Interpreting Accomplishments by Script Knowledge: A Comparison Study between Chinese and French

Yingyi Luo[1], Xiaoqian Zhang[1]

[1] Institute of Linguistics, Chinese Academy of Social Sciences
`luoyingyi@cass.org.cn`,
`xiaoqianzhang.diderot@yahoo.com`

Abstract. In this study, a recent model of "event-script homomorphism" which highlights the representation of script knowledge is empirically examined as a mechanism to identify accomplishment events in comparison with another `acknowledged model of "event-argument homomorphism". We tested Chinese and French native speakers' interpretations of perfective sentences with incremental theme accomplishment predicates. Results showed that the representation of an accomplishment usually implies the incremental theme being mostly affected, as claimed by the "event-argument homomorphism" model. Similarly, and importantly, the representation also implies the completion of the script, with the marking stages having happened. This suggests that the "event-script homomorphism" model can be applied to explain the identification of accomplishment events, on a par with the "event-argument homomorphism". A difference of interpretation between Chinese and French was observed in incremental theme involvement but was reduced in script completion, and manifested mainly by verbs of destruction.

Keywords: "Event-argument Homomorphism" Model, "Event-script Homomorphism" Model, Accomplishment, Incremental Theme, Event, Script Knowledge.

1   Introduction

Events are often treated as entities [1]. One question subsequently arises as to how events can be segmented as individuals so as to be counted like objects. In this study, a model of "event-script homomorphism" as a mechanism to identify accomplishments is suggested and empirically examined. Our aim is to understand how adequately this model, *vis-à-vis* another model – i.e., the "event-argument homomorphism" –, can be applied to a specific type of accomplishments: that is, *incremental theme accomplishments*.

In the eyes of semanticists, the theme of an accomplishment verb sometimes plays an important role in the identification of an accomplishment event ([2, 3, 4-10, 11, 12, 13] among others). As they propose, there is a "homomorphism from the denotation of the theme to the extent of the event in which the theme is a participant" [12, P. 94]: as the event described by the incremental verb progresses, the theme also undergoes some

changes; in fact, the event is "accomplished" when the theme is also completely affected. For instance, in the event of *building a house*, the direct object *a house* "is used up 'bit by bit'" as the event of *building* progresses [12, P. 92]. An accomplishment of *building a house* cannot be identified as an event of *building a house* if the house is merely half built (see [3] for a similar example); it can only be identified as an individual event of *building a house* when the house is completely built. Verbs such as *build* are called *incremental verbs* and their objects *incremental themes* (henceforth, IT).

Alternatively, there exists another approach, which is mainly adopted by researchers of event perception and cognition. It considers the event schemas or scripts – i.e., a type of semantic knowledge about the commonalities across a set of events [14] – to be critical in event identification. In line with this, Zhang et al. [15] proposed an "event-script homomorphism" model to explain how accomplishments can be identified: the progression of an accomplishment event corresponds to the unfolding of the stages composing the accomplishment script, which establishes a homomorphism between the accomplishment and the script. For instance, the event of *frying a plate of raw chicken legs* is commonly considered to have a script composed by a number of sequential stages: marinate the chicken legs, coat the chicken legs with flour, place the chicken legs in hot oil for a while and take them out of the oil. When the chicken legs have been taken out of the oil after being there for a period of time – that is, when the final stage of the script is finished, the event of *frying a plate of raw chicken legs* reaches its ending. Therefore, the event script acts as a criterion to segment one individual event since the completion of the last stage of the event script marks the completion of the accomplishment (see Table 1 for another example). Script knowledge can be concisely encoded in the main verb phrase of a sentence and retrieved when the verb phrase is accessed during comprehension.

