Chinese-speaking adults' understanding of argument structure

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Abstract

Syntactic constructions roughly correspond to sentence meanings. Previous research has shown that Chinese children can associate an SVO construction with a causative event at age 2, but do not always map an SV construction to a non-causative event even after reaching 5 years of age. The latter results may be attributed to the fact that Chinese allows argument-dropping (Jiang & Haryu, 2010). This paper investigated Chinese adults' syntax-semantics knowledge and found that even adults do not always map an intransitive construction to a non-causative event, although they are likely to use an intransitive construction to describe a non-causative event. The results suggest that although Chinese adults understand that causative and non-causative events should typically be described using transitive and intransitive constructions, respectively, the use of this knowledge in inferring novel verb meanings seems to be regulated by the actual usage of SV sentences in Chinese.

Keywords: argument structure; Mandarin Chinese; adults; verb meanings; intransitive; transitive.

Introduction

It is said that for children, learning verbs is difficult (e.g., Gentner, 1978, 1982; Imai et al., 2008). This is due to the fact that when a novel verb is introduced for a particular scene, there are an infinite number of possibilities concerning which aspect of the scene the verb refers to. For example, if we hear the novel verb "*gorping*" while watching a scene in which a girl is walking with a dog, the verb "*gorping*" may refer to "walking," "taking a dog for a walk," or "moving from one place to another." Even for adults, it is difficult to infer the meaning of a given verb if it is presented without any syntactic information (Gillette, Gleitman, Gleitman, & Lederer, 1999). When they are told in what syntactic construction the verb appears, however, adults find it much easier to infer its meaning. Thus, the syntactic constructions in which verbs appear provide us with a very important cue to verb meanings, since the types of verb meanings roughly correspond to the syntactic structures in which those verbs appear (Gleitman, 1990). For example, a verb that appears in an intransitive construction with a single argument (e.g., "The boy goes") is likely to describe a non-causative event, while a verb that appears in a transitive construction with two arguments (e.g., "The girl pushed the boy") typically refers to a causative event.

Developmental psycholinguists have investigated whether and when children are able to use syntactic constructions to infer verb meanings. In recent studies, a forced-choice pointing task has been used to investigate this problem. In this task, children are typically presented with two videos side-by-side, one showing a causative event and the other a non-causative event, and asked to select a scene that matches a presented sentence involving a novel verb. Two types of test sentences are used: In one type, the novel verb is presented in a transitive construction, and in the other type, the novel verb is embedded in an intransitive construction. For example, while watching two events, a causative one in which a duck is pushing a bunny into a squat position and a non-causative one in which a duck and a bunny are moving one of their arms in a circle, children hear the novel verb "*blick*" in a transitive sentence such as "The duck is *blicking* the bunny," or in an intransitive construction with a conjoined noun such as "The duck and the bunny are *blicking*." The children are then asked to point to the event that matches the presented sentence. Thus, these studies have focused on whether children would select a causative event for a transitive sentence, and a non-causative event for an intransitive one.

These previous studies have found that English-learning 2-year-olds associate a transitive construction with a causative event. However, children of the same age do not always map an intransitive construction to a non-causative event (Arunachalam & Waxman, 2010; Noble, Rowland, & Pine, 2011). They become able to map an intransitive construction to a non-causative event by 3 years of age (Noble et al., 2011). Research that examined Chinese-learning children using the same method also found that Chinese 2-year-olds were able to map a transitive construction to a causative event. However, Chinese children did not always associate an intransitive construction with a non-causative event even after reaching 5 years of age (Jiang & Haryu, 2010). That is, in both English and Chinese, children seem to have some difficulty in acquiring knowledge of intransitive constructions, and their acquisition of intransitive constructions is later than that of transitive constructions.

The fact that it takes longer for children to become able to use intransitive constructions to infer verb meanings may be partly attributed to the fact that there are some verbs that have a general meaning and can be used in an intransitive construction but can refer to a causative event, not only in

English but also in Chinese. For example, the verb "play" can be used in an intransitive construction to refer to a causative event in which a girl makes a boy perform an action, by saying "The girl and the boy are playing." Thus, the existence of such intransitive verbs may contribute to the fact that both English- and Chinese-learning children need more time to acquire knowledge of intransitive constructions, compared to the time they take to acquire knowledge of transitive constructions.

