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Linguistic and conceptual encoding of transfer events in English and Mandarin Chinese speakers

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This study investigates how English and Mandarin Chinese speakers linguistically encode transfer events (e.g., *give, take*). We test the hypothesis that transfer events, like motion events, involve Goal and Source paths and are, therefore, subject to a Goal bias, such that Goals are encoded more prominently than Sources. Across two experiments, speakers of both languages described transfer events. In both languages, descriptions showed a robust Goal bias: speakers mentioned Goals more often than Sources, even when controlling for potential Agent–Subject mapping effects, and they were more likely to use canonical Goal-encoding devices for Goals than canonical Source-encoding devices for Sources. These findings reveal a cross-linguistically reliable preference for Goals in transfer-event descriptions, consistent with the possibility that Goal prominence reflects general principles of event message planning. More broadly, the results provide support for accounts that extend Goal/Source path representations beyond spatial language.

1. Introduction

Research on event perception, memory, and communication consistently shows that human cognition organizes dynamic experiences into structured event representations (Kurby & Zacks, 2008; Radvansky & Zacks, 2014; Richmond & Zacks, 2017; Zacks & Tversky, 2001). These representations encompass event participants (*roles*) and the relations between them. Compelling evidence emerges from studies demonstrating adults' remarkable ability to rapidly extract information about event participants (Dobel et al., 2007; Griffin & Bock, 2000; Hafri et al., 2013; among others). For instance, after just 37 milliseconds of exposure to a pictorial depiction of an event, adults can identify key participants like the Agent (e.g., the kicker) and Patient (e.g., the person being kicked) (Hafri et al., 2013). Developmental research suggests that the understanding of event roles begins as early as infancy (see Papeo et al., 2024, for an overview; see also Göksun et al., 2010; Wagner & Lakusta, 2009).

Such nonlinguistic conceptualization of events is argued to be structured in a way that broadly parallels language, capturing the identity and number of event participants and their relational configurations (e.g., Hayward & Tarr, 1995; Lakusta & Landau, 2005, 2012; Munnich et al., 2001; Papafragou, 2010; Ünal et al., 2021, 2024; Wilson et al., 2014). According to prominent models of speech production (e.g., Levelt, 1993), this conceptual representation serves as a prerequisite for planning the linguistic realization of events, especially the way *thematic relations*, such as Agents, Patients and other event roles, map onto syntactic positions within a sentence, such as subject and object (see Papafragou & Grigoroglou, 2019, for a review). Cross-linguistic evidence demonstrates considerable regularities in how event structure is encoded, with robust correspondences between thematic relations and syntactic structure across languages (Pinker, 1989). Nevertheless, both the number and assignment of thematic roles in language and their correspondence to event roles in cognition remain topics of active investigation (see Levin & Rappaport Hovav, 2005; Rissman & Majid, 2019, for reviews).

In this article, we explore the event role representations reflected in language production, focusing on events that capture transfer of possession, such as giving or taking (henceforth, *transfer events*). Such events hold a special place in human cognition, as they represent vital social relations: reactive and pro-active resource sharing is ubiquitously observed across human societies (Gurven, 2004; Jaeggi et al., 2010). In addition, transfer events hold a special place in language: despite the relative rarity of three-place predicates, transfer events are widely encoded in such predicates, often with the start-state possessor, the transferred object, and the end-state possessor each being realized as one argument, across the world's languages (Kittilä, 2006; Margetts & Austin, 2007; Newman, 2005). Transfer events, with their complex structure, have given rise to a host of accounts seeking to explain the intricacy of their linguistic and conceptual encoding.

1.1 The structure of transfer events

An influential class of linguistic theories (e.g., Gruber, 1965; Jackendoff, 1983, 1990) suggests that transfer events can be analyzed in spatial terms and, thus, bear similarities to motion events. Consider the motion event denoted by the sentence *The butterfly flew from the flower to the tree*. In this sentence, the subject encodes the Agent, or moving entity (the butterfly), the *from*-phrase encodes the Source, or starting point, of the motion, and the *to*-phrase encodes the Goal, or endpoint, of the motion. Adopting the position that spatial representations are fundamental in both language and cognition, with spatial concepts extending into non-spatial domains (Jackendoff, 1983, 1990; Talmy, 2000), this class of theories proposes that participants in transfer events have dual thematic roles: the two animate (often, human) participants involved in the transfer action are simultaneously Agent and Patient (in terms of causality), and Goal and Source (in terms of the transferred object's spatial movement). For instance, in the Giving event denoted by the sentence *Harry gave an apple to Ruby*, Harry is the Agent and Source, while Ruby is the Patient and Goal. Conversely, in the Taking event denoted by the sentence *Harry took an apple from Ruby*, Harry is the Agent and Goal, and Ruby is the Patient and Source. On this theory, Agent/Patient and Source/Goal roles are assigned at different analysis levels, with Agent/Patient assignment determining the mapping of event participants to syntax (with Agents typically being assigned subject position; see also Dowty, 1991) and Source/Goal structure determining the thematic structure and conceptualization of the event (e.g., Jackendoff, 1983). On this approach, the roles of Source and Goal apply to events beyond the spatial (motion) domain. As a result, this and other proposals within this class can naturally accommodate – and, in fact, lead one to expect – similarities in the mental properties of motion and transfer events (see Baker, 1996; Clark & Carpenter, 1989; Goldberg, 1995; Harley, 2002; Pylkkänen, 2008, among others).

Other researchers posit distinct representations for transfer and motion events (Bresnan & Kanerva, 1989; Pinker, 1989; Rappaport Hovav & Levin, 2008; see Rissman & Majid, 2019). These theorists typically reserve the term *Goal* for entities at the endpoints of motion events and use the term *Recipient* for the entity receiving the affected (transferred) object in transfer events (see Levin & Rappaport Hovav, 2005). Proponents of these theories point out that spatial Goals differ from Recipients in several respects. For instance, Recipients are typically animate, but spatial Goals do not have to be. Furthermore, spatial Goals are normally reached in motion events (cf. *The butterfly flew to the tree*) but Recipients do not necessarily end up in possession of the transferred object (one can say *Harry gave an apple to Ruby but she didn't take it*). And, even though some kinds of transfer of possession verbs, such as *throw* and *send* in English, have been argued to have both a transfer and a caused motion interpretation (and allow either a Recipient or a spatial Goal, respectively), *give*-type verbs are assumed to have only transfer meanings and, thus, license Recipients exclusively (Rappaport Hovav & Levin, 2008). This last case of events, thus, offers the clearest case where the predictions of the two classes of theories differ.

1.2 Transfer events and the scope of the Goal bias

In the current article, we examine the linguistic encoding of transfer events to test whether these events include a Source-Goal structure, as proposed by some theories in our earlier discussion, but not others. As mentioned already, such events are expected to contain implicit Goals and Sources according to some views (Baker, 1996; Clark & Carpenter, 1989; Goldberg, 1995; Harley, 2002; Jackendoff, 1983, 1990; Pylkkänen, 2008; Talmy, 2000), but not others (Bresnan & Kanerva, 1989; Pinker, 1989; Rappaport Hovav & Levin, 2008). It follows that only the first, but not the second, class of theories expects the linguistic encoding of transfer of possession to be characterized by a signature role asymmetry between Sources and Goals, known within the motion domain as *the Goal bias*.

