japanese conceptual features.

5.3. Developmental differences in the role of animacy and intentionality for
encoding the agent/patient

Across languages, animacy and intentionality influence children’s and adult’s sentence preference
differently. Our studies showed, in general, both Japanese and English 3yr-old children tend to
have less of a transitive/intransitive preference than have 5yr-olds and adults. However, 3-yr old
children did show a preference when they were introduced to novel verbs in the transitive and
intransitive constructions. While they are learning to use new words, both English and Japanese
3yr-old children seem to rely on animacy to choose a construction. Japanese 3yr-olds showed a
stronger transitive preference with animate than inanimate patients, and English 3yr-olds showed a
stronger transitive preference with inanimate patients. From 5yrs of age, children and adults tended
to rely more on intentionality for construction selection. These results suggest that from age three
to five, children start learning form-meaning mappings showing language-specific usage, and
during development change their preferred cue of animacy to intentionality to choose an
appropriate construction when describing causal events.

Animacy may be important early on in development because it can be more easily detectable than
intentionality. Many pioneering studies (Keil, 1979; Gelman, Spelke, & Meek, 1983; Dolgin &
Behrend, 1984) revealed that preschool children can distinguish between animate and inanimate
objects although their ability is not fully developed, and until 5-years, young children are more
influenced by movement and appearance in associating entities with animate objects. Thus, when
children encounter a novel word and are unsure about sentence constructions
(transitives/intransitives), they may choose between transitive and intransitive constructions by weighing up animacy. However, animacy cues are less dependent on the familiarity of a particular event structure for their interpretation. Although children are sensitive to the intentionality of actions from at least 12 months of age (Carpenter, Call & Tomasello, 2005), interpreting intentionality in terms of its relation to perspective taking and choice of sentence structure is more complex. Unfamiliar verbs, in the context of this study, were designed to denote actions unfamiliar to children, and therefore it may be more difficult for them to identify intended vs. accidental outcomes and/or map this difference onto language using unfamiliar verb forms. Thus, one possible reason why our three-year-olds showed an animacy effect with novel verbs is that in the absence of prior experience with the verbs in question, they fell back on prototypical sentence structures, with English children favouring transitives with an animate agent and inanimate patient (Cameron-Faulkner et al., 2003; Theakston et al, 2012; Noble, Iqbal, Lieven, & Theakston, 2016), while Japanese children favoured transitives with both an animate agent and patient.

5.4. How do children learn form-meaning mappings?

Clark (2004) argued that at the pre-linguistic stage all infants have general cognitive skills (e.g. discriminating spatial relations), whereas individual languages differ in their encoding. Infants learn the constructions in their own languages from the input they hear in child-directed speech (see more detail in Chapter 2). As we discussed (see more detail in Chapter 1), at the pre-linguistic stage, infants can detect causal events, and distinguish animacy and intentionality (causality: e.g. Oakes, & Cohen, 1990; animacy: e.g. Poulin-Dubois & Heroux, 1994; intentionality: e.g. Shultz, Wells, & Sarda, 1980). However, our experimental results showed that, at the linguistic stage, Japanese speakers more strongly preferred intransitive constructions with accidental scenes, and avoided production of the agent more than the English. These language-specific mappings would be learned through the input children received from their caregivers, as Clark (2004) and Goldberg (2003) argued. Our corpus studies support their opinions because both English and Japanese children’s use of transitive/intransitive constructions with causative alternation verbs were correlated with that of their caregivers. Therefore, we can assume that children learn not just words, but also how these verbs are used and in which context it is appropriate to use which sentence construction.

Importantly, although it seems reasonably easy for children to learn the basics of syntactic structures, it seems to take longer (more than 5 years) for children to fine-tune the precise form-meaning mappings. Our studies showed that, in particular when describing intentional/accidental scenes, both Japanese monolingual and English monolingual 5yr-old groups had similar preferences for sentence patterns to their adults. However, 5yr-old children’s preference for transitive constructions was still stronger than the adults' with accidental scenes, although both English and Japanese adults (in particular) more clearly showed that transitive sentences were more preferred with intentional scenes, and intransitives with accidental scenes. Moreover, our results from the production task also suggest that Japanese-English bilingual children showed syntactic transfer effects, although the bilingual adults showed transfer effects for form-meaning mappings. Thus, these three experiments suggest that 5yr-olds know the basics of syntactic
structures, but they have not yet fully understood pragmatic usage of sentence constructions or completely built the form-meaning mappings.

The idea that 5yr-old children have not fully developed form-meaning mappings is supported by the study of Theakston, Maslen, Lieven, & Tomasello (2012). The first experimenter (E1) named a specific character before E1 introduced four video clips. The second experimenter (E2) then picked the relevant puppets and explained which character would be in the video clips (e.g. “All these videos are about this cat”). Next, with a still shot of the action on screen, E1 told the child, e.g. “I think this video is about dancing”. After the video clips, the child was asked by E1 to tell what (s)he saw to E2 who was going to act out with the puppets. The children’s responses (what type of expressions they used to refer to the puppet) were analysed. Her results showed that English 5yr-old children did not appropriately use pronouns in transitive sentences, although usually adults can do it. (Pronouns should be used to refer to given information). The children have not separated cues of pronouns as subjects and pronouns only for given information. Probably, the children followed their input (their adult usage) to use the pronoun as the subject without being sensitive to pronouns referring to given information, because pronoun subjects and lexical noun objects are common patterns (Cameron-Faulkner et al., 2003).