Furthermore, a certain characteristic of Chinese might make it even more difficult for Chinese-speaking children to learn the correspondence between an intransitive construction and a non-causative event. Unlike English, Chinese allows pervasive ellipsis of noun arguments. Either or both the subject and the object can be dropped from the sentence. Therefore, in Chinese, an SV sentence could be either an intransitive sentence or a transitive sentence with the object omitted. As a result, SV sentences Chinese-learning children hear in their daily life do not always refer to a non-causative event. This may also contribute to the difficulty that Chinese children have in learning the correspondence between an intransitive construction and a non-causative event. Given this characteristic of the Chinese language, it may also be the case that Chinese adults do not associate an intransitive construction with a non-causative event.

In the present research, two experiments were carried out to investigate whether Chinese-speaking adults associate a sentence with a single argument with a non-causative event in the same way that they associate a sentence with two arguments with a causative event. In Experiment 1, by presenting Chinese adults with two videos, one showing a non-causative event and the other a causative event, we examined whether they would map an SV sentence to a non-causative event, and an SVO sentence to a causative event, respectively. In Experiment 2, we presented Chinese adults with a video showing either a causative or a non-causative event, and asked them to select an appropriate sentence to describe the scene out of two types of test sentences, an SV sentence and an SVO sentence.

Experiment 1

In Experiment 1, we investigated Chinese adults' syntax-semantics knowledge using a forced-choice pointing task, which has been used in recent studies on children. In the current experiment, participants were presented with a novel verb placed in a transitive construction or in an intransitive construction with a conjoined noun ("the woman and the man") as the subject while they watched two events, one causative and the other non-causative. The participants were then asked to point to the event that matched the presented sentence. If, as argued by Jiang & Haryu (2010), the pervasive ellipsis of noun arguments in Chinese makes it difficult not only for Chinese-learning children but also for Chinese-speaking adults to map an SV sentence to a non-causative event, then the adults would not map an intransitive construction to a non-causative event, even when they assign a transitive construction to a causative event.

Method

Participants The participants were 40 undergraduate students (20 males and 20 females, mean age 21 years, range 20 to 24 years). The participants were randomly assigned to two conditions: the intransitive condition and the transitive condition. In each condition, there were the same number of males and females. All the participants were native speakers of Mandarin Chinese.

Materials Six sets of videos were used (see Table 1 for details). They were the same videos that were used in the experiment with Chinese children in the previous research conducted by Jiang and Haryu (2010). Each set consisted of two videos, one showing a non-causative event and the other showing a causative one. In the non-causative event, a young woman and a young man performed the same repetitive action separately, side by side. In half of the causative videos, the young woman made the young man perform an action, while in the other half the man made the woman perform an action (see Figure 1 for an example).

As novel verbs, six monosyllabic nonsense words, the same ones in Jiang & Haryu (2010), "xia3," "kao2," "pa3," "de4," "mu1," and "tie2," were used. Ten college students who were native speakers of Mandarin Chinese agreed that these words are senseless in that language. However, in the present experiment, these novel words were all low-pass filtered so that the sounds did not cause the participants to remember similar-sounding verbs that already exist in Chinese. The auditory stimuli were created by embedding these low-pass filtered words in the verb position of SV or SVO sentences, which were recorded clearly by a female adult native speaker of Mandarin Chinese.

Procedure Participants were tested individually using a forced-choice pointing task. The video stimuli were presented on a note PC using PowerPoint. All videos lasted about 10 seconds. In each test trial, a sentence was presented twice using Windows Media Player while the participant was watching two videos side-by-side, one showing a causative event and the other a non-causative event. The participant was then asked to point to the matching video. Participants in the intransitive condition heard a novel verb in an intransitive construction, such as "A1yi2 he2 shu1shu zai4 X (The woman and the man are X-ing)," while those in the transitive condition were presented with a novel verb embedded in a transitive construction, such as "A1yi2 zai4 X shu1shu (The woman is X-ing the man)." Each participant received six test trials.

Results and discussion

The selection of a causative event was scored as a causative response. The mean proportions of causative responses were calculated for each condition (see Figure 2).

Table 1: Stimulus materials used in Experiment 1

Set	Non-causative events	Causative events	Novel verb
1	A woman and a man sway side by side.	A woman tugs at a man's hand.	xia3
2	A man and a woman move up and down by bending their knees.	A man shakes a woman by the shoulders.	kao2
3	A man and a woman twist their torsos from left to right.	A man makes a woman bend down by pressing on her shoulders.	pa3
4	A woman and a man bow repeatedly.	A woman pats a man on his shoulder.	de4
5	A woman and a man swing both of their arms up and down together.	A woman turns a man's body in a circle.	mu1
6	A man and a woman stamp their feet.	A man holds a woman's hand and waves it.	tie2

Figure 1: A sample set of video events used in Experiment 1 (Set 1)

