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Encoding transfer of possession events

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Abstract. The present study focuses on the linguistic and non-linguistic encoding of giving and taking events. For both English and Mandarin Chinese speakers, we find that the linguistic encoding of these transfer events respects the Thematic Hierarchy and the Source-Goal asymmetry (Exp.1 and 2): Agents are mentioned more often than Patient; Goals are encoded more often than Sources. However, in non-linguistic representation, the bias against Sources is not observed (Exp.3 and 4): Giver, Givee, Taker and Takee are equally prominent in memory. Taken together, our results support linguistic theories extending Source/Goal paths to Transfer of Possession events and call for a finer-grained account of homology between linguistic and non-linguistic encoding of events.

Keywords. source-goal asymmetry; goal bias; event cognition; thematic roles; transfer of possession; psycholinguistics

1. Introduction. The same event can be described in many ways depending on the speaker's perspective. For example, a simple event such as a squirrel going from a mailbox to a trash can be described as "The squirrel went to the trash can", "The squirrel came from the mailbox" or "The squirrel went from the mailbox to the trash can". Recent research has demonstrated an asymmetry between the origins (Source) and endpoints (Goal) of motion events: if people were to describe the aforementioned example event, they would mention the Goal ("to the trash can") more often than the Source ("from the mailbox") (Lakusta & Landau 2005, Lakusta & Landau 2012, Papafragou 2010, Regier & Zheng 2007, Do, Papafragou & Trueswell 2020). This asymmetry in language holds in production studies as well as natural corpora (Stefanowitsch & Rohlde 2004), for adults as well as children (Papafragou 2010, Lakusta & Landau 2012, Lakusta, Muentener, Petrillo, Mullanaphy, & Muniz 2016), in different subtypes of motion events (Lakusta & Landau 2005, 2012) as well as in typologically (even modally) different languages (e.g., Regier & Zheng 2007, Johanson, Selimis, & Papafragou 2019, Zheng & Goldin-Meadow 2002). Further, a parallel asymmetry has been found in the non-linguistic representation of motion events. Researchers found that Goals are more accurately encoded in memory than Sources of motion events in adults (e.g., Papafragou 2010, Regier & Zheng 2007, Regier 1996, Do et al. 2020) as well as in prelinguistic children (Lakusta, Wagner, O'Hearn, & Landau 2007, Lakusta & Carey 2015, Lakusta & DiFabrizio 2017). Taken together, there is a robust Source-Goal asymmetry in both linguistic and non-linguistic encoding of motion events.

We might have reasons to believe that the thematic notion of Sources and Goals are not limited to the simple motion events described above. In many theories of language and cognition, spatial representations are considered fundamental, and non-spatial meanings extend metaphorically from spatial meanings (Talmy 2000, Jackendoff 1972, Jackendoff 1983, among others). More specifically, linguists have hinted that the Agent and Patient in Transfer of

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Possession events are also Source and Goal respectively. For example, Jackendoff pointed out that a Transfer of Possession event such as "Amy gave the doll TO Beth" is encoded in a way that is parallel to changes in location as in "Amy went TO the store" (1983: 192). Clark and Carpenter wrote: "Agents are also a kind of source... In 'Jane sold the book to Ken', the agent and source are the same (Jane), although there is no explicit marking of the source (1989: 3)." Following these theories that argue for the presence of Source/Goal path in Transfer of Possession, we might expect the Source-Goal asymmetry in motion events to extend to people's linguistic and non-linguistic encoding of Transfer of Possession events.

However, there is also evidence against such simple homogeneity of spatial and metaphorical Goals. For example, Ziegler and Snedeker (2018) argued for distinct representation of the spatial Goal and Recipient in transfer events based on their finding that sentences with a spatial Goal component ("The boy sprayed water on the plant") did not prime sentences involving a Recipient ("The woman fed the strawberry to the goose."). Some typological linguistic work showed equally extensive yet distinct clustering of Goal and Recipient, but no evidence that the Goal was more robust, or attested earlier than the Recipient (Rissman & Majid 2019). The same authors also put forth a hypothesis that representations of Goal and Recipient rely on two fundamental but distinct cognitive systems – spatial cognition for the former and social one for the latter (Rissman & Majid 2019). Following this line of work, people's representation of spatial Goals and metaphorical Goals, such as Recipients, might be distinct, and thus it is not guaranteed that a Goal bias will necessarily extend to Transfer of Possession events.