This study investigated the adequacy of this hypothesized "event-script homomorphism" model in explaining the mental representations of accomplishments during sentence reading. Specifically, we selected a typical type of accomplishments, i.e., *incremental theme accomplishments*, as a target to test for these events' general conformity with the "event-argument homomorphism" model. As exemplified above, the "event-argument homomorphism" model predicts that the extent to which an IT is affected determines the progression of an IT accomplishment. Evidence [16] has shown that such an accomplishment verb phrase is interpreted to entail that, when the event is completed, the whole IT – or a major part of it – is affected. Analogously, as stated by the "event-script homomorphism" model, these IT verb phrases would activate a reading according to which "when the event is completed, the script is considered finished", leading to a representation in which the critical stages of the script have all been settled.

To this end, we conducted an experiment where native speakers were asked to read perfective sentences with verb phrases describing accomplishments, and to report their interpretations in terms of the degree of object involvement and the degree of script completion. These two measurements correspond to the two models, respectively, and can be compared from an experimental perspective. They are predicted to be highly correlated if the "event-script homomorphism" model functions as well as the "event-argument homomorphism" model.

We also compared interpretation patterns between Chinese and French native speakers to examine the universality of accomplishment event cognition. Because of

the considerable typological differences between the two languages [16-20], one might expect that diverging interpretation patterns for the two groups of speakers would emerge. However, we are more prone to argue in favor of a general cognition mechanism underlying humans, which would result in more commonalities than differences across languages.

Table 1. Exemplar trial of accomplishment wipe the classroom floor in Chinese and French.

Target Predicate	Chinese Predicate → 擦教室的地板 French Predicate → nettoyer le sol de la salle de classe English Translation → to wipe the classroom floor		
Critical Sentence	Chinese Critical Sentence → 小明擦了教室的地板。 French Critical Sentence → Julien a nettoyé le sol de la salle de classe English Translation → Xiaoming wiped the classroom floor.		
IT Judgment	**Chinese** 请问地板被擦了多少？（可多选） (a) 小部分 (b) 一半 (c) 大部分 (d) 全部	**French** Jugez quelle partie du sol Julien a probablement nettoyé. (choix multiple possible) (a) Une petite partie du sol de la salle de classe (b) Une moitié du sol de la salle de classe (c) Une grande partie du sol de la salle de classe (d) Tout le sol de la sal de class	**English Translation** How much of the floor has been wiped? (multiple choice allowed) (a) a small part (b) half of it (c) a large part (d) all of it
Script Judgment	**Chinese** 请判断下列哪些场景与"小明擦了教室的地板。"的描述相符？（可多选） (a) 擦一桶清水 (b) 擦一桶清水→用清水洗拖布并拖地板 (c) 擦一桶清水→用清水洗拖布并拖地板→用干拖布拖地板	**French** Quelles sont les situations/quelle est la situation qui correspond(ent) à la description de la phrase "Julien a nettoyé le sol de la sal de la classe"? (choix multiple possible) (a) remplir un seau d'eau (b) remplir un seau d'eau → mouiller une serpillière dans l'eau et laver le sol de la salle de clase avec la serpillière mouillée (c) remplir un seau d'eau → mouiller une serpillière dans l'eau et laver le sol de la salle de clase avec la serpillière mouillée → sécher le sol avec une serpillière sèche	**English Translation** Please judge which of the following scenario(s) is/are consistent with the sentence "Xiaomi wiped the classroom floor". (multiple choice allowed) (a) fill a bucket with water (b) fill a bucket with water → wet a mop and wipe the classroom floor with it (c) fill a bucket with water → wet a mop and wipe the classroom floor with it → dry the floor with a dry mop

2 Methods

2.1 Participants

Thirty native Mandarin speakers, aged from 18 to 22 years old (24 females), were recruited from Chinese universities to attend the Chinese experiment. Thirty-three native French speakers attended the French experiment, with 3 being excluded from further data analysis due to their misunderstanding of the task. The remaining thirty French participants were aged from 21 to 75 years old (13 females). One reported that she was also a native speaker of Cantonese. All participants received a monetary reward.