The Goal bias refers to the fact that, when people are asked to describe a motion event (e.g., a butterfly flying from the flower to the tree), they tend to mention the Goal ("to a flower") more often than the Source ("from a tree") (Chen et al., 2023, 2024; Do et al., 2020; Lakusta & Landau, 2005, 2012; Papafragou, 2010; Regier & Zheng, 2007). This asymmetry is found in both adults and children (Lakusta & Landau, 2012; Lakusta et al., 2016; Papafragou, 2010), is corroborated in naturalistic corpora (Stefanowitsch & Rohlde, 2004), and extends to typologically and modally different languages (e.g., Johanson et al., 2019; Regier & Zheng, 2007; Zheng & Goldin-Meadow, 2002).

The asymmetry between Sources and Goals in language production seems to have conceptual roots, as evidenced by memory tasks. After viewing similar motion events, adults (e.g., Chen et al., 2023, 2024; Do et al., 2020; Lakusta & Landau, 2012; Papafragou, 2010; Regier & Zheng, 2007) and prelinguistic infants (Lakusta & Carey, 2015; Lakusta & DiFabrizio, 2017; Lakusta et al., 2007) are more sensitive to changes to Goals, compared to changes to Sources. These findings suggest that the Goal bias in language reflects a more fundamental aspect of how humans process and remember motion events.

At present, much empirical evidence provides initial support for extending the Goal-Source structure, including the Goal bias, to the encoding of transfer events. In linguistic typology, languages encode Goal-path transfers (e.g., giving) and Source-path transfers (e.g., taking) using different grammatical devices, despite their parallel schematic structures. Cross-linguistic studies have shown that, across languages, transfer events involving Goal paths are more widely encoded in three-place predicates – with the start-state possessor, the transferred object, and the end-state possessor each being realized as one argument of the verb – compared to those involving Source paths (Kittilä, 2006; Margetts & Austin, 2007; Newman, 2005). This bias extends beyond linguistic structure to language production and comprehension. Analyses of sentences describing transfer action in natural corpora have shown that speakers are more likely to re-mention Goals, compared to Sources, in a consecutive sentence (Arnold, 2001). In turn, when asked to identify the referent of an ambiguous pronoun in a previous sentence depicting transfer events, adult

comprehenders more readily associate an ambiguous pronoun with the sentence object when that object is a Goal (e.g., *Ana sent a text to Liz and then* she *took a screenshot*), than when it is a Source (e.g., *Ana received a text from Liz and then* she *took a screenshot*) (Johnson & Arnold, 2023; Langlois et al., 2023).

Elicitation studies in a laboratory setting provide some of the most direct evidence for the presence of a Goal bias in the linguistic encoding of transfer events, as the perceptual and discourse properties of the event components accessible to the speakers are more controlled. In one study, when describing the same videotaped transfer event, participants preferred describing it as a Giving event (e.g., "He gave the flowers to the woman") rather than a Receiving event (e.g., "She received the flowers from the man") and included Goal-path prepositional phrases (e.g., "to the woman") more frequently than Source-path phrases (e.g., "from the man") (Lakusta & Landau, 2005). Similarly, when shown a video depicting an elephant handing a ball to a rabbit, both adults and preschoolers preferentially described the scene with the verb *give*, rather than *take/ receive* (Fisher et al., 1994).

Further research on early action role representation suggests a potential conceptual basis for a Goal bias in transfer events. Studies consistently show that a three-participant schema is robust and early for Giving events. For instance, infants react to object removal in Giving events, but not in hugging events, suggesting they recognize the object's essential role in transfer events (Gordon, 2003). Additionally, 10.5- and 12-month-olds can distinguish between role reversal (when a Giver becomes a Taker) and direction reversal (Schöppner et al., 2006). However, such early sensitivity to the three-participant event structure of Giving does not seem to hold true for Taking events (e.g., Tatone et al., 2015; Tatone et al., 2021). For instance, infants represented Giving events with a three-participant schema, but failed to do so for Taking events: after viewing animated abstract shapes, infants distinguished Giving from Disposing, but not Taking from Acquiring (Tatone et al., 2015). This suggests that, while the presence of a receiver (Goal) in Giving events signals a distinct event type, the presence of the deprived party (Source) in Taking events does not.

However, other considerations cast doubt on the hypothesis that spatial Sources and Goals, as well as the Goal bias, straightforwardly extend to the representation of transfer events. First, recent evidence challenges the presumed similarity between spatial Goals and non-spatial Goals, such as Recipients in transfer events: Ziegler and Snedeker (2018) demonstrated that sentences with spatial Goals (*The boy sprayed water on the plant*) failed to prime sentences with Recipients (*The woman fed the strawberry to the goose*), and vice versa. Cross-linguistic studies further support the conclusion that spatial Goals and Recipients should be kept separate: while the two kinds of roles show equally robust clustering across languages, there is no evidence suggesting that Goals are more fundamental or more likely to extend to Recipients than vice versa. Similarly, there is no evidence that Goals emerge earlier than Recipients in the history of different languages (e.g.,

Bickel et al., 2014; Hartmann et al., 2014; Haspelmath, 2003; Heine, 1990; Malchukov et al., 2010; see Rissman & Majid, 2019, for a review). These findings suggest that people's representations of spatial Goals and metaphorical Goals (such as Recipients) might be fundamentally distinct, indicating that the Goal bias might not automatically extend to transfer events. Instead, the early robust priority given to Recipients might stem from a separate cognitive system, possibly through a schema representation of socially significant actions.

1.3 Open issues

Currently, it seems clear that we need to broaden the available empirical evidence to assess the extent to which transfer events have a Source-Goal structure (including an asymmetric representation of the two roles). In particular, new empirical data need to address two issues. First, as mentioned already, the two participants in transfer events can also be construed as Agents and Patients (in addition to Sources and Goals). We know that Agents consistently occupy more prominent syntactic positions than Patients (Baker, 1997; Jackendoff, 1990; Levin & Rappaport Hovav, 2005; Pinker, 1989). In language production studies, speakers' descriptions of events have been found to follow this asymmetry (ünal et al., 2024; Wilson et al., 2014). Furthermore, this Agent bias also sometimes occurs in nonlinguistic conceptual processing of events. For instance, in frame-by-frame self-paced reading of comic book panels, readers spent more time looking at the Agent than the Patient (Cohn & Paczynski, 2013; cf. also ünal et al., 2024).

This well-established Agent bias affects our understanding of the apparent Goal bias in transfer events. While the findings reviewed earlier can be considered as initial evidence for a Goal bias in the linguistic encoding of transfer events, they could be alternatively explained by an Agent bias, namely, the tendency to map the Agent onto the Subject (Dowty, 1991). Specifically, previous studies that examined the Goal bias in transfer events (Fisher et al., 1994; Lakusta & Landau, 2005) looked at the different perspectives taken when describing the same event – e.g., a man giving the flower to the woman. In these scenarios, the Giver was inherently more agentive (i.e., had more active postures, initiated action; Hafri et al., 2013) than the Receiver. Therefore, it is possible that the preference for describing the event as Giving would stem from the fact that people tend to attend to the Givers first and select them as the subject of the sentence, rather than from a bias for a Goal-path perspective.

More generally, if the Agent bias affects transfer event descriptions, we would expect Agents (Givers or Takers) to be mentioned more frequently and more robustly encoded than Patients (Givees or Takees). Notice that the Agent-Patient role assignment cross-cuts the Source-Goal assignment: in Giving events, the Giver is both the Agent and the Source, while the Givee functions as both the Patient and the Goal. However, in a Taking event, the Taker is both the Agent and the *Goal*, while the Takee is both the Patient and the *Source*. It remains an open empirical question whether the Goal bias would emerge when Agentivity of the event participants is controlled for.