5.5. Comprehension and Production task

Though our comprehension and production task showed consistent results in that, with intentional scenes, all three groups (monolingual-Japanese and –English, and bilingual Japanese-English speakers) more strongly preferred transitive sentences, and more frequently produced the agent than with accidental scenes, these results strongly suggest that different language speakers have different form-meaning mappings. This suggestion is supported by other studies. Yoshinari, Pardeshi, and Chung (2010) asked Japanese, Korean, and Marathi monolingual speakers to describe events, and found that all three groups used more transitives with intentional scenes. However, with accidental scenes, Japanese and Marathi speakers preferred intransitives, the preference stronger with the Marathi than the Japanese. Fausey, Long, Inamori, and Boroditsky (2010) tested Japanese and English monolingual speakers. They asked the participants to watch 16 videos of accidental/intentional causal events and to describe the scenes in their native languages. They found that both adult groups produced transitive constructions with intentional scenes. However, with accidental scenes, English monolingual speakers more frequently produced transitives than the Japanese.

Our comprehension and production data suggest the possibility of ‘intention-to-CAUSE bias’. According to Muentener and Lakusta (2011), children may have a universal ‘intention-to-CAUSE’ bias leading them to map causal language onto intentional causal events rather than onto unintentional or object-caused events. English 3;5 and 4yr-olds were asked to watch short videos of intended, unintended and object-caused events, and to describe the scenes. What types of verbs they used [causal (alternation) verbs, e.g. break; non-causal effect verbs, e.g. fall; non-causal other verbs, e.g. hit] was analysed. When causative alternation verbs were used intransitively, they were coded as ‘non-causal effect verb’. They showed that English children preferred causal verbs in both their production and judgments of descriptions of the intentional
events. Our comprehension task also showed English and Japanese 3yr- to 5yr-old children (in particular the older groups) showed a preference for transitive constructions over intransitives, suggesting that children may have a bias toward mapping causative meaning into causative transitive sentences. In the production task, both English-monolingual and Japanese-English bilingual children more frequently produced transitive sentences over intransitive sentences. Therefore, children could retain the intention-to-CAUSE bias while they are still fine-tuning form-meaning mappings.

Muentener and Lakusta (2011) argued that early (pre-linguistic) infants associate human hands, and self-moving entities with eyes, with causal events, rather than inert objects and suggest this conceptual bias influences their causal language later (see more explanation in Chapter 1). However, our study showed that the transitive preference was stronger in older children, so, this bias may come from children’s learning over development. In the comprehension task, 3yr-old English monolingual children preferred transitives and their preference was not markedly different between accidental and intentional scenes. On the other hand, in the production task they produced transitives in only about 30% of accidental and about 50% of intentional scenes, compared to the production of intransitives. To describe the intentional scenes, their preference for transitives was stronger than when describing accidental scenes. However, their use of intransitives was more frequent than that of transitives at age three. There are two possible reasons to explain this difference between the comprehension and production tasks.

Firstly, the comprehension task could be difficult for children because they need both to understand what the sentences mean and what the differences are between intransitive and transitive, which requires metalinguistic skills. For some of the 3yr-old children in the comprehension task, it may have been too demanding to distinguish between the intentional and accidental scenes, so they did not show a difference according to intentionality and followed the universal ‘intention-to-CAUSE bias’.

Secondly our video clips may not have been clear enough to show the difference between accidental and intentional scenes for 3yr-old children, although they heard a sound effect with the action to draw their attention to the causal event. In reality, when accidental scenes happen, people often naturally use some verbal expressions such as “whoops”, but these interjections were not included in the clips. Carpenter, Akhtar, & Tomasello (1998) studying 18-month infants, added “whoops” for accidental scenes and “there” for intentional scenes. It may prove more effective to use such interjects rather than sound effects if young children rely on more overt verbal cues.

5.6. The implications of this research

These studies suggest that context such as animacy and intentionality are important in the choice of sentence structure, and that different age groups and (typologically) different language speakers differently weigh those factors for determining constructions. Hopper and Thompson (1980) proposed the 10 properties of transitivty (see Chapter 1, Table 1.1) based on English or Indo-
European languages. It is argued widely that high values for those properties are associated with transitive usage. As our results indicate, when the objects (patients) were animate, (according to Hopper & Thompson, that is high transitivity), Japanese 3yr-olds preferred transitives with novel verbs. However, when the patients were inanimate (low transitivity), the English 3yr-olds preferred transitives. Moreover, both Japanese and English children used the animacy of the patient to determine their choice more than did the adults, and Japanese adults were more sensitive to intentionality for sentence constructions than English adults.

Our study also shows that there were significant covariate effects of transitivity bias in the comprehension tasks. There was a different general pattern of sentence constructions between languages. It would be important to consider how verb bias can influence participants’ responses, and to take account of the precise distributional characteristics of verb use, when cross-linguistic studies are conducted.

There are many studies, at the pre-linguistic stage, indicating that young children have the cognitive skills of distinguishing causality, animacy and intentionality, and knowledge and understanding of syntactic structures (causality: e.g. Oakes, & Cohen, 1990; animacy: e.g. Poulin-Dubois & Heroux, 1994; intentionality: e.g. Shultz, Wells, & Sarda; 1980). Also, there is considerable evidence that young children are fairly sensitive to syntactic structure (in English: Gertner, Fisher, & Eisengart, 2006; in Cantonese: Chan, Lieven, & Tomasello, 2009; in German: Dittmar, Abbot-Smith, Lieven, & Tomasello, 2014). However, there has been little research of how children link cognitive information to the syntactic structures. These studies connected the two areas and showed how children learn to use sentence constructions in their language-specific ways.