2.2 Design and Materials

Eleven verb phrases of IT accomplishments were targeted (see Table 2). These verbs in their English form were discussed in [6, 7, 12, 21, 22]. We translated them into Chinese and French, and put them in sentences framed like "Subject + Verb-le$_{\text{perfective marker}}$ + Object" in Chinese and "Subject + Verb$_{\text{passé composé form}}$ + Object" in French. Thus, target sentences were created – 11 for Chinese and 11 for French.

We also developed scripts for the accomplishment events described by the target predicates, preparing prototypical sequences of stages based on encyclopedic research. Web-sourced encyclopedia such as *wikiHow.com* and *zhihu.com* were consulted, where questions regarding "how" an activity/event takes place are asked and answered with the typical procedure of the event. The drafted scripts were subsequently confirmed by two linguists. Among 11 target accomplishments, two described an event with a 2-stage script, three with a 3-stage script, and six with a 4-stage script (Table 2).

Each sentence was presented twice to each participant, either followed by an *IT judgment task* or by a *script judgment task* (not necessarily in this order). In the IT task, participants had to judge to what extent one physical property (surface, size, volume, etc.) of the IT was affected. As illustrated in Table 1, option A, B, C, and D referred to different degrees of affectedness/involvement, from a small proportion to the full proportion. Participants were allowed to choose any option – as well as any combination – from the provided four as long as the indicated extent of object involvement was considered to be a feasible reading derived from the sentence. Thus, there were theoretically up to fifteen possible response patterns since this could consist of one up to all four options.

In the script judgment task, participants read the target sentence and chose from optional combinations of stages according to the sentence interpretation. The combinations of stages were structured in an increasingly compositional manner, analogously to the logic of option setup in the IT judgment task: A described the first stage of the schema script, B described the second stage joining the first, C (if there was) described the third stage joining the first and the second, and so on. When participants chose the last option, it meant that they inferred from the target sentence that all N stages of the script had been completed; when they chose the penultimate option, it meant that the last stage was considered unnecessary to happen in the target

event; when they chose more than one option, it meant that more than one stage sequence was considered a possible reading.

2.3   Procedure

For both languages, the eleven target predicates were assigned to three lists, each list having in total 44 trials (one sentence and one judgment task) for different research purposes. Identical target sentences with different tasks were assigned to the same list to minimize individual differences between tasks. Each list adopted a pseudo-randomized sequence such that consecutive trials would not share one target sentence. Each list was then administered to ten Chinese and ten French participants.

Each participant was randomly assigned to one version and received the test via the *Wènjuàn Xīng* (www.wjx.cn), a crowdsourcing website for questionnaire research. They were required to read the instructions and make judgments trial by trial. Only one trial at a time was shown on screen, i.e., the target sentence and its corresponding judgment task. Participants were not allowed to go back to the preceding trials once they made a choice. Additionally, for each trial, participants were given the option to leave a comment if they had any concern. Only three trials (one in Chinese and two in French) were commented, and they were all settled in the post-test interview.

2.4   Data Categorization

Both tasks allowed participants to choose either single or multiple options. For the IT judgment task, a response involving the combination CD, or the single options C or D was classified as "Salient Consequence", meaning that the event representation activated by the sentence included a marking consequence of over 50% of IT being affected; instead, the selection of all options (ABCD) indicated "No Salient Consequence" meaning that any level of involvement was possible according to the sentence interpretation.

Similarly, for the script judgment task, choosing a script with N or/and N-1 step was classified as "Salient Consequence" showing that the event representation included the consequence of most stages of the script being completed; on the contrary, a response consisting of all options was classified as "No Salient Consequence" of script in the accomplishment event representation. For the two accomplishments described with a 2-stage script, choosing both options was also classified as "No Salient Consequence".

3   Results

IT Judgment Task. 54 trials (49.1%) for Chinese and 76 trials (69.1%) for French out of 110 were interpreted to imply that the IT was 100% affected. Interpretations that refer to "over half of the IT being affected" made up 19.1% for Chinese and 14.5% for French, resulting in the total proportion of "Salient Consequence" responses taking 68.2% for Chinese and 83.6% for French. On the other hand, 29.1% trials in Chinese and 11.8% trials in French were read in a way that the IT could be affected to any degree.