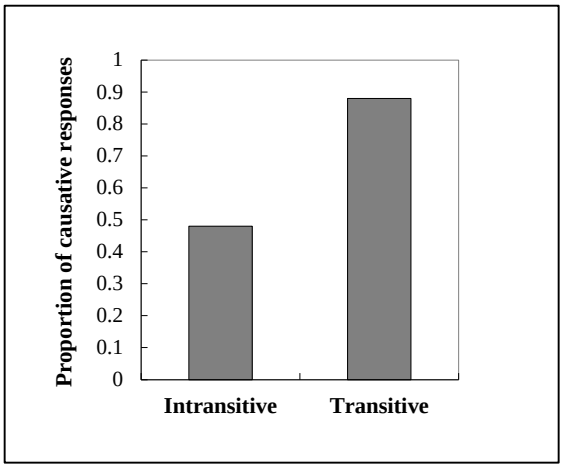

Figure 2: Mean proportions of causative responses in Experiment 1

The participants in the transitive condition selected causative events .88 of the time, which was significantly above chance level ($t(19) = 10.48$, $p < .001$, $d = 2.34$). However, the participants in the intransitive condition selected causative events .48 of the time, which was not different from chance ($t(19) = .64$, $p = .53$, $d = .14$). That is, participants in the transitive condition matched a transitive sentence with two arguments to a causative event, while those in the intransitive condition did not always select a non-causative event for an intransitive sentence. Furthermore, an unpaired *t*-test revealed a significant difference between the two conditions, $t(38) = 7.64$, $p < .001$, $d = 2.42$, indicating that participants in the transitive condition chose causative events much more frequently than those in the intransitive condition. The above results suggest that while Chinese adults assign a transitive construction to a causative event, they do not always map an intransitive construction to a non-causative event.

To summarize, when shown a non-causative and a causative event and asked to select which of the two events the given sentence described, Chinese adults were likely to select a causative event in response to a transitive construction, while they did not show a clear tendency to choose a non-causative event over a causative event in response to an SV construction. Their behavior was consistent with that of the young Chinese-speaking children in Jiang & Haryu (2010).

Experiment 2

The results of Experiment 1 suggest that Chinese adults think an SVO construction describes a causative event while at the same time they think that an SV construction can be used to describe not only a non-causative event but also a causative event. This belief seems to be consistent with the usage of SV sentences in Chinese. However, does this mean that there is no typical scene that should be described by using an SV construction? In Experiment 2, we investigated this problem by presenting the participants with a non-causative or a causative event and asking them to choose which of two given sentences, i.e., an SV sentence and an SVO sentence both containing the same novel verb, matched the event.

Method

Participants Twenty undergraduate students, who were not tested in Experiment 1, took part in this experiment. The participants consisted of 8 males and 12 females (mean age 20 years, range 18 to 21 years), who were all native speakers of Mandarin Chinese.

Materials and procedure The visual materials were the same videos (six non-causative and six causative) as used in Experiment 1. In addition to the six nonsense words ("xia3," "kao2," "pa3," "de4," "mu1," and "tie2") used in Experiment 1, another six ones ("pei3," "ne1," "mai1," "diu4," "ka2," and "hua3") were also used as novel verbs. These 12 words were all confirmed as nonsense in Mandarin Chinese by 10 college students whose native language was Mandarin Chinese. Unlike Experiment 1, these words were not low-pass filtered, because participants in this experiment were asked to select one out of two sentences involving the same novel word, and thus the sounds of the novel words would not affect their performance.

While a video was shown, two sentences (i.e., an SV sentence and an SVO sentence, both involving the same novel verb) were presented. The participants were asked to select which sentence better matched the video. For example, when presented with a causative event in which a woman was tugging at a man's hand, the participants heard the intransitive sentence "A1yi2 he2 shu1shu zai4 *Xia3* (The woman and the man are *Xia3*-ing)" together with the transitive sentence "A1yi2 zai4 *Xia3* shu1shu (The woman is *Xia3*-ing the man)" and were asked to choose the one that matched the event. This procedure was repeated for 12 videos. That is, each participant received six causative trials and six non-causative trials.

Results and discussion

We counted the number of responses in which the participants chose an intransitive sentence in response to a non-causative event, and a transitive sentence in response to a causative event, respectively. The mean scores each for the non-causative and the causative events were 5.7 (SD = 0.57) and 5.7 (SD = 0.57) out of 6, respectively. Two *t*-tests were conducted to see whether these scores were significantly above chance. The analyses revealed that participants were more likely to choose intransitive sentences to describe a non-causative event than expected by chance, $t(19) = 21.14$, $p < .001$, $d = 9.11$, and that they described a causative event by using transitive sentences more frequently than chance, $t(19) = 21.14$, $p < .001$, $d = 9.11$.