While our study revealed cross-linguistic and developmental differences in transitive preference between English and Japanese, we do not have sufficient data to use this in support of the theory of linguistic relativity. While our results may imply that there are different mental representations in the two different languages, further study of bilinguals would be useful in investigating whether they change sentence construction according to which language they are using to describe events.

5.7. Further study

In any future similar experimental investigation, it would be desirable to control the outcome of the causal events. Some studies revealed that children judge whether the causal situation is intentional or unintentional depending on whether the outcome is negative (e.g. breaking a flowerpot by accident) rather than positive (e.g. pouring water into a flowerpot by accident) (6-year olds: Bian, Wang, & Zhong, 2017; 4yr- to 5yr-olds: Killen & Smetana, 2015). During our experiments for example, some children commented on the video clip “He is naughty! He is melting the snowman!”. So the outcome of the events may have affected the children’s sentence preference or production.
Secondly, in the production task we could test Japanese-monolingual children to investigate whether we can replicate the result of the comprehension task in that group. Moreover, we could test bilingual participants both in English and Japanese to see whether the transfer effects implicate differences of perception or language use.

Further, it would be beneficial to obtain more detailed information on how much bilingual speakers have received input of Japanese and English languages, so we can use this information as a covariate. Thus, the combination of data on Japanese speakers’ preferences in the comprehension task and on the degree of language exposure may provide a more in-depth analysis of how input affects the degree of transfer effect.

Some studies argue that East-Asian and European-American people show cultural differences in perception (Chua, Boland, & Nisbett, 2005; Goto, Ando, Huang, Yee, & Lewis, 2009). Chua et al. (2005) with eye-tracking and Goto et al., (2009) using N400 Event Related Potential (ERP) concluded that East Asian people focus on the context (background) while European-American people focus on the objects ('figures'). We cannot easily differentiate between effects of culture and language, however by using techniques such as ERP and eye-tracking, we could consider whether different language speakers simply have different form-meaning mappings although their perception is the same, or whether their perception changes during development as they learn language-specific encoding.

In summary, the current thesis has demonstrated that English and Japanese speakers take a different perspective when encoding causal events, placing greater or lesser emphasis on the agent or patient of an action. When 3yr-old children encode using novel verbs, Japanese children preferred transitive sentences with animate patients while the English preferred transitives with inanimate patient. However, after 5 years of age, both Japanese and English speakers relied more on intentionality for encoding. In particular, Japanese adults preferred more intransitives to transitives with accidental scenes. Our results suggest that during development children use different cues for encoding, and at age 5, both Japanese and English children are learning form-meaning mappings from their input. At age 5, the children still require fine-tuning for form-meaning mapping. In further work, it would be interesting to conduct non-linguistic studies such as eye-tracking to investigate whether different language speakers have different perception, cognitive processes or only different language usage.
References


## Appendices

Appendix 1: Table A.1.