Particularly, most Chinese speakers responded to sentences with *dismantle* and *destroy* as "No Salient Consequence" (see Table 2). Chinese speakers made more "No Salient Consequence" as well as fewer "Salient Consequence responses" than French speakers, as reflected by the significant result of the Chi-square test (p-value < .008, which is the criterion according to Bonferroni correction).

Table 2. Distribution of response types for each verb phrase. CHN: Chinese; FR: French.

	IT judgment				Script judgment			
	>50%		No Salient Endpoint		N-1 & N		No Salient Endpoint	
	CHN	FR	CHN	FR	CHN	FR	CHN	FR
2-stage script								
Examine a/that paper copy	8	7	2	3	7	10	3	
Burn a pile of leaves	7	6	3	1	7	7	3	3
3-stage script								
Wipe the floor of the classroom	7	10	1		10	9		
Paint a wall	7	8	3	2	10	10		
Fry a plate of raw chicken legs	8	8	2	1	10	10		
4-stage script								
Dismantle a plane model	1	8	9	1	2	8	8	2
Build a house	10	9		1	3	2		1
Draw a picture	10	9		1	6	8	1	
Destroy a car	1	9	9		1	6	8	3
Dye a piece of cloth	9	7	1	3	9	9		
Iron a sheet	7	10	2		10	10		

Script Judgment Task. Chinese and French participants considered the option with all stages as the only appropriate script consistent with their interpretation of the target sentence in 63 (57.3%) and 69 trials (62.7%) out of the total 110 trials, respectively. Adding the number of trials that were answered with the selection of "N-1 or/and N stage(s)", the total proportion of "Salient Consequence" reached up to 72.7% for Chinese and 80% for French. By contrast, a relatively small number of trials, 20.9% for Chinese and 8.1% for French, were answered with all options being selected, suggesting that the interpretation of these accomplishment events did not indicate a clear ending stage. Most of these trials involved the predicates *dismantle* and *destroy* especially for Chinese speakers, similarly to the findings in the IT judgement task. It should be noted that for trials with a 3-stage script none was considered "No Salient Consequence". Interestingly, the Chi-square test failed to show significant distinction of responses between the languages (p-value > .016) although the pattern was numerically similar to that of IT judgment.

Cross-Task Analysis. First, the distribution of "Salient Consequence" responses and "No Salient Consequence" responses between the two tasks was compared with a Chi-square test in Chinese and French, respectively. No significant result was found (ps > .05), meaning that there was not enough evidence to argue that interpretation patterns differ across tasks as reflected by the present data; rather, they appeared to be similar.

Moreover, for the sentences in which the object was judged as being completely affected (CHN:54, FR:76), a large percentage (CHN:45 trials, 83.3%, FR:64 trials, 84.2%) was also considered as the script being completed and approaching the "Salient Consequence", whereas only 2 trials of Chinese and 2 of French had a "No Salient Consequence" response in the script judgment task (see Table 3). However, for

sentences interpreted as all stages of the given script being completed (CHN:63, FR:69), a numerically smaller proportion of trials (CHN:51 trials, 80.9%; FR:54 trials, 78.3%) was considered approaching "Salient Consequence" for IT while an increased number (CHN:11 trials, 17.5%; FR:11 trials, 15.9%) was answered with "No Salient Consequence" – the IT could be affected to any extent. The asymmetry of two types of maximum levels was captured by Chi-square tests for both Chinese and French speakers ($ps < .008$).

Table 3. Proportion of response types by the script judgment and the IT judgment tasks among the 110 trials for either language. CHN:Chinese; FR:French.