To the best of our knowledge, only one empirical study examined the extension of Source-Goal asymmetry in simple motion events to other types of events that contain metaphorical Source/Goal, including Transfer of Possession events. Lakusta and Landau (2005) found that participants always preferred using "give", a verb that tends to be followed by a Goal-path (e.g., "TO the man"), than "receive/get", verbs that tend to be followed by a Source-path (e.g., "FROM the woman") when describing the same Transfer of Possession event. Additionally, the Goal-path prepositional phrases were included more frequently than the Source-path phrases in participants' descriptions. This finding provided initial evidence for a Source-Goal asymmetry in the linguistic encoding of Transfer of Possession events. However, there was one limitation in the investigation: although these results were consistent with a preference for Goal-path construal, they could also be explained by a general Agent-Subject mapping (Dowty 1991) or as a consequence of real-time attention allocation regardless of the actors' status as Goal or Source. Since the Giver was perceptually more agentive (i.e., had more actions) than the Receiver, and necessarily initiated the action, it was natural for people to attend to the Giver first and select them as the subject of the sentence. Therefore, the first research question of the current study (Experiment 1) is whether the previously found linguistic Goal bias in Transfer of Possession events will be preserved when we counterbalance the agentivity of Goal and Source as well as how their actions are situated in the temporal structure of the event. To do that, we asked participants to describe both Giving events, where the Goal is Patient, and Taking events, where the Goal is Agent.

Because the linguistic Source-Goal asymmetry of simple motion event description has not been extensively looked at cross-linguistically (for exceptions, see Regier & Zheng 2007, Johanson, Selimis & Papafragou 2019) and has not been examined at all in events other than simple motion events, it remains an open possibility that such asymmetry might be limited (or even not found) in languages where the linguistic encoding of Source is more "privileged" (e.g., where Sources are encoded not only as an adjunct). Therefore, in the current study, we also

examine whether this linguistic asymmetry holds for Mandarin Chinese speakers, for whom it is possible to encode Source as verbal argument (Experiment 2).

In English, some verbs are licensed in a Double Object Construction (DOC), which allows incorporating the indirect object into the verb argument structure (Gropen et al. 1989). As shown in (1), speakers can encode recipients in a Transfer of Possession event either with a prepositional phrase (1a) or as an argument directly 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, it is not possible to incorporate indirect objects that have the thematic role of Source into a verb's argument structure in English. For example, as shown in the contrast of (1c) and (1d), Source can only be introduced by a preposition phrase, not as an indirect object in DOC. Crucially, besides the Goal DOC (see 1a & 1b) alternation, Mandarin Chinese also allows Source DOC (Huang 2007). As shown in (2c) and (2d), Source can either be introduced by preposition "cong" or directly follow the verb in obtaining events (e.g., *na* "take", *tou* "steal", *mai* "buy").

(2) a. Wo song-le yi-ge pingguo gei John.
1sg-NOM give-PERF one-CL apple GEI John
'I gave an apple to John.'
b. Wo song-le John yi-ge pingguo.
1SG-NOM give-PERF John one-CL apple
'I gave John an apple.'
c. Wo na-le John yi-ge pingguo.
1SG-NOM take-PERF John one-CL apple
'I took an apple from John'
d. 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'

From the above, we can see that Mandarin Chinese has an important additional morphosyntactic device to encode Source in a Transfer of Possession event compared to English, namely introducing Source as a verbal argument. Therefore, in Experiment 2, we ask how often Chinese speakers make use of this construction when describing Taking events, and whether that would boost Source encoding for them.

Lastly, if a Source-Goal asymmetry is found to extend to Transfer of Possession events, we ask whether there is a conceptual basis for this linguistic asymmetry. There's a body of evidence suggesting that there should be. Many studies have demonstrated the linguistic-conceptual homology of Source/Goal encoding in motion events: participants showed a Goal bias both in their linguistic descriptions, as well as in memory of the event (Lakusta & Landau 2012: Experiment 1, Papafragou 2010, Do et al. 2020). In addition, from a different perspective, Tatone and colleagues (2015) showed that infants represented Giving events as having a three-participant schema but did not do the same for Taking events. After viewing events represented by animated abstract shapes, infants distinguished Giving from Disposing, but did not readily distinguish Taking and Acquiring: the presence of a receiver in a Giving event (Goal) signaled a different event type, but the presence of the (Source) in the Taking event did not. This account

would also predict that people have a conceptual Source-Goal asymmetry because Source is likely to be weakly represented if it is not consistently part of the event schema.