Japanese Verbs on Miipro Corpora: The Frequencies and English Translation

<table>
<thead>
<tr>
<th>INTRANSITIVE</th>
<th>TRANSLITIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>Japanese</td>
</tr>
<tr>
<td>adhere to</td>
<td>tsuku</td>
</tr>
<tr>
<td>advance</td>
<td>susumaru</td>
</tr>
<tr>
<td>appear, become reflected</td>
<td>utsuru</td>
</tr>
<tr>
<td>be buried</td>
<td>umaru</td>
</tr>
<tr>
<td>be caught</td>
<td>tsukamaru</td>
</tr>
<tr>
<td>be caught of fish</td>
<td>tsuru</td>
</tr>
<tr>
<td>be delivered</td>
<td>todoku</td>
</tr>
<tr>
<td>be dyed</td>
<td>somaru</td>
</tr>
<tr>
<td>be found</td>
<td>mitsukaru</td>
</tr>
<tr>
<td>be helped</td>
<td>tasukaru</td>
</tr>
<tr>
<td>be in balance</td>
<td>tsuraiu</td>
</tr>
<tr>
<td>be late for</td>
<td>okuren</td>
</tr>
<tr>
<td>beat</td>
<td>buttobu</td>
</tr>
<tr>
<td>become</td>
<td>naru</td>
</tr>
<tr>
<td>become audible</td>
<td>kokoeru</td>
</tr>
<tr>
<td>become better</td>
<td>naonu</td>
</tr>
<tr>
<td>become caught between</td>
<td>hasamanu</td>
</tr>
<tr>
<td>become complete</td>
<td>sorou</td>
</tr>
<tr>
<td>become connected</td>
<td>tsunagaru</td>
</tr>
<tr>
<td>become cool</td>
<td>sameru</td>
</tr>
<tr>
<td>become covered (with), put on (one's own) head</td>
<td>kaburu</td>
</tr>
<tr>
<td>become crushed</td>
<td>tsubureru</td>
</tr>
<tr>
<td>become decided</td>
<td>himaru</td>
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<tr>
<td>become dirty</td>
<td>yogoren</td>
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<tr>
<td>become extended</td>
<td>nobiru</td>
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<tr>
<td>become lost</td>
<td>nakunaru</td>
</tr>
<tr>
<td>become lower</td>
<td>sagaru</td>
</tr>
<tr>
<td>become mixed with</td>
<td>mazaru?</td>
</tr>
<tr>
<td>become obstructed</td>
<td>fusagaru</td>
</tr>
<tr>
<td>become out of line</td>
<td>zureru</td>
</tr>
<tr>
<td>become round</td>
<td>marumaru</td>
</tr>
<tr>
<td>become scattered</td>
<td>tirakaru</td>
</tr>
<tr>
<td>become visible</td>
<td>mieru</td>
</tr>
<tr>
<td>become warm</td>
<td>atatamaru</td>
</tr>
<tr>
<td>become wet</td>
<td>nureru</td>
</tr>
<tr>
<td>begin</td>
<td>hajimaru</td>
</tr>
<tr>
<td>bend</td>
<td>magaru</td>
</tr>
<tr>
<td>borrow</td>
<td>karinu</td>
</tr>
<tr>
<td>break</td>
<td>kowareru</td>
</tr>
<tr>
<td>break</td>
<td>oreru</td>
</tr>
<tr>
<td>break</td>
<td>wareru</td>
</tr>
<tr>
<td>Verb</td>
<td>Present Form</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>break</td>
<td>bukkowareru</td>
</tr>
<tr>
<td>burn</td>
<td>moeru</td>
</tr>
<tr>
<td>bump into</td>
<td>butsukaru</td>
</tr>
<tr>
<td>change</td>
<td>kawaru</td>
</tr>
<tr>
<td>close</td>
<td>shimeru</td>
</tr>
<tr>
<td>collapse</td>
<td>kuzureru</td>
</tr>
<tr>
<td>come off</td>
<td>hazureru</td>
</tr>
<tr>
<td>come off</td>
<td>nugeru</td>
</tr>
<tr>
<td>come out</td>
<td>deru</td>
</tr>
<tr>
<td>come out</td>
<td>nukeru</td>
</tr>
<tr>
<td>continue</td>
<td>tsuzuku</td>
</tr>
<tr>
<td>cook</td>
<td>niru</td>
</tr>
<tr>
<td>cry</td>
<td>naku</td>
</tr>
<tr>
<td>decrease</td>
<td>heru</td>
</tr>
<tr>
<td>differ</td>
<td>chigau</td>
</tr>
<tr>
<td>draw back</td>
<td>hikkomu</td>
</tr>
<tr>
<td>drop</td>
<td>okkochiru</td>
</tr>
<tr>
<td>drop</td>
<td>tareru</td>
</tr>
<tr>
<td>dry</td>
<td>kawaku</td>
</tr>
<tr>
<td>end</td>
<td>owaru</td>
</tr>
<tr>
<td>enter</td>
<td>hairu</td>
</tr>
<tr>
<td>escape</td>
<td>nigeru</td>
</tr>
<tr>
<td>fall</td>
<td>taorenru</td>
</tr>
<tr>
<td>fall</td>
<td>ochiru</td>
</tr>
<tr>
<td>fit into</td>
<td>hamaru</td>
</tr>
<tr>
<td>fit?</td>
<td>au</td>
</tr>
<tr>
<td>float</td>
<td>ukabu</td>
</tr>
<tr>
<td>flow</td>
<td>nagareru</td>
</tr>
<tr>
<td>fly</td>
<td>tobu</td>
</tr>
<tr>
<td>fold</td>
<td>oreru</td>
</tr>
<tr>
<td>gather</td>
<td>atsumaru</td>
</tr>
<tr>
<td>get</td>
<td>toreru</td>
</tr>
<tr>
<td>get off</td>
<td>oriru</td>
</tr>
<tr>
<td>get on</td>
<td>noru</td>
</tr>
<tr>
<td>get on?</td>
<td>nokkaru</td>
</tr>
<tr>
<td>get out of the way</td>
<td>doku</td>
</tr>
<tr>
<td>get up</td>
<td>okiru</td>
</tr>
<tr>
<td>go out</td>
<td>kieru</td>
</tr>
<tr>
<td>grow</td>
<td>hauen</td>
</tr>
<tr>
<td>hang</td>
<td>kakaru</td>
</tr>
<tr>
<td>hang down</td>
<td>burasagaru</td>
</tr>
<tr>
<td>hang?</td>
<td>hikkakaru</td>
</tr>
<tr>
<td>harden</td>
<td>katamaru</td>
</tr>
<tr>
<td>hide</td>
<td>kakureru</td>
</tr>
<tr>
<td>incline</td>
<td>katamuku</td>
</tr>
<tr>
<td>increase</td>
<td>fueru</td>
</tr>
<tr>
<td>keep</td>
<td>azukaru</td>
</tr>
<tr>
<td>learn</td>
<td>osowaru</td>
</tr>
<tr>
<td>------</td>
<td>---------</td>
</tr>
<tr>
<td>lift?</td>
<td>agaru</td>
</tr>
<tr>
<td>line up</td>
<td>narabu</td>
</tr>
<tr>
<td>make a mistake</td>
<td>machigau</td>
</tr>
<tr>
<td>melt</td>
<td>toku</td>
</tr>
<tr>
<td>move</td>
<td>usuru</td>
</tr>
<tr>
<td>move</td>
<td>ugoru</td>
</tr>
<tr>
<td>move away from</td>
<td>hanaeru</td>
</tr>
<tr>
<td>open</td>
<td>ake</td>
</tr>
<tr>
<td>pass</td>
<td>tooru</td>
</tr>
<tr>
<td>peel off</td>
<td>hageru</td>
</tr>
<tr>
<td>pile up</td>
<td>kasanaru</td>
</tr>
<tr>
<td>protrude</td>
<td>hamideru</td>
</tr>
<tr>
<td>remain</td>
<td>nokoru</td>
</tr>
<tr>
<td>remain</td>
<td>amaru</td>
</tr>
<tr>
<td>return</td>
<td>modor</td>
</tr>
<tr>
<td>return</td>
<td>koeru</td>
</tr>
<tr>
<td>ring</td>
<td>nar</td>
</tr>
<tr>
<td>rise</td>
<td>agaru</td>
</tr>
<tr>
<td>roll</td>
<td>korogaru</td>
</tr>
<tr>
<td>save, collect</td>
<td>tamaru</td>
</tr>
<tr>
<td>shake</td>
<td>fururu</td>
</tr>
<tr>
<td>shake</td>
<td>fureru</td>
</tr>
<tr>
<td>shave?</td>
<td>kezureru</td>
</tr>
<tr>
<td>shine</td>
<td>hikaru</td>
</tr>
<tr>
<td>sleep</td>
<td>neru</td>
</tr>
<tr>
<td>spill</td>
<td>koboreru</td>
</tr>
<tr>
<td>spread out</td>
<td>hiogaru</td>
</tr>
<tr>
<td>stand</td>
<td>tasu</td>
</tr>
<tr>
<td>stick</td>
<td>hittuku</td>
</tr>
<tr>
<td>stick</td>
<td>haritsuku</td>
</tr>
<tr>
<td>stick?</td>
<td>kuttuku</td>
</tr>
<tr>
<td>stop</td>
<td>tomaru</td>
</tr>
<tr>
<td>subside</td>
<td>osamaru</td>
</tr>
<tr>
<td>swell</td>
<td>fukuramu</td>
</tr>
<tr>
<td>swim</td>
<td>oyoga</td>
</tr>
<tr>
<td>switch</td>
<td>kirkawa</td>
</tr>
<tr>
<td>switch on?</td>
<td>tsuku</td>
</tr>
<tr>
<td>take shape</td>
<td>matomanu</td>
</tr>
<tr>
<td>tear</td>
<td>kaburewa,yabukaru?</td>
</tr>
<tr>
<td>tidy up</td>
<td>kaitazuku</td>
</tr>
<tr>
<td>touch</td>
<td>ataru</td>
</tr>
<tr>
<td>turn</td>
<td>mekuraru</td>
</tr>
<tr>
<td>turn</td>
<td>mawaru</td>
</tr>
<tr>
<td>turn</td>
<td>hikkurikaeru</td>
</tr>
<tr>
<td>wear</td>
<td>kiru</td>
</tr>
</tbody>
</table>

