RECIPROCAL CONDITIONS FOR TEMPORAL MIRROR INVERSED SENTENCES IN MODERN CHINESE

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ABSTRACT

Mirror inversed sentences (MISs) can be divided into attributive, spatial, attributive, attributive-temporal, spatial-attributive and attributive-spatial-attributive MISs. This paper presents the common condition for realizing the interchangeability of body words in temporal MISs and finds that the existence of "symmetry" semantic relations in the temporal dimension is the common condition for temporal MISs to realize the interchangeability of body words.

Key Words: MISs; Attributive; Symmetric semantic relation.

1. INTRODUCTION

Temporal mirror inversed sentences only have the subtype of complex temporal relationship, such as examples (1)-(2) (all the example have been taken from the previous literatures and we find the number of this type is quite limited). This section carefully examines the reciprocal conditions of this type of mirror inversed sentence.

(1) Maijinde ***yujianle*** *maijinde ↔ Manjinde* ***yujianle*** *maijiande (Tao, 1987)*

The gold buyer ***met*** *the gold seller ↔ The gold seller* ***met*** *the gold buyer*

(2) Dekesitela ***xiehoule*** *IBM gongside Ailun ↔ IBM gongside Ailun* ***xiehoule*** *Dekesitela (Tao, 1987)*

Dykstra ***met*** *Allen of IBM ↔ Allen of IBM* ***met*** *Dykstra*

Why can the body words in temporal MISs carry out reciprocity around predicates while keeping the propositional meaning basically unchanged? Most of the existing researches make descriptive analysis of the internal factors of language (i.e. predicates and body words) but lack the analysis adequacy and explanation adequacy. Although some researchers began to pay attention to revealing the motivation of the interchangeability of body words from the external factors of language (i.e. constructions), these explanations are mostly one-sided, and often only aim at some subclasses. In view of the fact that events have three basic elements of Attribute, space and time (Kant, 2004), this paper attempts to discuss the reciprocal conditions for body words in temporal MISs from both positive and negative aspects and explores the deep cognitive reasons for the interchangeability of body words.

2. TEMPORAL RELATIONSHIPS

Temporal relationship can be divided into absolute temporal relationship and relative temporal relationship, the latter mainly refers to temporal distance relationship, temporal sequence relationship and temporal topological relationship.

Temporal distance relationship can be expressed by words such as "early" and "late", such as "Zhang San ate early" and "Li Si finished his homework very late".

The temporal sequence relationship can be expressed by words such as "firstly" and "secondly", such as "Zhang San ate firstly" and "Li Si eats secondly". In addition, the sentence "Zhang San ate" does not contain the temporal vocabulary, but also reflects the sequence relationship between "Zhang San" and "Fan" through the action "ate". The core idea of temporal sequence relationship description is to keep the sequence of events around an action unchanged, which sometimes implies the causal connection between events.

Temporal topological relationship is the topological property unchanged under topological transformation, such as the adjacent relation of temporal objects. Temporal topological relationship is usually determined by two objects and topological predicates, such as "I meet you" and "Zhang San meets Li Si". The core idea of temporal topological relationship is that two adjacent action events always happen next to each other, that is, the simultaneity of events remains unchanged.

The specific type of temporal topological relationship can be derived from formula (1). Assuming that I and J are two different temporal targets in the complete set of time, the temporal topological relationship T_{Top} (I, J) between I and J based on point set theory is described as follows:

$$T_{Top}(I,J) = \begin{pmatrix} L_I \cap L_J & L_I \cap J^0 \\ I^0 \cap L_J & I^0 \cap J^0 \end{pmatrix}$$

（1）

In the above formula, L_I and I^0 are the boundaries and interiors of target I, and L_J and J^0 are the boundaries and interiors of target J. In pure mathematics, there are two cases in which each term of the quadruple is null or non-null. There are eight cases of temporal topological relationship as shown in Table 1 (where " ●━━● " is the temporal interval I and " ●┈┈┈● " is the temporal interval J):