However, it is also possible that we will not find such an asymmetry in conceptual representation, since there are cases where a clean homology between the linguistic and conceptual representation of events is not found. In motion events where the moving Figure is inanimate, unintentional, or non-agentive (Lakusta et al. 2007, Lakusta & Landau 2012, Lakusta & Carey 2015, Lakusta & DiFabrizio 2017), the Source-Goal asymmetry persists in linguistic descriptions, but the memory of Sources and Goals is equivalent. Therefore, factors such as intentionality and animacy both modulate conceptual representation of event components. In Transfer of Possession events, both the Source and the Goal are animate, whereas the transferred object is inanimate. Thus, it is also likely that viewers of the event might focus on the type of social interaction rather than the spatial configuration in these events. Thus, whether there would be a conceptual Source-Goal asymmetry in Transfer events is a truly open question. Given the mixed predictions, we ask whether there is a Source-Goal asymmetry in the nonlinguistic representation of Transfer of Possession events in speakers of English (Experiment 3) and Mandarin Chinese (Experiment 4).

In sum, the current study explores whether the Source-Goal asymmetry observed in simple motion events extends to Transfer of Possession events, which have been long believed in linguistic theories to also contain Source and Goal paths. Experiment 1 asks whether the asymmetry extends to the linguistic encoding of Transfer of Possession events. Experiment 2 asks whether the same asymmetry holds cross-linguistically, specifically in Mandarin Chinese, a language that allows encoding Source as a verbal argument. Lastly, Experiments 3 and 4 probe whether there is a conceptual basis behind the linguistic asymmetry in English and Mandarin speakers. Taking these results together, we hope to shed light on the nature of the Source-Goal asymmetry as well as the language-cognition homology in event representation.

2. Experiment 1.

2.1. Methods.

2.1.1. Participants. Twenty native speakers of American English who were recruited from the University of Pennsylvania subject pool participated for course credit.

2.1.2. Materials. We constructed videos consisting of actions carried out by four characters that are two pairs of twins, played by two actresses.[1] One actress played Ruby (when in a red hoodie) and Grace (when in a green dress). The other actress played Harry (when wearing a hat) and Mitch (when having a mustache).

Our critical stimuli were 12 pairs of video clips, each pair depicting a Giving and a Taking event with the same object. 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. In these critical events, all four characters appeared equally often (each 6 times) and with equal chances to appear as Agent or Patient (each 3 times). Each female-male character pair also appeared the same number of times.

[1] The purpose of having two pairs of twins as characters in the video clips is to set the stage for the change-detection memory test in Experiment 3.

a)  b) 

Figure 1. a) Sample frame of the 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.

a)  b)  c) 

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

In order to compare Giving vs Taking events within-participants, we put the Giving and the Taking version of each event (e.g., events represented in Figure 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. For each participant, half of the critical trials were Giving events and the other half were Taking. The filler events as well as their order among the critical events in the two lists were identical. 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 via a URL link. 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 trials did not appear in the actual task. After viewing the three example trials, participants proceeded to describe the 30 video clips (12 critical 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 twenty participants produced 240 critical responses. We excluded trials on which the description did not match the video from analysis (n = 13)[2]. Our analysis of participants' linguistic description was twofold. First, we looked at whether the characters that assumed the role of Goal in the event (i.e., Givee & Taker) were more likely to be mentioned by the participants. To do that, we built a logistic mixed-effect model to predict whether a character was mentioned by Role (Goal vs. Source, sum coded) in the event as fixed effect and included random by-participant and by-event-pair intercepts. Motivated by prior work showing the relative prominence of Agents over Patients (Dowty 1991), we added Agency (Agent vs. Patient, sum coded) as well as its interaction term with Role as fixed effects in the model as well. Based on prior work, we predicted that participants should be more likely to mention a character that is an Agent than one that is a Patient, and more likely to mention one that is 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.

Secondly, for the characters that were mentioned, we looked at how they were linguistically encoded. Specifically, we asked whether they were truly encoded as Goal/Source, 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 a strict sense, Ruby was encoded as a Possessor and her status as Source was only inferred. Following previous work (Papafragou 2010; Lakusta & Landau 2012), we considered prepositional phrases headed by "from", "out of" or "off" (PP) to be the only Source-encoding devices in English and prepositional phrases headed by "to", "onto" or "into" (PP) as well as indirect objects in a Double Object Construction (IO) as Goal-encoding devices. We predicted that Goal characters were more likely to be encoded as bona fide Goals than Source characters as Sources.