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### Appendix 2: Table A.2. Transitive and Intransitive Sentences in Study 1 (Familiar verbs)

<table>
<thead>
<tr>
<th>Verb: English (Japanese)</th>
<th>Animate/Inanimate patient</th>
<th>Intransitive sentences</th>
<th>Transitive sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drop (Ochiru/Otosu)</td>
<td>Cat/Rock</td>
<td>The cat/the rock dropped.</td>
<td>She dropped the cat/the rock.</td>
</tr>
<tr>
<td></td>
<td>Neko/Iwa</td>
<td>Neko-wa/Iwa-wa ochita</td>
<td>Kanojyo-wa iwa-wo otoshita.</td>
</tr>
<tr>
<td>Melt (Tokeru/Tokasu)</td>
<td>Snowman/Ice</td>
<td>The snowman/the ice melted.</td>
<td>He melted the snowman/the ice.</td>
</tr>
<tr>
<td></td>
<td>Snowman/Koori</td>
<td>Sunoman-wa/Koori-wa toketa</td>
<td>Kare-wa sunoman-o/koori-o tokashita.</td>
</tr>
<tr>
<td>Stop (Tommaru/Tomatta)</td>
<td>Man/Car</td>
<td>The man/the car stopped.</td>
<td>She stopped the man/the car.</td>
</tr>
<tr>
<td></td>
<td>Otoko/Kuruma</td>
<td>Otoko-wa/Kuruma-wa tomatta</td>
<td>Kanojyo-wa otoko-o/kuruma-o tometta.</td>
</tr>
<tr>
<td>Close (Shimaru/Shimeru)</td>
<td>Mr.Box/Box</td>
<td>Mr.Box/The box closed.</td>
<td>He closed Mr.Box/the box.</td>
</tr>
<tr>
<td></td>
<td>Mr.Box/Hako</td>
<td>Mr.Box-wa/Hakowa-shimatta.</td>
<td>Kare-wa Mr.Box-o/hoko-o shimeta.</td>
</tr>
<tr>
<td>Roll (Korogaru/Korogasu)</td>
<td>Hedgehog/Ball</td>
<td>The hedgehog/The ball rolled.</td>
<td>She rolled the hedgehog/the ball.</td>
</tr>
<tr>
<td></td>
<td>Harinezumi/Boru</td>
<td>Harinezumi-wa/Boru-wa korogatta.</td>
<td>Kanojyo-wa harinezumi-o/boru-o korogashita.</td>
</tr>
<tr>
<td>Float (Uku/Ukaberu)</td>
<td>Baby/Boat</td>
<td>The baby/the boat floated.</td>
<td>He floated the baby/the boat.</td>
</tr>
<tr>
<td></td>
<td>Akachan/Boto</td>
<td>Akachan-wa/Boto-wa uita.</td>
<td>Kare-wa akachan-o/boto-o ukabeta.</td>
</tr>
<tr>
<td>Ring (Naru/Narasu)</td>
<td>Mrs.Bell/Bell</td>
<td>Mrs.Bell/The bell rang.</td>
<td>She rang Mrs.Bell/the bell.</td>
</tr>
<tr>
<td>Freeze (Katamaru/Katameru)</td>
<td>Snowman/Water</td>
<td>The snowman/the water froze.</td>
<td>He froze the snowman/the water.</td>
</tr>
<tr>
<td></td>
<td>Sunoman/koori</td>
<td>Sunoman-wa/Koori-wa katamatta.</td>
<td>Kare-wa sunoman-o/koori-o katameta.</td>
</tr>
<tr>
<td>Spin (Mawaru/Mawasu)</td>
<td>Girl/Top</td>
<td>The girl/the top spun.</td>
<td>He spun the girl/the top.</td>
</tr>
<tr>
<td></td>
<td>Onnanoko/Koma</td>
<td>Onnanoko-wa/Koma-wa mawatta.</td>
<td>Kare-wa onnanoko-o/koma-o mawashita.</td>
</tr>
<tr>
<td>Bend (Magaru/Mageru)</td>
<td>Girl/Tree</td>
<td>The girl/the tree bent.</td>
<td>He bent the girl/the tree.</td>
</tr>
<tr>
<td></td>
<td>Onnanokonokoshi/Ki</td>
<td>Onnanokonokoshi-wa/Ki-wa magatta.</td>
<td>Kare-wa onnanokonokoshi-o/ki-o mageta.</td>
</tr>
<tr>
<td>Break (Kowareru/Kowasu)</td>
<td>Mrs.Bell/Camera</td>
<td>Mrs.Bell/the camera broke.</td>
<td>He broke Mrs.Bell/the camera.</td>
</tr>
<tr>
<td></td>
<td>Beruchan/Kamera</td>
<td>Beru-chan-wa/Kamera-wa kowareta.</td>
<td>Kare-wa Beruchan-o/kamera-o kowashita.</td>
</tr>
<tr>
<td>Open (Aku/Akeru)</td>
<td>Mr.Box/Box</td>
<td>Mr.Box/the box opened.</td>
<td>She opened Mr.Box/the box.</td>
</tr>
<tr>
<td></td>
<td>Mr.Box/Hako</td>
<td>Mr.Box-wa/Hako-wa aita.</td>
<td>Kanojyo-wa Mr.Box-o/hako-o aketa.</td>
</tr>
</tbody>
</table>
Appendix 3: Table A.3. *Novel Actions for Novel Verbs in Studies 1 & 2*