Second, even if transfer events are characterized by a Source-Goal structure and induce a Goal bias, a critical question is whether that Goal bias would generalize across speakers of different languages, given cross-linguistic variation in transfer event encoding. While the Goal bias in the motion domain has been documented across languages (Johanson et al., 2019; Regier & Zheng, 2007; Zheng & Goldin-Meadow, 2002), experimental studies of Source and Goal encoding in transfer events have been limited to English speakers.

Cross-linguistic research shows that languages typically have more numerous (Svorou, 1994) and semantically richer (Kabata, 2013) devices for encoding Goals compared to Sources. However, languages vary in their morphosyntactic capacity to encode Sources in transfer events, with some languages offering more robust Source-encoding options. Mandarin Chinese exemplifies this linguistic variation: unlike many other languages, it allows Sources in transfer events to be encoded not only as prepositional phrase adjuncts but also as verbal arguments, suggesting a more privileged status for Source encoding.

English permits certain verbs in Double Object Constructions (DOC), where indirect objects can be incorporated into the verb's argument structure (Gropen et al., 1989). For transfer of possession events, speakers can encode Recipients either through a Prepositional Phrase (1a) or as a direct argument following the verb (1b):

(1) a. I gave an apple to John.
b. I gave John an apple.
c. I took an apple from John.
d. *I took John an apple.

However, English does not allow the incorporation of Sources as indirect objects in its argument structure. For example, as shown in the contrast between (1c) and (1d), the Source can only be introduced by a prepositional phrase, but not as an indirect object in a DOC. Crucially, a Source DOC is allowed in Chinese (Huang, 2007). As shown in (2), the Source can either be introduced by the preposition *cong* or directly follow the verb in obtaining events (e.g. *na* 'take', *tou* 'steal', *mai* 'buy').

(2) a. Wo na-le John yi-ge pingguo.
1SG-NOM take-PERF John one-CL apple
'I took an apple from John.'

b. Wo cong John-na'er na-le yi-ge pingguo.
1SG-NOM from John-LOC take-PERF one-CL apple
'I took an apple from John.'

This additional morphosyntactic option for encoding Sources in transfer events raises important empirical questions: How frequently do Chinese speakers employ this construction when

describing Taking events, and does the availability of a structure promoting the Source to a core argument status increase overall Source encoding?

1.4 Current study

Our study investigates the linguistic representations of transfer events across languages, with the aim of addressing the open issues raised in 1.3. Within the transfer class, we focus on events of Giving and Taking with animate (human) participants for which different theories make maximally different predictions (see the end of 1.1). We examine the following key questions. First, we ask whether transfer of possession events, long characterized by some linguistic theories as containing Source and Goal paths, exhibit the linguistic Goal bias observed in simple motion events (Experiments 1 and 2). Importantly, we seek to isolate effects of the Goal bias during language production from agentivity effects. As mentioned already, previous evidence for a linguistic Goal bias in transfer events (favoring Giving over Receiving descriptions) is potentially confounded with the tendency to map Agents to Subject position. The preference for Giving descriptions might reflect speakers' tendency to begin sentences with Agents (who happen to be Givers), rather than a true Goal-path perspective. Notably absent from prior research is the systematic study of Taking events, where the Agent-first preference actually yields a Source perspective (e.g., *She took an apple from him* rather than *He lost an apple to her*). In Experiments 1 and 2, we examine descriptions of matched Giving events (Goal = Patient, Source = Agent) and Taking events (Goal = Agent, Source = Patient), treating Source-Goal and Agent-Patient dynamics as independent variables. This design allows us to disentangle any Goal bias from the established Agent bias.

Second, we explore cross-linguistic differences in transfer event descriptions by testing both English (Experiment 1) and Mandarin Chinese speakers (Experiment 2). Mandarin Chinese uniquely allows the Source to be encoded as a verbal argument, providing an opportunity to examine how this additional morphosyntactic option influences event descriptions. If the extent to which the Goal bias is manifested is influenced by the availability of linguistic encoding devices, we would expect it to be weaker or absent for Mandarin speakers. If the bias stems from universal processes in message planning, both language groups should show similar patterns. Together, our experiments bear on theories of thematic roles and event representation as the foundation for language production.

2. Experiment 1

In Experiment 1, we probed whether English speakers describing transfer events would mention Sources and Goals to different degrees during a language production task (taking into consideration Agent/Patient status).

2.1 Methods

2.1.1 Participants

Nineteen native speakers of American English who were recruited from the University of Pennsylvania subject pool participated for course credit. Sample size was determined based on prior adult studies using comparable paradigms to assess role-based asymmetries in linguistic event encoding (e.g., Papafragou, 2010, n = 16; Lakusta & Landau, 2012, n = 14).

2.1.2 Materials

We constructed videos consisting of actions carried out by four characters that were described to participants as forming two pairs of twins. The four characters were played by two actresses. One actress played Ruby (when in a red hoodie) and Grace (when in a green dress). The other actress played Harry (with a hat) and Mitch (with a mustache).

Our critical stimuli were 12 pairs of video clips, each pair depicting a Giving and a Taking event with the same object. These 12 pairs were generated by crossing the all **four possible unique character pairings** (Harry-Ruby, Harry-Grace, Mitch-Ruby, and Mitch-Grace) with **two role assignments** (which character served as Agent vs. Patient). As a result, in these critical events, all four characters appeared equally often (6 times each) and with equal chances to appear as Agent or Patient (3 times each). Each character pair also appeared the same number of times. In Giving events, the Agent gave the object to the Patient (**Figure 1a**). In Taking events, the Agent took the same object from the Patient (**Figure 1b**). The Patient always performed only minimal actions (i.e., raising hands, looking at the transferred object) and was otherwise static. Each clip lasted two to three seconds.

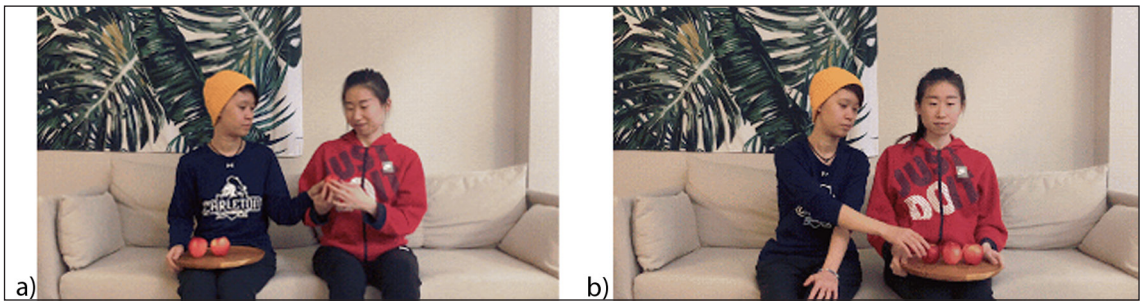

Figure 1: (a) Sample frame of a Giving event ('Harry gave an apple to Ruby'). **(b)** Sample frame of the corresponding Taking event ('Harry took an apple from Ruby').

In addition to the critical events, we also created 3 types of Fillers, which did not involve transfer of possession. There were 6 video clips depicting one-participant events (**Figure 2a**), 6 clips depicting events where one participant was a complete bystander (**Figure 2b**), and 6 clips

depicting joint-action events (**Figure 2c**). We included a variety of event-participant numbers and dynamics to reassure participants that, during the description task, mentioning only one character in the event was acceptable.