2.2. RESULTS AND DISCUSSION.

2.2.1. CHARACTER MENTIONED. As can be seen in Figure 2a, 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 94% of the time when it was the Source of a Taking event.

With respect to our planned analysis, since Agents were 100% mentioned, to avoid singularity issues, we didn't include Agency and its interaction with Role in the model.[3] Despite the overall high rates of mention, Source characters were still significantly less likely to be mentioned than Goal characters (Est = 0.178, SE = 0.023, $p < 0.001$). As demonstrated by Figure 2a, the difference between Source and Goal character mention was entirely driven by the differential mention of Patients: people always mentioned Agents in both Giving and Taking

[2] 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 "Grace took the controller from Mitch" as "Mitch gave it to Grace") were excluded. Interestingly, if a misconstrual involved path reversal as in the previous example, it was only attested that participants mistook Taking events for Giving, never Giving events for Taking. 3) Trials in which participants didn't construe the event as a Transfer of Possession event as intended were excluded. (e.g., describing the event where Harry passed the ball to Ruby as "Harry and Ruby were playing catch with each other".) The same criteria were used in Experiment 2.

[3] The random effects in this model were also dropped due to failure of convergence. The results reported were from a simple logistic regression.

events, but - although they also always mentioned Patients in Giving events (Goals) - left the Patients in Taking events (Sources) unmentioned sometimes.

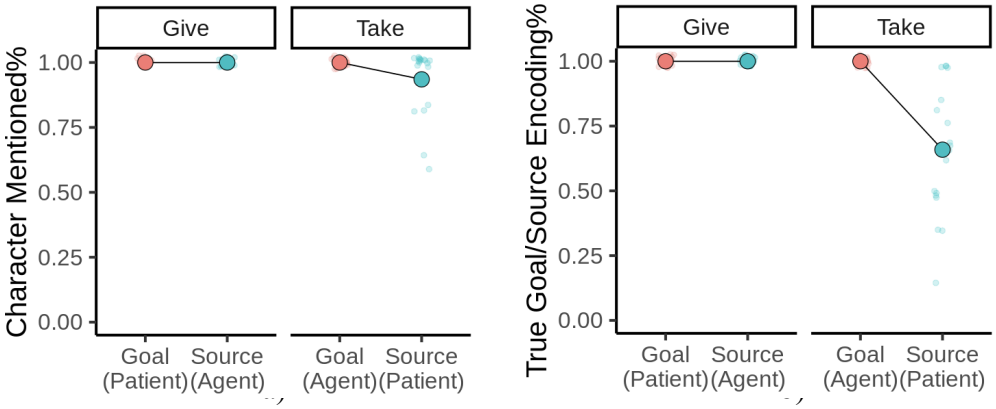

Figure 2. a) English speakers' mean proportion of mentioning the Goal/Source character in their linguistic description. b) English speakers' mean proportion of encoding the Goal/Source character as linguistic Goal/Source.

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 "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 "Harry took an apple from Ruby" can also theoretically be encoded as "Ruby lost an apple (to Harry)." However, all our participants abided by the Agent-subject mapping (Dowty 1991).

On the other hand, when encoding the Patient characters, participants showed different patterns depending on whether these were Source or Goal characters. English speakers always encoded the Patient Goal characters as true Goals, with one of the two canonical Goal-encoding devices in English - IO or PP. They slightly preferred using IO and used it on 77% of total Giving trials (See Table 1).

	Linguistic Device	**Example**	**Goal Encoding?**	**%**
Mentioned	Indirect object in DOC	"Harry gave Ruby an apple."	Yes	64.81
	Goal PP complement	"Grace gave keys to Mitch."	Yes	35.19

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

However, when encoding the Patient Source characters, participants' strategies were more diverse (See Table 2). First, participants only encoded them as true Sources 64% of the time using a Source-PP. On a little less than a third of these trials that elicited true Source encoding, the character was included in the Source-PP but was not the direct complement of the preposition (e.g., "Harry took the keys from Ruby's hand.") On a large proportion of trials (28.97 % of total Taking trials), the Source character was mentioned as a Possessor of the transferred theme (e.g., "Harry took Ruby's apple"), which is not literal Source-encoding.

To test the linguistic Source-Goal asymmetry under this more conservative way of coding Source and Goal encoding, we constructed a second logistic mixed-effect model. Since Agents were encoded as subjects without exception, we focused on Patient characters only in this model as well. This model predicted whether a character was encoded as true Source/Goal by its Role (Goal vs. Source, sum coded) and included random by-participant intercepts. The model confirmed that an even greater asymmetry was found if we consider Source/Goal encoding in a strict sense: participants were more likely to encode the Goal characters as Goals than they were to encode the Source characters as Sources (Est = 0.178, SE = 0.023, $p < 0.001$) (Figure 2b).