<table>
<thead>
<tr>
<th>Study 1</th>
<th>Meeking</th>
<th>The Agent stands with a foot on one end of a see-saw. As the Agent pushes this end to the ground, the Patient/Object, sitting at the other end, is catapulted off.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blicking</td>
<td>The Object (a guitar) is lying inside the bottom of a large parabolic object which rests with its vertex on the ground. When the Agent rocks it by hand, the Object is displaced upwards along the curve from its resting position before falling back.</td>
<td></td>
</tr>
<tr>
<td>Lorping</td>
<td>The Agent jumps up to catch the end of a rope suspended out of reach above him. The rope runs over a pulley above, attached to a sack which is pulled up off the ground as the Agent lands holding the rope.</td>
<td></td>
</tr>
<tr>
<td>Daxing</td>
<td>The Patient/Object sits on a circular platform mounted in the end of a vertical coiled spring. When the Agent presses down on the platform it recoils, momentarily throwing the Patient/Object into the air.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study 2*</th>
<th>Meeking</th>
<th>Setting in motion (rocking or spinning) a self-righting ('roly-poly') toy.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blicking</td>
<td>An Object suspended over the lower end of a seesaw is displaced vertically when the other end of the seesaw is pushed down.</td>
<td></td>
</tr>
<tr>
<td>Lorping</td>
<td>Displacing upwards one end of a seesaw causes the other end to move downward hitting the Object.</td>
<td></td>
</tr>
<tr>
<td>Daxing</td>
<td>Shallow dish connected to a solid base below by means of a very springy stem wobbles considerably when it is touched/moved, such that an Object contained in it is ejected.</td>
<td></td>
</tr>
</tbody>
</table>

*For the accidental scenes, a performer was engaged in an action (e.g. drinking coffee, walking) and then accidentally touched the object to cause the event to take place. For the intentional scenes, a performer touched the object directly to cause the event without being engaged in other actions.*
### Table A.4. Transitive and Intransitive Sentences in Study 1 (Novel Verbs)