Figure 2: (a) Sample first frame of a one-participant event ('Harry was opening a package'). **(b)** Sample first frame of a bystander event ('Harry was eating an orange'). **(c)** Sample first frame of a joint-action event ('Mitch and Grace were folding a blanket').

In order to compare the linguistic encoding of Giving vs. Taking events within participants, we put the Giving and the Taking version of each event (e.g., the events represented in **Figures 1a** and **1b**) in two separate lists. Each participant was randomly assigned to one experimental list. Therefore, for each video pair, each participant either saw a Giving version or a Taking version. Importantly, each list was organized such that half of the critical trials were Giving events and the other half were Taking events. The filler events, as well as their order among the critical events in the two lists, were identical (see the Appendix for the complete list of critical events). Therefore, participants in the two lists saw an identical set of stimuli, except for the Giving-Taking reversal.

2.1.3 Procedure

Participants were directed to this online experiment, built in PCIbex (Zehr & Schwarz, 2018), via a URL link. After participants provided written consent, the experiment started. First, we familiarized participants with the characters' characteristics and names. An identification task was administered to make sure that participants were able to correctly distinguish and name the twins. Then, participants were given the verbal description task. They were told to describe what happened in each of the short video clips. Three example trials, one of each filler type, with possible descriptions were given to show the participants that they were not obligated to mention all the characters in the events in every case. These example events did not appear in the actual task. After viewing the three example trials, participants proceeded to describe the 30 video clips (12 critical events and 18 filler events). On each trial, participants were prompted to type their description of the event in a textbox below the video clip right after the video played once. These typed responses were directly used for coding and analysis.

2.1.4 Analysis and predictions

The nineteen participants produced 228 critical responses. We excluded from analysis trials in which the description did not match the video (n = 16).[1] The remaining responses included a variety of Give (*give, feed, pass*) and Take (*take, steal*) verbs.

Our analysis of participants' linguistic descriptions was twofold. First, we looked at whether the characters that assumed the role of Goal in the event (i.e., Givee and Taker) were more likely to be mentioned by the participants, compared to those that assumed the role of Source (i.e., Giver and Takee). In order to do that, we built a logistic mixed-effects model to predict whether a character was mentioned. The model included Role (Goal vs. Source, sum-coded) as a fixed effect and random by-participant and by-event-pair intercepts. Based on prior work showing the relative prominence of Agents over Patients (e.g., Dowty, 1991; Wilson et al., 2014), we added Agency (Agent vs. Patient, sum-coded) as an independent fixed effect as well as its interaction term with Role in the model. We hypothesized a main effect of Agency – participants would be more likely to mention a character that is an Agent than one that is a Patient – and a main effect of Role – participants would be more likely to mention a character that is a Goal than one that is a Source. Note that in Giving events, the Agent (Giver) was the Source, and the Patient (Givee) was the Goal. However, in Taking events, the Agent (Taker) was the Goal, and the Patient (Takee) was the Source. Since the Takee was both a Patient and a Source, we expected it to be mentioned the least. We hypothesized an interaction between Agency and Role: since Agents typically occupy subject positions, which are obligatory in English, the difference in mention rates between Goals and Sources might only emerge when they are Patients. However, we still included Agent comparisons, because speakers can omit Agents by reconstruing events from a different perspective – for example, the event encoded as *Harry gave Ruby an apple* can also be described as *Ruby got an apple*.

Second, we looked at how the characters that were mentioned were linguistically encoded. Specifically, we asked whether they were truly encoded as surface Goal/Sources with the canonical linguistic devices for Source/Goal encoding in English. For example, in a description such as "Harry took Ruby's apple", although the character Ruby was mentioned, in the strict sense, Ruby was encoded as a possessor and her status as Source was only inferred. Following previous work (Lakusta & Landau, 2012; Papafragou, 2010), we considered prepositional phrases (PP) headed by *from*, *out of,* or *off* to be the only Source-encoding devices in English and prepositional phrases headed by *to*, *onto,* or *into*, as well as indirect objects (IO) in a DOC, as Goal-encoding devices. We

[1] The exclusion criteria were the following: (1) Trials with incomplete sentences were excluded. (2) Trials that were inaccurate descriptions of the event (e.g. describing the event in which Grace took the controller from Mitch as "Mitch gave it to Grace") were excluded. (3) Trials in which participants didn't construe the event as a transfer event as intended were excluded (e.g., describing the event in which Harry passed the ball to Ruby as "Harry and Ruby were playing catch with each other"). The same criteria were used in Experiment 2.

predicted that Goal characters were more likely to be encoded as bona fide surface-level Goals than Source characters were as surface-level Sources.

2.2 Results and discussion

2.2.1 Characters mentioned

As can be seen in **Figure 3a**, participants were highly likely to mention all characters. Participants always mentioned the Agent of each event (i.e., the Source in Giving events and the Goal in Taking events), with no exception. They also always mentioned the Patient, including it 100% of the time when it was the Goal of a Giving event and 95% of the time when it was the Source of a Taking event.

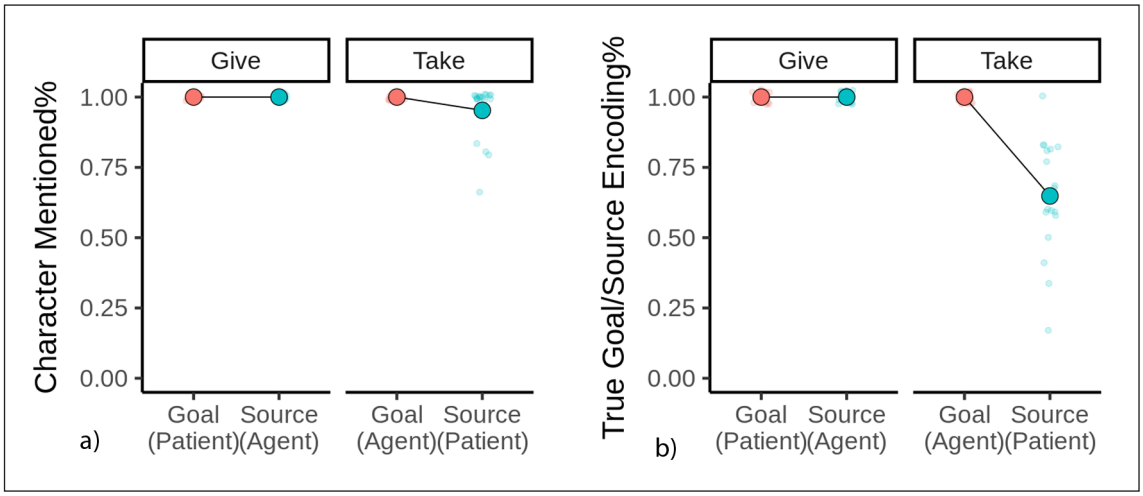

Figure 3: (a) English speakers' mean proportion of mentioning the Goal/Source character in their linguistic description. **(b)** English speakers' mean proportion of encoding the Goal/Source character as a true (formal) Goal/Source in their linguistic description.

With respect to our planned analysis, since Agents were 100% mentioned, to avoid singularity issues, we did not include Agency and its interaction with Role in the model.[2] In other words, we only compared Sources and Goals mentioned when they were both Patients – whether the same character was more likely to be mentioned when she was given something, compared to when she was deprived of something. Despite the overall high rates of mention, Source characters were still significantly less likely to be mentioned than Goal characters (Est = –2.465, SE = 1.48, p = 0.024). As demonstrated by **Figure 3a**, the difference between Source and Goal character

[2] Due to convergence failure with random effects and near-perfect separation in the data, we used a simple logistic regression with Firth correction rather than a mixed-effects model in Experiment 1.

mention emerged specifically in Patient mentions: while speakers consistently mentioned Agents in both Giving and Taking events and always mentioned Patient Goals in Giving events, they sometimes omitted Patient Sources in Taking events.