	Linguistic Device	**Example**	**Source Encoding?**	**%**
Mentioned	Source PP complement	"Harry took an apple from Ruby."	Yes	48.60
	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	15.89
	Possessor	"Grace took Mitch's pitcher."	No	28.97
Not mentioned	∅	"Ruby grabbed a plant."	No	6.54

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

In sum, our analysis supports the conclusion that there is a bias against Sources in the linguistic encoding of Transfer of Possession events. Not only was the Source component less likely to be mentioned; even when mentioned, it was often mentioned as a modifier of the transferred theme, but not necessarily as a core event component.

3. Experiment 2. Here we examined the motion descriptions of native speakers of Mandarin Chinese, for whom a linguistic device to encode Source as verbal argument is available. We asked how often Chinese speakers made use of the Source DOC when describing our Taking events, and whether that would boost their Source encoding, thus redressing the bias. Experiment 2 was identical to Experiment 1, except that the instructions of the experiment were in Mandarin Chinese and the participants were twenty native speakers of Chinese recruited from the University of Pennsylvania's subject pool. We excluded trials on which the description did not match the video from analysis (n = 34).

The pattern for character mentions was identical to that of Experiment 1. As shown in Figure 3a, Chinese speakers also mentioned Agents more frequently than Patients. For the same reason of preventing singularity, we didn't put Agency and its interaction with Role in the model and focused on the Patients. Results of the model confirmed that Chinese speakers mentioned Patient Goals more often than Patient Sources (Est = 2.345, SE= 0.447, $p < 0.001$). An additional logistic mixed-effect model adding Language (English vs. Chinese, sum coded) as a predictor revealed that, although Chinese speakers dropped the Patient slightly more often than English speakers, this effect did not reach significance (Est = 0.958, SE = 0.52, $p = 0.067$).

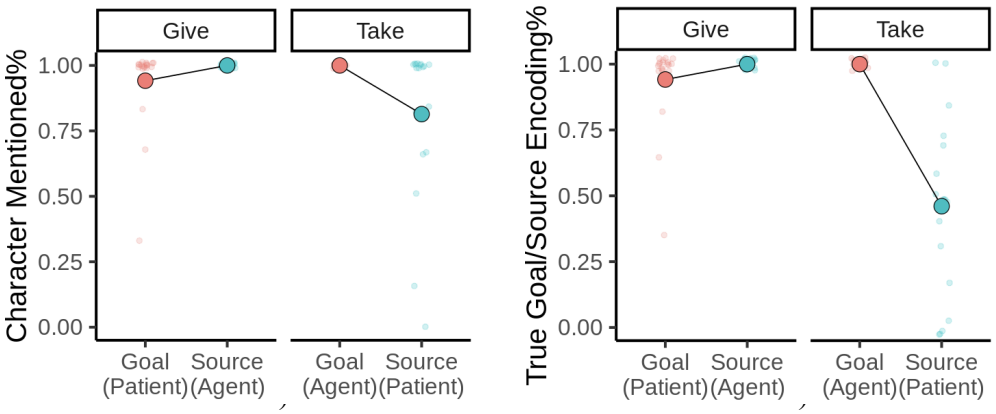

Figure 3. a) Chinese speakers' mean proportion of mentioning Goal/Source character in their linguistic description. b) Chinese speakers' mean proportion of encoding the Goal/Source character as linguistic Goal/Source.

Just like 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 Source/Goal encoding devices in Chinese (Figure 3b). In Chinese, the Goal-encoding devices were the direct objects of transfer verbs[4], indirect objects in DOC and prepositional phrases headed by *gei* "to". The Source-encoding devices are indirect objects in Source Double Object Construction (IO) and prepositional phrases headed by *cong* "from".

Just like their English-speaking counterparts, all Chinese speakers abided by the Agent-subject mapping as well, 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 =94.85%). The most popular encoding devices for the Patient Goal character were introducing them as indirect objects in DOC and as direct verbal complements (Table 3).