		Script judgment					
		N stage only		N-1 or/and N stage		Any stage	
		CHN	FR	CHN	FR	CHN	FR
	100%	34.5%	45.5%	6.4%	12.7%	1.8%	1.8%
IT judgment	>50%	11.8%	3.6%	4.5%	4.5%	3.6%	4.5%
	Any degree	10.0%	10.0%	2.7%	0.9%	15.5%	0.9%

4   Discussion and Conclusion

To examine two models functioning as mechanisms by which accomplishments are identified in language use, we investigated the readers' interpretation of IT accomplishments in terms of both the degree of object involvement and the degree of script completion. As the "event-argument homomorphism" model predicts, both Chinese and French participants considered the event described by the perfective accomplishment sentence as implying a major part of the object being affected.

Moreover, participants were also inclined to believe that the critical stage of the event's script had to be included in the accomplishment event representation, with a similar tendency to interpret the IT as being affected. This finding is central to our concerns because it suggests that the "event-script homomorphism" model explains the mental representations of IT accomplishments as adequately as the "event-argument homomorphism" model. Provided that the change of the IT is assumed to be vital for the incremental accomplishment event identification, we believe that the proceeding of the script also underlies whether an event can be individualized as an accomplishment.

In fact, in view of the "maximum consequence" of the two measurements, the full object involvement strongly associates with the completion of the critical stage in the representation of an accomplishment event but not vice versa; the completion of the script's final stage seems to have a *weaker* association with the IT being affected to a major extent. We thus speculate that the IT involvement is more likely to be conditional on the script completion for segmenting an incremental theme accomplishment. More evidence is needed to address this hypothesis.

The finding of reduced language difference in the script judgment task further suggests that Chinese and French may have great commonalities in interpreting accomplishment events, particularly by script knowledge, despite showing some distinctions in judging IT involvement as observed in the present and previous studies.

The implication of this finding is twofold. First, as we predicted, the "event-script homomorphism" model shows improved adequacy in uncovering and depicting the universality of interpreting accomplishments across languages because it approaches the general mechanism of event cognition underlying humans. Second, the tendency that Chinese speakers favor a reading of "No Salient Consequence" in IT judgment tasks compared to French speakers must be reconciled by noting that the reading of "No Salient Consequence" is uncommon for most predicates both in Chinese and in French. Instead, it emerged more frequently for Chinese accomplishment verbs of destruction, like *dismantle* or *destroy,* as reflected by our data. In other words, Chinese and French speakers may share interpretations of most IT accomplishments, yet they diverge in their semantic representation of verbs of destruction.

With reference to the IT involvement quantification on a scale of proportions, one may wonder whether the script judgment task is sufficiently "standardized". The sequential stages may differ across people if they are asked to verbally develop their own scripts, due to individual differences of experiences, world knowledge, as well as strategies in individuating sub-events. However, scholars also have the consensus that there is presumably a high degree of uniformity across people in the way events are perceived [23] in which key aspects of our mental representations of events such as times, locations, entities, and relations among them lay the foundation. The script judgment task was thus designed to preserve and present the uniformed perceptual structure of an event in terms of stages, i.e., the "greatest common divisor". For this sake, the scripts of events were first drafted based on the web-sourced encyclopedia of "how to do something" that introduces the typical procedure of an event, and their validity was further evaluated by two linguists. Feedbacks from participants confirmed that the scripts we developed were well agreed by both Chinese and French native speakers, as they did not report any difficulties in understanding the stage sequences and succeeded in completing the task.

In light of that, not only themes but more elements of events, which are all included under the broad concept of script, are considered to engage in event identification in the "event-script homomorphism" model; therefore, we expect this model to be more effective in explaining diverse event types, and in particular complex events in which more than one aspect/property of the themes changes along with the events' progression. In the follow-up study, we tested against this expectation with experiments and the primary result is promising.

In conclusion, this study showed that the representation of an accomplishment usually implies not only the IT being mostly affected, but also the script being completed with the marking stages having happened. This suggests that the "event-script homomorphism" model can be adequately applied to explain accomplishment events identification from the perspective of script knowledge on a par with the event-argument homomorphism" model.

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