2.2.2 Source/Goal encoding

We further looked at how the Goal and Source characters were linguistically encoded. First, Agents were mapped to subjects regardless of whether they were the Goal (in Taking events) or the Source (in Giving events). Note that this did not have to be true: the event encoded as *Harry gave an apple to Ruby*, where Harry is the Agent, can also be encoded as *Ruby got an apple from Harry* or *Ruby was given an apple (by Harry)*. Similarly, a Taking event encoded as *Harry took an apple from Ruby* can also theoretically be encoded as *Ruby lost an apple (to Harry)*. However, all of our participants abided by the Agent-subject mapping (Dowty, 1991).

On the other hand, when encoding the Patient characters, participants showed different surface-level patterns, depending on whether these were Source or Goal characters. English speakers always encoded the Patient Goal characters as true formal Goals, predominantly with one of the two canonical Goal-encoding devices in English – IO or PP. They slightly preferred using an IO and used it in 65.42% of total Giving trials (see **Table 1**).

Table 1: Form of Patient Goal character mentions in English-speaker participants' linguistic descriptions of Giving events.

	Linguistic Device	**Example**	**True Goal Encoding?**	**%**
Mentioned	Indirect object in DOC	Harry gave Ruby an apple.	Yes	65.42
	Goal PP complement	Grace gave keys to Mitch.	Yes	32.71
	Included in a specific Goal PP	Harry poured some juice into Ruby's glass.	Yes	1.87

However, when encoding the Patient Source characters, participants' surface-level strategies were more diverse (see **Table 2**). About two-thirds of the time, participants used a Source PP to describe these Taking events. Within these Source-PP trials, in around 15% of the instances, the character appeared within the PP, but not as its direct complement (e.g., "Harry took the keys from Ruby's hand"). In a substantial portion of these Taking trials (around 27%), participants mentioned the Source character as a possessor of the transferred object (e.g., "Harry took Ruby's apple"), rather than encoding it as a true surface-level Source.

Table 2: Form of Patient Source character mentions in English-speaker participants' linguistic descriptions of Taking events.

	Linguistic Device	Example	True Source Encoding?	%
Mentioned	Source PP complement	Harry took an apple from Ruby.	Yes	49.52
	Included in a specific Source PP	Grace took the water filter from Mitch's hands. Harry grabbed an apple from the tray Ruby was holding.	Yes	15.24
	Possessor	Grace took Mitch's pitcher.	No	26.67
	Other	Ruby poured a drink and Harry took it.	No	3.81
Not mentioned	∅	Ruby grabbed a plant.	No	4.76

To test the Source–Goal asymmetry under a more conservative coding scheme, we counted Source and Goal as encoded only when they were expressed via canonical Source/Goal devices. We then constructed a second logistic mixed-effects model focusing only on Patient characters (as Agents were invariably encoded as subjects). The model predicted true surface-level Source/Goal encoding based on Role (Goal vs. Source, sum-coded) and included random by-participant intercepts. This analysis revealed an even stronger asymmetry: participants were significantly more likely to formally encode Goal characters as Goals than Source characters as Sources (Est $= -4.768$, SE $= 1.432$, $p < 0.001$) (**Figure 3b**).

These results demonstrate a clear bias against Sources in the linguistic encoding of transfer events. Characters filling the role of (conceptual) Sources were not only mentioned less frequently than those filling the role of (conceptual) Goals, but when they were mentioned, they often appeared as modifiers of the transferred object rather than as core event participants.

3. Experiment 2

We next examined how Mandarin Chinese speakers describe the same set of transfer events used in Experiment 1. Specifically, we investigated their use of Double Object Constructions (DOC) to encode Sources as verbal arguments in Taking events and asked whether this additional linguistic option might increase Source encoding and reduce the Goal bias.

3.1 Methods

Experiment 2 was identical to Experiment 1, except that the instructions for the experiment were in Mandarin Chinese. The participants were twenty native speakers of Chinese recruited from the

University of Pennsylvania's subject pool.[3] Just as in Experiment 1, we excluded from analysis trials in which the description did not match the video (n = 24).

3.2 Results and discussion

3.2.1 Characters mentioned

The pattern of character mentions paralleled that of Experiment 1. As shown in **Figure 4a**, Chinese speakers, like English speakers, mentioned Agents more frequently than Patients. Since Agent mentions were, again, categorical, we excluded Agency and its interaction with Role from the model to avoid singularity issues, focusing instead on Patients. The model revealed that Chinese speakers mentioned Patient Goals significantly more often than Patient Sources (Est = 1.399, SE = 0.522, p = 0.007).

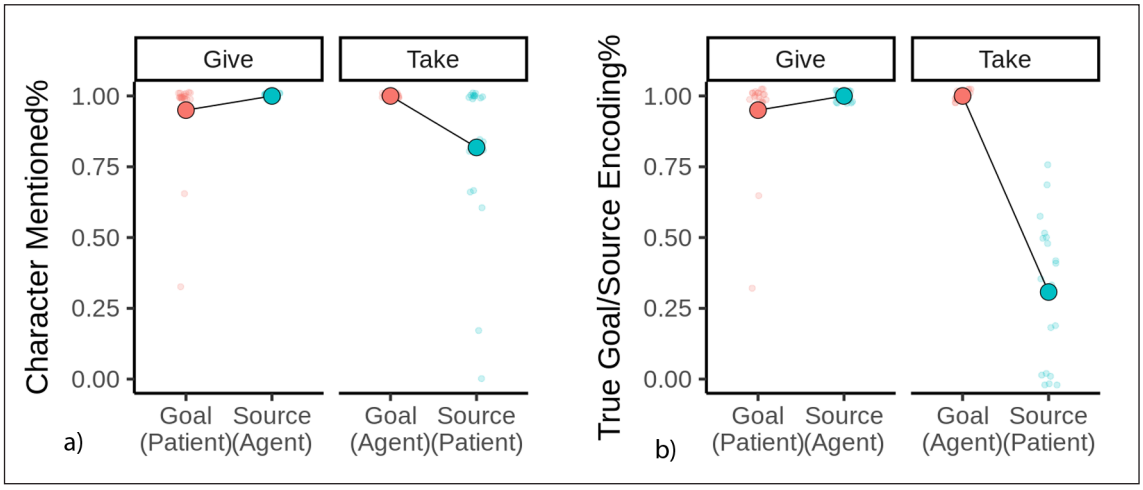

Figure 4: (a) Chinese speakers' mean proportion of mentioning the Goal/Source character in their linguistic description. **(b)** Chinese speakers' mean proportion of encoding the Goal/Source character as a true (formal) Goal/Source in their linguistic description.

An additional logistic mixed-effects model predicting character mentions based on Role and Language (English vs. Chinese, sum-coded) confirmed that the Goal bias persisted across both language groups (Est = 1.761, SE = 0.613, p = 0.004). While Chinese speakers showed a tendency to omit Patients more frequently than English speakers, this difference was not statistically significant (Est = 1.246, SE = 0.70, p = 0.076).[4]

[3] We are aware that, given the recruitment method, these native Mandarin Chinese speakers are necessarily English-Chinese bilingual. The Mandarin Chinese instructions and examples should provide a natural context for Chinese encoding. However, we remain open to the possibility that monolingual Mandarin Chinese speakers might show different encoding preferences, which might arguably be more different from the English pattern.