	Linguistic Device	**Example**	**Goal Encoding?**	**%**
Mentioned	Indirect Object in DOC	"Xiaomao gei Xiaohong yi-ge pingguo." Harry give Ruby one-CL apple	Yes	45.45
	Direct Verbal complement	"Xiaomao ba yi-ge pingguo gei-le Xiaohong" Harry BA one-CL apple give-PERF Ruby	Yes	39.18
	Goal PP complement	"Xiaolv di shoubing gei Xiaohu." Grace pass controller to Mitch	Yes	7.22
Not mentioned	∅	"Xiaohu di-le maozi." Mitch pass-PERF hat	No	5.15

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

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

However, Chinese speakers only encoded Patient Source characters as true Sources 48% of the time (see Table 4). Similar to English speakers, one of the most popular strategies to mention Patient Source characters was to encode them as Possessors of the transferred object. A logistic mixed-effect model predicting whether the Patient character was encoded as 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 Goals than to encode Patient Source characters as Sources (Est = 2.345, SE = 0.447, $p < 0.001$).

	Linguistic Device	**Example**	**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	Yes	4.63
	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	Yes	22.22
	Indirect object in Source DOC	"Xiaohu na-le Xiaolv maozi."[5] Mitch take-PERF Grace hat	Yes	21.30
	Possessor	"Xiaohu na-le Xiaolv de maozi" Mitch take-PERF Grace POSS hat	No	35.18
Not mentioned	∅	"Xiaomao na-le yi-ge pingguo." Harry take-PERF one-CL apple	No	16.67

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

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 Sources than Patient Goals as Goals (Est = 2.366, SE = 0.349, $p < 0.001$). Chinese speakers were also slightly less likely to encode both types of Patients in general (Est = 0.640, SE = 0.299, $p = 0.033$).

Taken together, despite the different available linguistic devices for Source encoding, there was a similar linguistic Source-Goal asymmetry in English speakers' and Chinese speakers' description of Transfer of Possession events. Although Chinese speakers had the option to encode Source in a more indispensable position, this did not boost their Source encoding. In fact, the only difference between the two language groups was that Chinese were less likely to encode the Patient characters in general. The lack of the predicted cross-linguistic difference suggests

[5] Note that although omission of the possessive marker "de" is possible in Mandarin Chinese, this is not a case of "de-omission" (compare with 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 translation to English '(lit) Grace was taken a hat by Mitch'.

that the linguistic Source-Goal asymmetry cannot be solely attributed to the limitation of linguistic devices for Source encoding and should at least partly be attributed to universal constraints governing event descriptions. In Experiment 3, we directly probe whether there is differential representation of Goals and Sources in non-linguistic encoding these events that can potentially account for such linguistic asymmetry.

4. Experiment 3. In Experiment 3, we sought to probe whether there was a non-linguistic Source-goal asymmetry in English speakers' representation of the Transfer of Possession events through testing participants' memory of Sources and Goals after passively viewing the same events as in previous experiments.

4.1. METHODS.

4.1.1. PARTICIPANTS. Thirty-seven native speakers of American English who were recruited from the University of Pennsylvania subject pool participated for course credit.

4.1.2. MATERIALS AND PROCEDURE. The experiment consisted of an exposure phase and a test phase. As in Experiment 1 and 2, participants were first familiarized with the characters' names. Then participants saw the exposure phase, where they were instructed to carefully view some events and told that they would be asked questions about them later. They then viewed the same events as in Experiment 1 and 2 (12 critical and 18 filler events) in the same order. Each video played once and automatically proceeded to the next after 2.5 seconds.

A test phase immediately followed. To probe speakers' conceptual encoding of Sources and Goals in memory, we constructed a two-alternative forced choice (2AFC) test. For each critical video clip, we selected a frame that was representative of the video and blocked one character with a gray rectangle (Figure 4). On each test trial, participants were asked to select which twin was the blocked character in this event according to what they saw and remembered.