Table 1 Common temporal topological relationship between objects

Matrix	Valency	Figures	semantics	relations
$\begin{pmatrix} \neg\varnothing & \varnothing \\ \varnothing & \varnothing \end{pmatrix}$	There is an intersection between the boundaries of I and J; There is no intersection between the boundary of I and the interior of J; There is no intersection between the interior of I and the boundary of J; There is	●━━●┈┈┈●	*I and J are connected*	Connection

	no intersection between the interiors of I and J.			
$\begin{pmatrix} \neg\varnothing & \neg\varnothing \\ \neg\varnothing & \neg\varnothing \end{pmatrix}$	There is an intersection between the boundaries of I and J; There is an intersection between the boundary of I and the interior of J; There is an intersection between the interior of I and the boundary of J; There is an intersection between the interiors of I and J.		*I and J are intersected*	Intersection
$\begin{pmatrix} \neg\varnothing & \varnothing \\ \varnothing & \neg\varnothing \end{pmatrix}$	There is an intersection between the boundaries of I and J; There is no intersection between the boundary of I and the interior of J; There is no intersection between the interior of I and the boundary of J; There is an intersection between the interiors of I and J.		*I and J are equal*	Equality
$\begin{pmatrix} \varnothing & \varnothing \\ \neg\varnothing & \neg\varnothing \end{pmatrix}$	There is no intersection between the boundaries of I and J; There is no intersection between the boundary of I and the interior of J; There is an intersection between the interior of I and the boundary of J; There is an intersection between the interiors of I and J.		*I contains J*	Containing
$\begin{pmatrix} \varnothing & \neg\varnothing \\ \varnothing & \neg\varnothing \end{pmatrix}$	There is no intersection between the boundaries of I and J; There is an intersection between the boundary of I and the interior of J; There is no intersection between the interior of I and the boundary of J; There is		*I is contained in J*	Contained

	an intersection between the interiors of I and J.			
$\begin{pmatrix} \neg\varnothing & \varnothing \\ \neg\varnothing & \neg\varnothing \end{pmatrix}$	There is an intersection between the boundaries of I and J; There is no intersection between the boundary of I and the interior of J; There is an intersection between the interior of I and the boundary of J; There is an intersection between the interiors of I and J.	●—————●—————●	*I covered J*	Covering
$\begin{pmatrix} \neg\varnothing & \neg\varnothing \\ \varnothing & \neg\varnothing \end{pmatrix}$	There is an intersection between the boundaries of I and J; There is an intersection between the boundary of I and the interior of J; There is no intersection between the interior of I and the boundary of J; There is an intersection between the interiors of I and J.	●·······●—————●	*I is covered by J*	Covered
$\begin{pmatrix} \varnothing & \varnothing \\ \varnothing & \varnothing \end{pmatrix}$	There is no intersection between the boundaries of I and J; There is no intersection between the boundary of I and the interior of J; There is no intersection between the interior of I and the boundary of J; There is no intersection between the interiors of I and J.	●—————● ●·······●	*I and J are separated*	Separation

As shown in Table 1, topological temporal relationships include the following 8 categories: connection, intersection, equality, including, included, covering, covered, and separation.

To sum up, temporal relationships include absolute and relative temporal relationships. And the relative relationships consist of temporal distance relations, temporal sequence relations and temporal topological relations. Among them, the temporal topological relations can be divided into 8 subtypes, such as connection, intersection, equality, including, included, covering, covered and separation. Temporal topological relations are "symmetrical" semantic relations because they

have the same topological properties under topological changes. However, the temporal distance relation and the temporal sequence relation are "asymmetric" semantic relations due to the interference of distance identification and sequence identification.

3. RECIPROCAL CONDITIONS FOR TEMPORAL MIRROR INVERSED SENTENCES

According to section 2, relative temporal relationships can be divided into three categories: temporal distance relations, temporal sequence relations and temporal topological relations. Among them, the temporal topological relation can be further divided into 8 sub-types: connection, intersection, equality, including, included, covering, covered, and separation. After investigation, it is found that the mirror inversed expressions of examples (1)-(2) belong to temporal topological relations.

Let's take sentence (1) "Maijinde **yujianle** maijinde (The gold buyer **met** the gold seller) ↔ Manjinde **yujianle** maijiande (The gold seller **met** the gold buyer)" as an example to explain the reciprocity conditions of mirror inversed sentences with temporal topological relations.