These results suggest that Chinese adults prefer SV sentences to SVO sentences when describing non-causative events, and use SVO sentences more often when referring to causative events.

General Discussion

The present research examined Chinese-speaking adults' understanding of argument structure through two experiments that tested whether Chinese adults associate an SV and an SVO construction with a non-causative and a causative event, respectively. In Experiment 1, we found that when shown two events (a non-causative and a causative one) and asked to choose which one matched the presented sentence, Chinese adults were willing to map an SVO sentence to a causative event, while at the same time they did not always associate a given SV sentence with a non-causative event, which was also the case with Chinese young children (see Jiang & Haryu, 2010). In contrast, when given two sentences (an intransitive and a transitive one) and asked to select which matched the given event in Experiment 2, Chinese adults were likely to assign a transitive sentence and an intransitive sentence to a causative event and a non-causative event, respectively.

The results of Experiment 1, together with those of Jiang and Haryu (2010), indicate that Chinese speakers, whether young children or adults, do not assume that SV sentences refer to non-causative events. At the same time, they think that SVO sentences describe causative events. This attitude in Chinese speakers is in contrast with what was found in English speakers who match SV constructions to non-causative events as well as matching SVO constructions to causative events (Arunachalam & Waxman, 2010; Noble et al., 2011). This difference between Chinese- and English-speakers appears to come from the fact that English does not allow argument-dropping whereas Chinese allows pervasive ellipsis of noun arguments. Due to this particular property of Chinese, SV sentences could be either an intransitive construction or a transitive construction with the object dropped. Therefore, it is not appropriate for Chinese speakers to assume that a given SV sentence always refers to a non-causative event. In this respect, the behavior of Chinese speakers that do not automatically associate an SV sentence with a non-causative event seems to be in accordance to the actual usage of SV constructions in the language, indicating the possibility that the knowledge of argument structure is learned from the language input.

However, at the same time, as shown in Experiment 2, when Chinese adults are asked which of two constructions, an SV or an SVO construction, should be used to describe a

causative and a non-causative event, respectively, they answer that an SV construction rather than an SVO construction should be used to describe a non-causative event. In addition, they prefer to use an SVO construction rather than an SV construction to describe a causative event. This belief appears inconsistent not only with the Chinese input they have received, but also with the fact that Chinese speakers do not always map SV constructions to non-causative events.

Two possibilities may be considered as the origin of such asymmetrical behavior in Chinese speakers. The first possibility is that the knowledge of argument structure may be universal and innate, but one of the characteristics of Chinese (the fact that it allows the pervasive ellipsis of noun arguments) may guide people to regulate the use of this knowledge in inferring the meaning of a given sentence. Lidz, Gleitman, & Gleitman (2003) argued for the view that the knowledge of argument structure is universal, based on their findings: Children learning Kannada make use of the number of noun arguments rather than morphological inflections as a cue to determine whether the given sentence refers to a causative or a non-causative event, although in Kannada not number of arguments but morphological inflections are definitive cues to the causativity of described events.

The other possibility is that owing to the pragmatic demands of communication, people independently of the properties of their native language prefer to use an SVO construction to describe a causative event and an SV construction to describe a non-causative event. When an SV construction such as "The woman and the man are playing" is used to describe a causative event in which the woman is making the man perform a certain action, what action the woman is in fact making the man perform is not known. In order to precisely convey what is happening, the different roles played by different agents should be described separately, using SVO constructions. On the other hand, using SV constructions may convey that all the agents play the same role in the event. Such pragmatic needs may guide people to prefer to use SVO constructions to describe causative events, and SV constructions for non-causative events, even though SV constructions do not always correspond to causative events in the Chinese input.

In sum, the present research has shown that although Chinese adults prefer to use SVO and SV constructions to describe causative and non-causative events, respectively, they do not always use this knowledge of syntax-semantics correspondences in deciding whether a given sentence refers to a causative or a non-causative event. The latter result suggests that the particular property of Chinese that allows argument-dropping might guide Chinese speakers not to automatically map an SV sentence to a non-causative event. However, despite this property of the Chinese language, why do Chinese speakers prefer to use SV and SVO constructions to describe non-causative and causative events, respectively? Is this because the knowledge of syntax-semantics correspondences is universal, as suggested by Lidz et al. (2003)? Or does it relate to the pragmatic demands of communication? Further research is required to investigate this question.

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