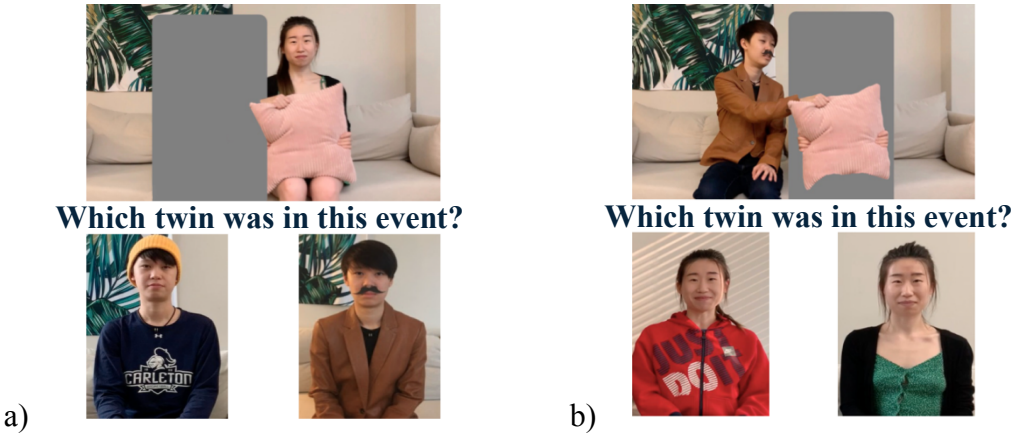

Figure 4. a) A sample Goal test trial and b) a sample Source test trial of the same event where Mitch took the pillow from Grace in Experiment 3.

4.1.3. ANALYSIS AND PREDICTIONS. To determine whether participants remember Goals more accurately than Sources in Transfer of Possession events, we built a logistic mixed-effect model to predict whether a character was correctly remembered by its Role (Goal vs. Source, sum coded), Agency (Agent vs. Patient, sum coded) in the event and the interaction term of the two as fixed effects, with random intercepts by each event pair.

We expected that in both types of events, participants would remember Agents more accurately than Patients, and Goals more accurately than Sources. Since the Takee was both a Patient and a Source, we expected it to be remembered least accurately.

4.2. RESULTS AND DISCUSSION. Our predictions were not borne out. As shown in Figure 5 (Top panel), English speakers remembered the characters equally well regardless of whether they were Agents or Patients (Est = 0.008, SE = 0.124, p = 0.946), and Sources or Goals (Est = 0.094, SE = 0.124, p = 0.448). No significant interaction was found (Est = -0.089, SE = 0.124, p = 0.473). We did not find evidence to support a conceptual Source-Goal asymmetry.

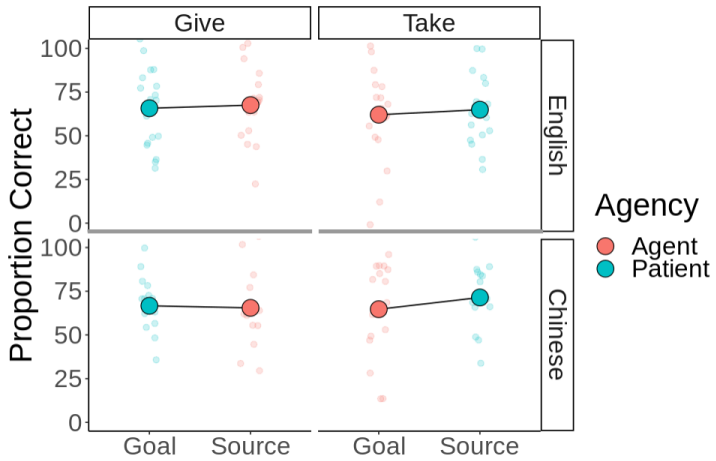

Figure 5. English-speaking (Top panel) and Chinese-speaking (Bottom panel) participants' mean memory accuracy for Sources and Goals in Giving and Taking events. We expected a main effect of Agency (such that red dots should be higher than blue dots), Role (such that Goals should be higher than Sources), and an interaction (such that Sources in Taking events would be remembered the worst). None of these predictions was borne out.

5. Experiment 4. In Experiment 4, we tested native Chinese speakers on their nonlinguistic representations of Sources and Goals in Transfer of Possession events with the same memory task. The only difference between Experiment 3 and Experiment 4 was that the participants in Experiment 4 were thirty-one native Chinese speakers recruited from the University of Pennsylvania subject pool and that the instructions were in Mandarin Chinese.

As shown in Figure 5 (Bottom panel), the pattern was identical for Chinese speakers: we found no effect of Agency (Est = -0.064, SE = 0.126, p = 0.608) or Role (Est = 0.051, SE = 0.126, p = 0.684) and no significant interaction of the two (Est = 0.174, SE = 0.129, p = 0.175). Again, we did not find any conceptual asymmetry between Sources and Goals for Transfer of Possession events (manifested as differences in memory for the event participants) in Chinese speakers.