<table>
<thead>
<tr>
<th>Verb</th>
<th>Sentence type</th>
<th>Intransitive sentences</th>
<th>Transitive sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meek (Neku/Nekeru)</td>
<td>Training (Continuous tense)</td>
<td>The chicken/the rock is meeking</td>
<td>She is meeking the chicken/the rock.</td>
</tr>
<tr>
<td></td>
<td>Training (Past tense)</td>
<td>The chicken/the rock meeked.</td>
<td>She meeked the chicken/the rock.</td>
</tr>
<tr>
<td></td>
<td>Test sentence</td>
<td>The frog/the book meeked.</td>
<td>She meeked the frog/book.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kae-ru-wa/hon-wa nekitta.</td>
<td>Kanojyo-wa kaeru-o/hon-o neketta.</td>
</tr>
<tr>
<td>Blick (Chimaru/Chimeru)</td>
<td>Training (Continuous tense)</td>
<td>The pig/guitar is blicking.</td>
<td>She is blicking the pig/the guitar.</td>
</tr>
<tr>
<td></td>
<td>Training (Past tense)</td>
<td>The pig/the guitar blicked.</td>
<td>Sge blicked the pig/the guitar.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Buta-wa/gita-wa chimatta.</td>
<td>The pig blicked.</td>
</tr>
<tr>
<td></td>
<td>Test sentence</td>
<td>The rabbit/the ball blicked.</td>
<td>She blicked the pig/the ball.</td>
</tr>
<tr>
<td>Dax (Hemaru/Hemeru)</td>
<td>Training (Continuous tense)</td>
<td>The fox/the train is daxing.</td>
<td>He is daxing the fox/the train.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kitsune-wa/densha-wa hematteiru.</td>
<td>Kare- wa kitsune-o/densha-o hemeteiru.</td>
</tr>
<tr>
<td></td>
<td>Training (Past tense)</td>
<td>The fox/the train daxed.</td>
<td>He daxed the fox/the train.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kitsune-wa/densha-wa hematta.</td>
<td>Kare- wa kitsune-o/densha-o hemetta.</td>
</tr>
<tr>
<td></td>
<td>Test sentence</td>
<td>The girl/the rocket daxed.</td>
<td>He daxed the girl/the rocket.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Onnanoko-wa/roketto-wa hemetta.</td>
<td>Kare- wa onnanoko-o/roketto-o hemeta.</td>
</tr>
<tr>
<td>Lorp (Ruku/Rukeru)</td>
<td>Training (Continuous tense)</td>
<td>The dog/bag is lorping.</td>
<td>He is lorping the dog/the bag.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inu-wa/fukuro-wa rukiteiru.</td>
<td>Kare- wa inu-o/fukuro-o ruketeiru.</td>
</tr>
<tr>
<td></td>
<td>Training (Past tense)</td>
<td>The dog/the bag lored.</td>
<td>Kare- wa fukuro-o ruketa.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inu-wa/fukuro-wa rukita.</td>
<td>The dog/the bag lored.</td>
</tr>
<tr>
<td></td>
<td>Test sentence</td>
<td>The girl/the chair lored.</td>
<td>Kare- wa onnanoko-o/isu-o ruketa.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Onnanoko-wa/isu-wa rukita.</td>
<td>He lорped the girl/the chair.</td>
</tr>
</tbody>
</table>
**Appendix 5. Table A.5. Transitive and Intransitive Sentences in Study 2 (Familiar Verbs)**

<table>
<thead>
<tr>
<th>Verb: English (Japanese Intransitive/Transitive)</th>
<th>Intransitive sentences</th>
<th>Transitive sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drop (Ochiru/Otosu)</td>
<td>The keys dropped.</td>
<td>He dropped the keys.</td>
</tr>
<tr>
<td></td>
<td>Kag-i-wa ochi-ta.</td>
<td>Kanojo-yo-wa kagi-o otoshi-ta.</td>
</tr>
<tr>
<td>Melt (Tokeru/Tokasu)</td>
<td>The ice cream melted.</td>
<td>He melted the ice cream.</td>
</tr>
<tr>
<td>Stop (Tommaru/Tomatta)</td>
<td>The car stopped.</td>
<td>He stopped the car.</td>
</tr>
<tr>
<td>Close (Shimaru/Shimeru)</td>
<td>The box closed.</td>
<td>He closed the box.</td>
</tr>
<tr>
<td></td>
<td>Hako-wa shimatta.</td>
<td>Kanojo-yo-wa hako-o shimeta.</td>
</tr>
<tr>
<td>Roll (Korogaru/Korogasu)</td>
<td>The ball rolled.</td>
<td>He rolled the ball.</td>
</tr>
<tr>
<td></td>
<td>Boru-wa korogatta.</td>
<td>Kanojo-yo-wa boru-o korogashita.</td>
</tr>
<tr>
<td>Ring (Naru/Narasu)</td>
<td>The doorbell rang.</td>
<td>He rang the doorbell.</td>
</tr>
<tr>
<td></td>
<td>Doaberu-wa natta.</td>
<td>Kanojo-yo-wa doaberu-o narashita.</td>
</tr>
<tr>
<td>Spin (Mawaru/Mawasu)</td>
<td>The pedals spun.</td>
<td>He spun the pedals.</td>
</tr>
<tr>
<td></td>
<td>Pedaru-wa mawatta.</td>
<td>Kanojo-yo-wa pedaru-o mawashita.</td>
</tr>
<tr>
<td>Bend (Magaru/Mageru)</td>
<td>The hanger bent.</td>
<td>He bent the hanger.</td>
</tr>
<tr>
<td></td>
<td>Hanga-wa magatta.</td>
<td>Kanojo-yo-wa hanga-wo mageta.</td>
</tr>
<tr>
<td>Break (Kowareru/Kowasu)</td>
<td>The blocks broke.</td>
<td>He broke the blocks.</td>
</tr>
<tr>
<td></td>
<td>Burokku-wa kowaretta.</td>
<td>Kanojo-yo-wa burokku-o kowashita.</td>
</tr>
<tr>
<td>Open (Aku/Akeru)</td>
<td>The door opened.</td>
<td>He opened the door.</td>
</tr>
<tr>
<td></td>
<td>Doa-wa aita.</td>
<td>Kanojo-yo-wa doa-o aketa.</td>
</tr>
<tr>
<td>Tear (Yabukeru/Yabuku)</td>
<td>The paper tore.</td>
<td>He tore the paper.</td>
</tr>
<tr>
<td></td>
<td>Kami-wa yabuketa.</td>
<td>Kanojo-yo-wa kami-o yabuita.</td>
</tr>
<tr>
<td>Move (Ugoku/Ugokasu)</td>
<td>The trolley moved.</td>
<td>He moved the trolley.</td>
</tr>
<tr>
<td></td>
<td>Kaato-wa ugoita.</td>
<td>Kanojo-yo-wa kaato-o ugokashita.</td>
</tr>
</tbody>
</table>

*For the accidental scenes, a performer was engaged in an action (e.g. drinking coffee, walking) and then accidentally interacted with the object to cause the event to take place. For the intentional scenes, a performer interacted with the object directly to cause the event without being engaged in other actions (e.g. falling back against a doorbell vs. pressing directly with hand).
### Appendix 6: Table A.6. Transitive and Intransitive Sentences in Study 2 (Novel Verbs)