[4] While the Language x Role interaction provides the most direct test of cross-linguistic differences in Goal bias magnitude, models including this term failed to converge or produced unstable estimates. We therefore report a model without the interaction term here and below in 3.2.2.

3.2.2 Source/Goal encoding

Just as in Experiment 1, an even stronger Source-Goal asymmetry was found when we subjected the linguistic encoding of the characters to a more rigid coding schema – noting whether the characters were truly encoded with formal Source/Goal encoding devices in Chinese (**Figure 4b**). In Chinese, the Goal-encoding devices are as direct objects of transfer verbs,[5] indirect objects in a DOC, and prepositional phrases headed by *gei* 'to'. The Source-encoding devices are as indirect objects (IO) in a Source DOC and prepositional phrases headed by *cong* 'from'.

Just like their English-speaking counterparts, all Chinese speakers abided by the Agent-subject mapping, encoding Agents as subjects regardless of whether they were Goal or Source. Similarly, Chinese speakers encoded almost all the Patient Goals as true Goals (M = 95%). The most popular encoding devices for the Patient Goal character were as indirect objects in a DOC and as direct verbal complements (**Table 3**).

Table 3: Form of Patient Goal character mentions in Mandarin-speaking participants' linguistic descriptions of Giving events.

	Linguistic Device	**Example**	**True Goal Encoding?**	**%**
Mentioned	Indirect Object in DOC	Xiaomao gei Xiaohong yi-ge pingguo. Harry give Ruby one-CL apple 'Harry gave Ruby an apple.'	Yes	48.96
	Direct Verbal complement	Xiaomao ba yi-ge pingguo gei-le Xiaohong. Harry BA one-CL apple give-PERF Ruby 'Harry gave Ruby an apple.'	Yes	39.58
	Goal PP complement	Xiaolv di shoubing gei Xiaohu. Grace pass controller to Mitch 'Grace passed the controller to Mitch.'	Yes	7.29
Not mentioned	∅	Xiaohu di-le maozi. Mitch pass-PERF hat 'Mitch passed a hat.'	No	4.17

Chinese speakers only encoded Patient Source characters as true Sources 31% of the time (see **Table 4**). The low rate of true Source encoding is due to the popularity of two strategies. Similar to English speakers, one popular strategy for mentioning the Patient Source characters was to encode them as possessors of the transferred object (35%). The other popular strategy

[5] In that case, the transferred object was then introduced as an additional argument through the BA construction.

was to embed the Patient character in a NP modifier of the transferred object (16.6%). A logistic mixed-effects model predicting whether the Patient character was encoded as a true Source/ Goal with Role (Goal vs. Source) as a fixed effect and random intercepts of participants and event pairs showed that Chinese speakers were more likely to encode Patient Goal characters as true (formal) Goals than to encode Patient Source characters as true Sources (Est = 2.815, SE = 0.547, $p < 0.001$).

Table 4: Form of Patient Source character mentions in Mandarin-speaking participants' linguistic descriptions of Taking events.

	Linguistic Device	**Example**	**True Source Encoding?**	**%**
Mentioned	Source PP Complement	Xiaomao cong Xiaohong-na'er na-le yi-ge pingguo. Harry from Ruby-LOC take-PERF one-CL apple 'Harry took an apple from Ruby.'	Yes	4.59
	In a specific Source PP	Xiaomao cong Xiaohong de panzi-li na-le yi-ke pingguo. Harry from Ruby POSS tray-in take-PERF one-CL apple 'Harry took an apple from Ruby's tray.'	Yes	22.02
	Indirect object in Source DOC	Xiaohu na-le Xiaolv maozi.[6] Mitch take-PERF Grace hat 'Mitch took Grace's hat.'	Yes	4.59
	In a NP modifier of theme	Xiaolv nazou-le Xiaohu shouli de shuihu. Grace take- PERF Harry hand-inside POSS kettle 'Grace took the kettle that was in Harry's hand.'	No	16.60
	Possessor	Xiaohu na-le Xiaolv de maozi. Mitch take-PERF Grace POSS hat 'Mitch took Grace's hat."	No	34.86
Not mentioned	∅	Xiaomao na-le yi-ge pingguo. Harry take-PERF one-CL apple 'Harry took an apple.'	No	15.60

[6] Note that although omission of the possessive marker *de* is possible in Mandarin Chinese, this is not a case of "*de*-omission" (compare the possessor example sentence). First, it is not possible to omit *de* between a proper noun and a possessed item. Second, the patient can also be passivized: *Xiaolv bei Xiaohu na-le maozi*, with a literal English translation '(lit.) Grace was taken a hat by Mitch'.

We ran the model predicting true Source/Goal encoding on the combined data of both English speakers and Chinese speakers, adding Language as a fixed effect. The model confirmed that, for both language groups, Patient Sources were less likely to be encoded as formal Sources than Patient Goals as formal Goals (Est = 2.823, SE = 0.419, $p < 0.001$). Chinese speakers were also less likely to encode both types of Patients with canonical Source or Goal encoding devices in general (Est = 1.084, SE = 0.283, $p < 0.001$).

These results revealed a similar Goal bias in both English and Chinese speakers' descriptions of transfer events, despite differences in available linguistic devices for Source encoding. Even though Chinese speakers could encode Sources in more prominent syntactic positions, this option did not increase their Source encoding. The most salient cross-linguistic difference was that Chinese speakers were generally less likely to use Source/Goal encoding devices for Patient characters, which reflects the accessibility of alternative syntactic strategies in Mandarin (e.g., relative clauses) that allow speakers to refer to these Patient characters without relying on canonical Source/Goal encoding structures.

The persistence of a Goal bias in both languages suggests that the Goal bias in language cannot be attributed solely to limitations in Source encoding devices, but likely reflects universal constraints on event descriptions.

4. General discussion

Our study investigated how two languages encode transfer events to shed light on cross-linguistic event representations. Across two experiments with English and Mandarin speakers, we examined the linguistic packaging of Giving and Taking events, an ideal test case because they involve rich thematic structure, three-argument verb frames, and well-known cross-linguistic differences in lexical and morphosyntactic encoding. We asked whether Source and Goal paths (and the asymmetry between them that is well-established in the spatial domain) also structure the representation of transfer events. This question bears on an ongoing theoretical debate about whether Source/Goal path concepts generalize beyond the spatial domain, and yet where empirical evidence remains limited, especially in languages other than English.

4.1 A Goal bias in the linguistic encoding of transfer events

Our results reveal a consistent Goal bias in descriptions of transfer events: participants were more likely to mention a character as a Givee than as a Takee (Experiments 1 and 2). We also found an unequivocal Agent bias, with Agents rarely omitted, consistent with previous findings in causative events (Baker, 1997; Cohn & Paczynski, 2013; Ünal et al., 2024) and the tendency to map Agents onto subjects (Dowty, 1991). By comparing minimally-paired Giving and Taking events, and systematically considering the Agent-Patient role assignments in parallel with Source-

Goal assignments, we were able to uniquely demonstrate that the linguistic Goal bias in transfer events exists independently of Agent-to-subject mapping tendencies.