6. General discussion and conclusion. In a series of experiments, we found that both English speakers and Mandarin Chinese speakers were less likely to encode Sources than Goals in their linguistic description of Transfer of Possession events, but their memory of Sources and Goals for the same events was equally robust. These results have implications for linguistic and psycholinguistic theories. First, our results provide empirical evidence in support of theoretical accounts that model Transfer of Possession events as having implicit Goal and Source paths: the same linguistic asymmetry previously detected when people described spatial Goals and Sources in simple motion events was detected in the description of human event participants in Transfer

of Possession events. Through a direct comparison of highly controlled pairs of Giving and Taking events, we showed that the same character is more likely to be mentioned when she receives something (e.g., an apple) than when she is deprived of the same thing. By comparing the Source/Goal mentions in minimal pairs of Giving and Taking events rather than two alternative perspectives on the same event (e.g., Giving vs Receiving, Landau & Lakusta 2005), we also contributed the first evidence that the previously found preference for Goal-path construal cannot be purely accounted for by the tendency to map Agent to subject.

Second, the linguistic asymmetry is uniformly attested in two languages whose available Source encoding devices are different. Specifically, even though in Mandarin Chinese speakers have the option of encoding Source as an incorporated verbal argument (a more prominent syntactic position than prepositional adjuncts), speakers did not mention it at a higher rate, or encode it as true Source (as opposed to implied Source via Possessor mention) more frequently. The fact that the Source-Goal encoding asymmetry is preserved despite different cross-linguistic motion encoding strategies has also been attested elsewhere (e.g., Johanson et al. 2019). This cross-linguistic stability further supports the conclusion that universal processes governing event perception are at least partially responsible for the linguistic Source-Goal asymmetry that we repeatedly observe.

Third, joining previous work (Lakusta & Landau 2012: Experiment 2 and 3, Lakusta & Carey 2015), we contributed another case where the linguistic Source-Goal asymmetry persisted in the absence of memory asymmetry. In fact, if we take a step back, it is intuitive that, when processing our stimuli, people are unlikely to be focusing on the inanimate object that is being transferred, treating the two human characters as simply the starting and end point of its trajectory, but instead are likely to be construing these events as social interactions between two people. Nonetheless, the linguistic asymmetry persisted. We thereby conclude that there is not a simple homology between linguistic and non-linguistic encoding of Transfer of Possession events: the linguistic asymmetry that we observed between Sources and Goals is not straightforwardly reflecting an asymmetry in the conceptual representation of these events. The linguistic facts, therefore, might have been a consequence of linguistic-internal factors: Goal encoding structures are of higher availability. Even in a language like Mandarin Chinese where there is an available structure to encode Source as argument as opposed to adjunct, the advantage of Goal encoding structure is still overwhelming. The linguistic asymmetry could also be modulated by pragmatic factors: people might just mention Sources less because they were already given - not new - information (cf. Do et al. 2020).

One caveat for the current work concerns the null effect of Source vs. Goal in the memory test. In theory, it is possible that the conceptual asymmetry is still there, but our method failed to detect it, especially given that our method is a rather unconventional one. In the current study, we used a 2AFC task and used a single critical frame to represent the video stimuli during the memory test. However, to the best of our knowledge, all previous research utilized a same-difference task during test: participants were shown a variant of the video that they saw at exposure with a change in either the Source or the Goal and were asked to answer whether it was the same event as before (Papafragou 2010, Regier & Zheng 2007, Regier, 1996, Do et al. 2020). However, there are reasons to doubt that the lack of a difference in memory of Goals and Sources in the current Transfer of Possession events is due to the insensitivity of the current memory probe. First, participants' performance was consistently above chance (as indicated by the significant positive intercepts in the memory models: English: EST =1.218, SE=0.283, $p< 0.001$, Chinese: EST =1.245, SE=0.254, $p< 0.001$) but not at ceiling. Therefore, the baseline

accuracy was within a reasonable range. Furthermore, the idea that the null result arises from the lack of sensitivity of our memory paradigm is hard to reconcile with the finding that, in both language groups, the memory of Takee (i.e., the Patient and Source in a Taking event, which is predicted to be the least well remembered if a Source-Goal asymmetry is in place) is in fact numerically the best. However, in order to get more robust results, we plan to replicate our Experiments 3 and 4 with a same-different paradigm similar to that used in prior literature.

Summarizing, the current experiments examined the linguistic and nonlinguistic representation of Transfer of Possession events. Although people's linguistic encoding showed a Goal bias similar to spatial event encoding, no apparent difference between Goals and Sources in these events was found at the conceptual level. The presence of a linguistic asymmetry without conceptual asymmetry was robustly replicated in two typologically different languages that specifically differ in Source/Goal encoding strategies, suggesting that the lack of perfect alignment between linguistic and nonlinguistic event representation is likely universal. Therefore, a finer-grained account of homology between language production and event encoding in memory is called for.

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