First of all, there is an interactive concept of "meeting (indicated by yujianle)", which presupposes the occurrence of two "meeting" action events. The actors of the two events, "manjinde (the gold buyer)" and "maijinde (the gold seller)", send out actions in two different time periods I and J respectively, and "meet" each other at the end of the actions. The temporal relationship between two action events can be expressed as Figure 1:
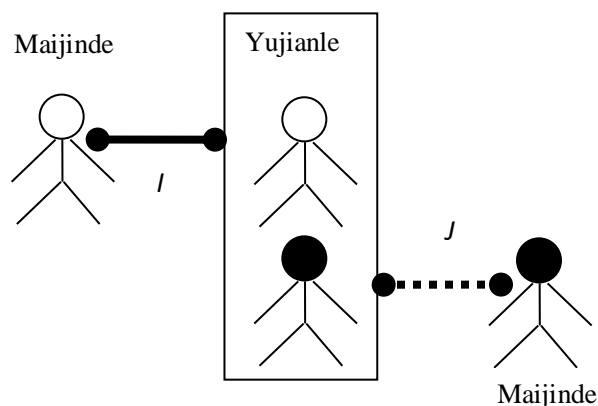

Fig1. The temporal relationship of example (1)

According to Fig. 1, There is an intersection between the boundaries of I and J; There is no intersection between the boundary of I and the interior of J; There is no intersection between the interior of I and the boundary of J; There is no intersection between the interiors of I and J. These characteristics are consistent with the definition of temporal connection (see Table 1 for details); As such, "I" and "J" have a topological relationship of temporal connection. In other words,

example (1) belongs to the mirror inversed sentence of temporal topological relation.

Next, we will try to change the temporal topological relationship between the body words "maijinde (the gold buyer)" and "maijinde (the gold seller)" in example (1), and verify the reciprocity of the body words under non-temporal topological relationship (i.e. temporal distance relationship and temporal sequence relationship) and the possibility of forming mirror inversed sentences. The specific verification results are shown in Table 2:

Table 2 Test of sentence pattern variants and body words reciprocity for example (1)

Changed relationship	Syntactic operation	Sentences before reciprocity	Sentences after reciprocity	MISs?
Spatial distance relation	Delete "yujianle"; Add the distance marker "bi… zaodao (earlier than…)"	Maijinde bi mainjinde zaodao (The gold buyer was earlier than the gold seller)	Maijinde bi mainjinde zaodao (The gold seller was earlier than the gold buyer)	Reciprocal but not MIS
Spatial sequence relation	Delete "yujianle"; Add the sequence marker "bi… xiandao (before …)"	Maijinde bi mainjinde xiandao (The gold buyer arrived before the gold seller)	Maijinde bi mainjinde xiandao (The gold seller arrived before the gold buyer)	Reciprocal but not MIS

As shown in Table 2, when we change the temporal topological relation of example (1) to the temporal distance relation and the temporal sequence relation, the changed sentence can realize the reciprocity of body words but cannot form mirror inversed sentences. In this way, the necessary condition for the mirror inverse sentence similar to (1) to realize the reciprocity of body words to become the mirror inversed sentence is that the mirror inversed sentence patterns before and after reciprocity all have the temporal topological relation.

Let's furthermore take sentence (2) "Dekesitela xiehoule IBM gongside Ailun (Dykstra met Allen of IBM)↔ IBM gongside Ailun xiehoule Dekesitela (Allen of IBM met Dykstra)" as an example to explain the reciprocity conditions of mirror inversed sentences with temporal topological relations.

First of all, there is an interactive concept of "meeting (indicated by xiehoule)", which presupposes the occurrence of two "meeting" action events. The actors of the two events, "Dekesitela (Dykstra)" and "Ailun (Allen)", send out actions in two different time periods I and J respectively, and "meet" each other at the end of the actions. The temporal relationship between two action events can be expressed as Figure 2:
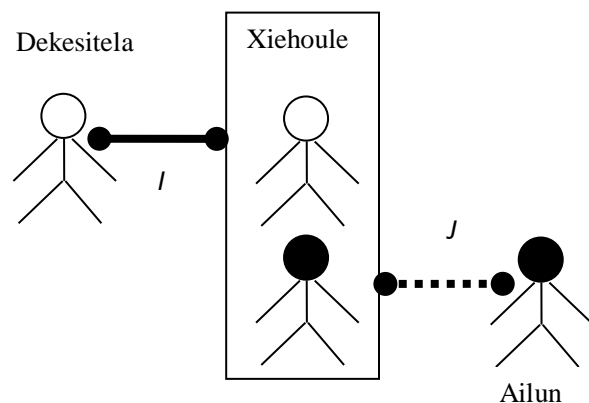
Fig1. The temporal relationship of example (2)