Taken together, our linguistic findings extend the scope of the Goal bias from motion events (Chen et al., 2023, 2024; Do et al., 2020; Papafragou, 2010) to transfer events, complementing previous research showing preferences for Goal/Giving perspectives (Fisher et al., 1994; Lakusta & Landau, 2005) and Goal-oriented reference patterns (Arnold, 2001; Johnson & Arnold, 2023). Particularly, whereas discourse studies document a Goal bias in re-mention once Source/Goal information has been linguistically introduced, our data show a parallel bias during initial event descriptions, when Source/Goal roles are only non-linguistically given and must be selected for encoding. These findings are consistent with theoretical accounts that model transfer events as containing implicit Goal and Source paths (e.g., Jackendoff, 1983, 1990). At the same time, they do not rule out the possibility that transfer events invoke a distinct Recipient role, such that the observed production asymmetry reflects a Recipient bias, rather than the same Goal bias documented for spatial events. These biases could, nonetheless, be related, given the semantic overlap between Goals and Recipients. For simplicity, we adopt the Goal/Source path account as our working explanation.

The attentive reader may wonder whether this conclusion accounts for all available evidence beyond our own studies. Recall that Ziegler and Snedeker (2018) demonstrated that sentences with spatial Goals failed to prime sentences with Recipients, and vice versa. Furthermore, there is no evidence suggesting that Goals are more fundamental or more likely to extend to Recipients than vice versa in cross-linguistic data, and no evidence that Goals emerge earlier than Recipients in the history of different languages (e.g., Bickel et al., 2014; Hartmann et al., 2014; Haspelmath, 2003; Heine, 1990; Malchukov et al., 2010; see Rissman & Majid, 2019, for a review). How can we reconcile these findings, which suggest separate and parallel representations of Recipients and Goals, with our own findings (and other prior work compatible with our data) suggesting an underlying Goal path structure in transfer events?

There are different options for arriving at a theoretical synthesis. One possibility is to reframe the relation between transfer and motion events to avoid the commitment that the observed Source-Goal structure is *primarily* and *essentially* spatial, such that its application to the transfer domain is a case of metaphorical extension. In some parts of his work, Jackendoff (1983, p. 210) seems to propose this option: “I am inclined to think of thematic structure not as spatial metaphor but as an abstract organization that can be applied with suitable specialization to any field. If there is any primacy to the spatial field, it is because this field is so strongly supported by nonlinguistic cognition.” On this view, the spatial domain would, then, simply be privileged in terms of the application of this broader organizational principle. Even though currently underspecified, this view could explain the lack of primacy of spatial Goals over Recipients in both cross-linguistic data and the history of different languages (Bickel et al., 2014; Hartmann

et al., 2014; Haspelmath, 2003; Heine, 1990; Malchukov et al., 2010), as well as the absence of priming effects across spatial Goals and Recipients (Ziegler & Snedeker, 2018). It would also be consistent with the independent effects of Agents in our own data. This possibility also seems compatible with the proposal that infants process Giving and Taking events differently because of distinct schemas for understanding social interactions (Tatone et al., 2015).

A second, somewhat related, possibility is that event roles in both language and cognition can be located and defined at different levels of event architecture. For instance, the roles involved in motion and transfer events may be representationally distinct (as proposed, for instance, in Rappaport Hovav & Levin, 2008), but connected at some higher level of abstraction. There are various proposals across different linguistic frameworks for hierarchically organizing thematic structure (Dowty, 1991; Van Valin & LaPolla, 1997). For instance, in Dowty's (1991) system, there are verb-specific roles, more abstract roles – such as Agent and Patient – that cross-cut several verb classes, and, further, prototypical roles (proto-Agents and proto-Patients). Even if this organization exists in the specific cases discussed in our article, however, it does not surface in priming studies of spatial Goals and Recipients (for discussion, see Ziegler & Snedeker, 2018). Additional evidence is needed to arbitrate more decisively between the two accounts, for example, including directly testing cross-structural priming between spatial Goals and transfer Recipients (and vice versa) and individual-difference correlations in Goal/Source mention across spatial and transfer domains.

4.2 The cross-linguistic encoding of transfer events

An important aspect of our findings was that the Goal bias in production appeared consistently across both English (Experiment 1) and Mandarin Chinese (Experiment 2) speakers, revealing a striking pattern that persisted despite significant cross-linguistic differences. While Mandarin Chinese provides speakers with more prominent syntactic positions for Sources, which allow them to encode Sources as incorporated verbal arguments rather than just prepositional adjuncts, this additional linguistic resource did not lead to more robust Source encoding: Mandarin speakers neither mentioned Sources more frequently nor encoded them as true Sources more often than English speakers. Instead, they were slightly more likely to opt to indicate Sources indirectly through possessor mentions.

At the same time, the cross-linguistic similarity in omission patterns is not straightforwardly attributable to what each language "allows". Both languages provide constructions that can, in principle, express the relevant arguments. For example, English *take* readily licenses a Source prepositional phrase (e.g., *take X from Y*), and the discourse context in our elicitation task, which was highly constrained and repetitive with constant participants and a salient Recipient, could plausibly license reduced *give* descriptions that omit the Givee (e.g., *Harry gave a hat*). Nonetheless, even when Source expressions were fully licensed, speakers often omitted the Source

in *take* descriptions, whereas Recipient omission in descriptions of giving was unattested in English and rare in Mandarin. While it is open to debate whether the Recipient is grammatically required in both languages, Recipient expression with *give* is arguably more conventionalized and grammaticalized as the canonical transfer frame than Source expression is with *take*, and this difference in conventionalization may contribute to the observed asymmetry. Taken together, these considerations suggest that the observed pattern reflects an interplay between language-specific grammatical affordances and speakers' production choices in the task context, rather than being reducible to grammatical possibility alone.

The cross-linguistic stability in the Source-Goal asymmetry echoes similar findings in the broader literature. For instance, Johanson et al. (2019) documented the persistence of the Goal bias across languages with varying motion encoding strategies, suggesting a deeper pattern that transcends surface-level linguistic differences. If the Goal bias was purely a product of linguistic constraints or conventions, we might expect it to vary more substantially across languages with different encoding options. Instead, its preservation across users of diverse linguistic systems suggests that this asymmetry originates, at least partially, from shared, potentially universal processes that shape how humans design event messages in communication. At the same time, the present data do not allow us to fully disentangle conceptual contributions from language-specific grammatical and discourse constraints, and future work will be needed to more directly arbitrate among these sources.

4.3 Parallel asymmetry in nonlinguistic representation of transfer?

The robust production asymmetry observed in both English and Mandarin is consistent with the possibility that speakers' linguistic choices reflect underlying nonlinguistic representations of transfer events. At the same time, this inference is necessarily tentative. Establishing a parallel asymmetry in nonlinguistic encoding requires direct evidence from tasks that probe memory and/or attention to event participants.

There are reasons to expect such a parallel. In particular, patterns in event description often covary with memory for event components (e.g., Fausey & Boroditsky, 2011; see Papafragou & Grigoroglou, 2019, for a review). In the spatial domain, a Goal advantage has been reported repeatedly in memory for Goals versus Sources (e.g., Chen et al., 2023, 2024; Do et al., 2020; Lakusta & Landau, 2012; Papafragou, 2010; Regier & Zheng, 2007). Especially relevant are findings suggesting that sensitivity to three-participant structure is more robust for Giving events than for Taking events in infants and adults (e.g., Tatone et al., 2015, 2021; Yin et al., 2022).