<table>
<thead>
<tr>
<th>Verb (Infinitive)</th>
<th>Training (Continuous tense)</th>
<th>Training (Past tense)</th>
<th>Test sentence</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Verb (Infinitive)</th>
<th>Training (Continuous tense)</th>
<th>Training (Past tense)</th>
<th>Test sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meek</td>
<td>Hana-wa rukiteiru</td>
<td>Kanojyo-wa hana-o rukiteiru.</td>
<td></td>
</tr>
<tr>
<td>Blick</td>
<td>Baggu-wa hematteiru.</td>
<td>Kanojyo-wa baggu-o hemeteiru.</td>
<td></td>
</tr>
<tr>
<td>Dax</td>
<td>Fuusen-wa chimatteiru.</td>
<td>Kanojyo-wa fuusen-o chimeteiru.</td>
<td></td>
</tr>
<tr>
<td>Lorp</td>
<td>Piero-wa neiteiru</td>
<td>Kanojyo-wa pieru-o neketeiru.</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 7: Table A.7. Filler and Practice Sentences in Studies 1 & 2.

<table>
<thead>
<tr>
<th>Item</th>
<th>Target sentence</th>
<th>Japanese</th>
<th>Distractor sentence</th>
<th>English</th>
<th>Japanese</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Study 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filler1</td>
<td>Duck was rocked by Rabbit.</td>
<td>Ahuru-wa usaghi-o yurasareta.</td>
<td>Duck was pulled by Rabbit.</td>
<td>Ahuru-wa usagi-ni hipparareta.</td>
<td></td>
</tr>
<tr>
<td>Filler2</td>
<td>Duck was tugged by Rabbit.</td>
<td>Ahiru-ha usagi-ni tsubukok hipparareta.</td>
<td>Duck was stroked by Rabbit.</td>
<td>Usagi-wa ahiruni naderareta.</td>
<td></td>
</tr>
<tr>
<td>Filler3</td>
<td>Rabbit was stroked by Duck.</td>
<td>Usagi-wa ahiruni naderareta.</td>
<td>Rabbit was bumped by Duck.</td>
<td>Usagi-wa ahiru-ni butsukarareta.</td>
<td></td>
</tr>
<tr>
<td>Filler4</td>
<td>Rabbit was pulled by Duck.</td>
<td>Usagi-wa ahiru-ni hipparareta.</td>
<td>Rabbit was rocked by Duck.</td>
<td>Usagi-wa ahiru-ni yurasareta.</td>
<td></td>
</tr>
<tr>
<td>Filler5</td>
<td>Rabbit was bumped by Duck.</td>
<td>Usagi-wa ahiru-ni butsukarareta.</td>
<td>Rabbit was tugged by Duck.</td>
<td>Usagi-wa ahiru-ni tsuyoku hipparareta.</td>
<td></td>
</tr>
<tr>
<td>Practice 1</td>
<td>He danced.</td>
<td>Kare-wa odotta.</td>
<td>He sat down.</td>
<td>Kare-wa suwatta.</td>
<td></td>
</tr>
<tr>
<td>Practice 2</td>
<td>She slept.</td>
<td>Kanojo-wa nemutta.</td>
<td>The bird flew.</td>
<td>Tori-wa tonda.</td>
<td></td>
</tr>
<tr>
<td>Practice 3</td>
<td>He rode his bike.</td>
<td>Kare-wa karenittensha-ni notta.</td>
<td>He lost his bike.</td>
<td>Kare-wa karenittensha-o nakushita.</td>
<td></td>
</tr>
</tbody>
</table>

**Study 2**

<table>
<thead>
<tr>
<th>Item</th>
<th>Target sentence</th>
<th>Japanese</th>
<th>Distractor sentence</th>
<th>English</th>
<th>Japanese</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filler1</td>
<td>He was rocked by the girl.</td>
<td>Kanojo-wa otoko-ni yusaburareta.</td>
<td>He was dried by the girl.</td>
<td>Kanojo-wa otoko-ni kawakasareta.</td>
<td></td>
</tr>
<tr>
<td>Filler2</td>
<td>He was stroked by the girl.</td>
<td>Kanojo-wa otoko-ni naderareta.</td>
<td>He was hit by the girl.</td>
<td>Kanojo-wa otoko-ni tatakareta.</td>
<td></td>
</tr>
<tr>
<td>Filler3</td>
<td>He was pulled by the girl.</td>
<td>Kanojo-wa otoko-ni hipparareta.</td>
<td>He was poked by the girl.</td>
<td>Kanojo-wa otoko-ni tsutsukarareta.</td>
<td></td>
</tr>
<tr>
<td>Filler4</td>
<td>He was bumped by the girl.</td>
<td>Kanojo-wa otoko-ni butsukarareta.</td>
<td>He was scratched by the girl.</td>
<td>Kanojo-wa otoko-ni hikkakakarareta.</td>
<td></td>
</tr>
<tr>
<td>Filler5</td>
<td>He was pushed by the girl.</td>
<td>Kanojo-wa otoko-ni osareta.</td>
<td>He was washed by the girl.</td>
<td>Kanojo-wa otoko-ni awarareta.</td>
<td></td>
</tr>
<tr>
<td>Practice 1</td>
<td>He danced.</td>
<td>Kanojo-wa odotta.</td>
<td>He slept.</td>
<td>Kanojo-wa nemutta.</td>
<td></td>
</tr>
</tbody>
</table>