According to Fig. 2, There is an intersection between the boundaries of I and J; There is no intersection between the boundary of I and the interior of J; There is no intersection between the interior of I and the boundary of J; There is no intersection between the interiors of I and J. These characteristics are consistent with the definition of temporal connection (see Table 1 for details); As such, "I" and "J" have a topological relationship of temporal connection. In other words, example (2) belongs to the mirror inversed sentence of temporal topological relation.

Next, we will try to change the temporal topological relationship between the body words "Dekesitela (Dykstra)" and "Ailun (Allen)" in example (2), and verify the reciprocity of the body words under non-temporal topological relationship (i.e. temporal distance relationship and temporal sequence relationship) and the possibility of forming mirror inversed sentences. The specific verification results are shown in Table 3:

Table 3 Test of sentence pattern variants and body words reciprocity for example (2)

Changed relationship	Syntactic operation	Sentences before reciprocity	Sentences after reciprocity	MISs?
Spatial distance relation	Delete "xiehoule"; Add the distance marker "bi… zaodao (earlier than…)"	Dekesitela bi Ailun zaodao (Dykstra was earlier than Allen)	Ailun bi Dekesitela zaodao (Allen was earlier than Dykstra)	Reciprocal but not MIS
Spatial sequence	Delete "xiehoule"; Add	Dekesitela bi Ailun xiandao (Dykstra	Ailun bi Dekesitela xiandao	Reciprocal but not

relation	the sequence marker "bi… xiandao (before …)"	arrived before Allen)	(Allen arrived before Dykstra)	MIS

As shown in Table 3, when we change the temporal topological relation of example (2) to the temporal distance relation and the temporal sequence relation, the changed sentence can realize the reciprocity of body words but cannot form mirror inversed sentences. In this way, the necessary condition for the mirror inverse sentence similar to (2) to realize the reciprocity of body words to become the mirror inversed sentence is that the mirror inversed sentence patterns before and after reciprocity all have the temporal topological relation.

Through the investigation of other examples of the temporal MISs, it is found that the necessary conditions for complex temporal relation MISs to realize the reciprocity of body words to become MISs are: the MISs before and after reciprocity have temporal topological relation. Since the temporal topological relation is the same topological property under topological transformation, describing the topological positional relation between geometric objects is a "symmetrical" semantic relation. It can be inferred from this that the existence of "symmetrical" semantic relation is a necessary condition for the simple spatial relation mirror inverse sentence to realize the reciprocity of body words.

4. CONCLUSIONS

From the perspective of temporal relationship, this paper focuses on the specific conditions for the reciprocity of body words in the temporal mirror inversed sentence pattern.

Firstly, this paper discusses the specific classification of temporal relationship. temporal relations can be firstly divided into the absolute and the relative relations, and the relative relations are generally discussed from three angles: temporal distance relations, temporal sequence relations and temporal topological relations. temporal topological relations can be divided into 8 sub-relations according to the topological definition of point sets: connection, intersection, equality, including, included, covering, covered and separation.

Then, this paper focuses on the specific conditions for the reciprocity of body words in the temporal mirror inversed sentence pattern. The necessary condition for the reciprocity of the body words in the temporal mirror inversed sentence is the "symmetrical" temporal topological relationship between the two body words. In short, the existence of "symmetrical" semantic relations in the temporal dimension is a common necessary condition for the reciprocity of body words in spatial mirror inversed sentences.

In other words, the symmetry of the conceptual semantics of the mirror inversed sentence pattern is the premise of its formal symmetry, and the formal symmetry is the reflection of its conceptual semantic symmetry. This is related to the iconicity of human cognition, specifically, to the iconicity motivation of human symmetry.

6. Acknowledgement

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