However, the link between linguistic asymmetries and nonlinguistic representations may be more complex than a one-to-one mapping. Conceptual biases may shape production while failing to surface in nonlinguistic tasks, depending on event structure, participant properties, and task demands. Prior work has documented dissociations between linguistic and memory

asymmetries, including for motion events with inanimate or non-intentional Agents (Lakusta & Carey, 2015; Lakusta & Landau, 2012) and for more complex causal events (Ünal et al., 2021, 2024). For example, Lakusta and Landau (2012) found that although speakers maintained a Goal bias in descriptions of motion events, memory for Sources versus Goals in those same events did not show a corresponding asymmetry. Animacy is especially important when considering transfer events, which (unlike previously studied motion events) depict interactions between two humans. Because animacy strongly shapes event apprehension, the prominence of multiple intentional agents could reduce or alter the expression of Goal and Agent biases in memory, even when production remains Goal-oriented. Methodological choices also matter. Chen et al. (2024) show that Goal advantages in motion events are reliably observed in change-detection tasks, the paradigm used in much of the prior memory literature, but can be attenuated or absent in forced-choice paradigms, where aided retrieval may boost memory for otherwise weakly encoded components, such as Sources. This suggests that null effects in memory need not imply the absence of conceptual asymmetry; they may instead reflect the demands and affordances of the particular task.

Future work is, therefore, needed to assess nonlinguistic role representations in transfer, using converging methods, including direct comparisons between same–different and forced-choice paradigms and manipulations of Givee/Takee animacy. We are currently conducting follow-up studies along these lines. Regardless of the outcome of the future work, the implications for the language–cognition interface will be informative. If a parallel memory asymmetry emerges, it would add to evidence that the relative prominence of event components often aligns across language and event cognition (e.g., Lakusta & Landau, 2005, 2012; Papafragou, 2010; Wilson et al., 2014; Ünal et al., 2021, 2024). If no memory asymmetry emerges, this would provide another case in which linguistic and memory asymmetries diverge, reinforcing the view that language is not an exhaustive representation of conceptual representational resources (e.g., Gleitman & Papafragou, 2005, 2013; Ünal & Papafragou, 2016). Such a pattern would also align with Perkins et al. (2025), who show that although infants represent Taking events in terms of distinct participant roles, they readily accept linguistic descriptions that omit the Takee (e.g., *She is pimming the truck*). In this scenario, adult production asymmetries may reflect how language-specific argument structure interfaces with event representations, rather than requiring a one-to-one correspondence with memory. Either way, the broader goal is to develop a more fine-grained account of how language production accesses, and sometimes departs from, the nonlinguistic conceptual structure of transfer events.

4.4 Conclusion

In sum, across two experiments with English and Mandarin speakers, we examined how transfer events are linguistically encoded. In both groups, participants' descriptions showed a Goal bias

that mirrors the well-documented asymmetry in spatial event encoding. This convergence has two key implications. First, it provides empirical support for theories positing that Source/Goal path structure generalizes to the linguistic encoding of transfer events. Second, the close alignment between English and Mandarin, despite substantial differences in their lexical and morphosyntactic resources, suggests that the Goal bias in production reflects shared, potentially universal mechanisms shaping how events are mapped onto language.

Appendix

Table A1: All critical events in Experiment 1. The two lists contain different role assignments.

	List 1		**List 2**
Giving	Harry gives Grace an apple.	Taking	Harry takes an apple from Grace.
	Harry pours Ruby some juice.		Harry takes some juice from Ruby.
	Ruby passes Harry a ball.		Ruby takes a ball from Harry.
	Ruby brings Mitch a pair of sunglasses.		Ruby takes a pair of sunglasses from Mitch.
	Grace gives Harry a gaming stick.		Grace takes a gaming stick from Harry.
	Mitch passes Ruby a hammer.		Mitch takes a hammer from Ruby.
Taking	Harry takes some yogurt from Ruby.	Giving	Harry feeds Ruby some yogurt.
	Ruby takes a plant from Mitch.		Ruby gives Mitch a plant.
	Grace takes a key from Harry.		Grace gives Harry a key.
	Grace takes a kettle from Mitch.		Grace gives Mitch a kettle.
	Mitch takes a pillow from Grace.		Mitch gives Grace a pillow.
	Mitch takes a hat from Grace.		Mitch brings Grace a hat.

Table A2: Experiment 1: Logistic regression predicting Source/Goal mention (penalized ML).

Predictor	**Estimate**	**SE**	**p**
Intercept	5.37	1.42	$<.001$
Role (Source)	–2.47	1.48	.024

Note. N = 212. Estimates are log-odds. P-value for Role is from likelihood ratio test.

Table A3: Experiment 1: Logistic regression predicting true Source/Goal encoding (penalized ML).

Predictor	**Estimate**	**SE**	**p**
Intercept	5.37	1.42	$<.001$
Role (Source)	–4.77	1.43	$<.001$

Note. N = 212. Estimates are log-odds. P-value for Role is from likelihood ratio test.

Table A4: Experiment 2: Mixed-effects model predicting Source/Goal mention.

Predictor	Estimate	SE	z	p
Fixed Effects				
Intercept	5.87	1.16	5.04	$<.001$
Role	2.88	0.76	3.80	$<.001$
Random Effects	**Variance**	**SD**		
ID (Intercept)	12.16	3.49		
Event Pair (Intercept)	0.64	0.80		
Role (Slope, by ID)	1.1846	1.0884		

Note. N = 205. Model includes random intercepts for ID and EventPair and random slopes of Role by ID.

Table A5: Experiment 2: Mixed-effects model predicting true Source/Goal encoding.

Predictor	Estimate	SE	z	p
Fixed Effects				
Intercept	1.53	0.59	2.60	.009
Role	2.82	0.55	5.15	$<.001$
Random Effects				
ID (Intercept)	2.59	1.61		
Event Pair (Intercept)	0.80	0.89		

Note. N = 203. Model includes random intercepts for ID and EventPair.

Table A6: Experiments 1 vs. 2: Mixed-effects model predicting Source/Goal mention.

Predictor	Estimate	SE	z	p
Fixed Effects				
(Intercept)	7.95	1.20	6.60	$<.001$
Role	3.60	0.84	4.29	$<.001$
Language	1.00	0.63	1.59	.112
Random Effects	**Variance**	**SD**		
ID (Intercept)	15.09	3.88		
Event Pair (Intercept)	1.29	1.13		
Role (Slope, by ID)	1.622	1.274		

Note. N = 417. Model includes random intercepts for ID and EventPair and random slopes of Role by ID.

Table A7: Experiments 1 vs. 2: Mixed-effects model predicting true Source/Goal encoding.

Predictor	Estimate	SE	z	p
Fixed Effects				
(Intercept)	2.53	0.55	4.56	$<.001$
Role	2.82	0.42	6.74	$<.001$
Language	1.08	0.28	3.83	$<.001$
Random Effects	**Variance**	**SD**		
ID (Intercept)	1.44	1.20		
Event Pair (Intercept)	1.56	1.25		

Note. N = 415. Model includes random intercepts for ID and EventPair.

Data accessibility statement

All data and analysis scripts associated with this article are available at this github repository: https://github.com/cheny39/Give_Take.

Ethics and consent

This research received approval from the University of Pennsylvania Institutional Review Board. Consent was obtained from all participants.

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Competing interests

The authors have no competing interests to declare.

Author contributions

Yiran Chen: Conceptualization, Data curation, Formal analysis, Methodology, Visualization, Funding acquisition, Writing – original draft, Writing – review & editing.

John Trueswell: Conceptualization, Supervision, Resources, Writing – review & editing.

Anna Papafragou: Conceptualization, Supervision, Resources, Writing – review & editing.

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