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Experimental investigation of locative inversion in Mandarin Chinese

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1 Introduction

Locative inversion (LI), constituting a word order “LocP V NP” that arises from the uninverted one “NP V LocP”, involves a change of position between a noun phrase (NP) and a locative phrase (LocP). This construction also involves a change in grammatical functions, with the preposed LocP being argued to be the subject (cf. [Bresnan and Kanerva 1989](#); [Bresnan 1994](#)).

- (1) a. *In the woods lives an old woman.* (LI)
b. *An old woman lives in the woods.* (non-LI)
([Levin 1993](#): (335))
- (2) a. [_{LocP}*Ku-mu-dzi*] *ku-na-bwér-á* [_{NP}*a-lendÔ-wo*]. (LI)
17-3-village 17SBJ-PST-come-IND 2-visitor-2those
'To the village came those visitors.'
([Bresnan and Kanerva 1989](#): (1b))
b. [_{NP}*A-lendÔ-wo*] *a-na-bwér-á* [_{LocP}*ku-mu-dzi*]. (non-LI)
2-visitor-2those 2SBJ-PST-come-IND 17-3-village
'Those visitors came to the village.'
([Bresnan and Kanerva 1989](#): (2b))
- (3) a. 台上坐着主席团. (LI)
[_{LocP}*Tai-shang*] *zuo-zhe* [_{NP}*zhuxituan*].
platform-on sit-IPFV presidium
'On the platform sat the presidium.'
b. 主席团坐在台上. (non-LI)
[_{NP}*Zhuxituan*] *zuo* [_{LocP}*zai tai-shang*].
presidium sit at platform-on
'The presidium sat on the platform.'

- One question that centers on my doctoral research is what motivates LI in Mandarin Chinese, and in particular on the question of what determines the choice of locative inversion over the uninverted sentence, with a focus on semantics and pragmatics. Previous accounts of locative inversion have been based on a purely syntactic¹ (e.g., [Coopmans 1989](#); [Freeze 1992](#); [Stowell 1981](#); [Zhu](#)

¹ Notably, in the light of [Harris's \(1965\)](#) transformational theory, [Zhu \(1982; 1986\)](#) captures the relation between locative inversion and uninverted construction in Mandarin Chinese by means of a “transformation”, referred to as 依存关系 *yicun guanxi* ‘dependency relation’. This concept posits a dependency relationship between two structurally different constructions. Other syntactic approaches include the small-clause (SC) analysis ([Hoekstra and Mulder 1990](#); [Zhang 2019](#)) and the light verb account ([Lin 2001](#)).

1982; 1986; Hoekstra and Mulder 1990; Zhang 2019; Lin 2001) or lexical² (see Bresnan and Kanerva 1989; Bresnan 1994; Pan 1996; Huang and Her 1998; Her 1998; 2003; 2006; Lin 2002) treatment. However, the relationship between locative inversion and its corresponding uninverted counterparts is more complex than previously assumed, requiring a broader examination that includes semantic and pragmatic considerations.

- The understanding of semantic and pragmatic dimensions of locative inversion, for which to our knowledge there is no systematic account, awaits investigation on a broad empirical basis. Against this backdrop, I adopt a multivariate corpus analysis to investigate the importance of a range of factors in determining the choice of locative inversion over the uninverted construction, including discourse information, definiteness effect, constituent weights, and animacy.
- Findings of the corpus study:
 - (1) According to the logistic regression model, there is evidence for the effect of five variables, which are (i) newness of theme, (ii) newness of location, (iii) heaviness, (iv) definiteness of theme, and (v) animacy of location, in order of importance based on their impact on the dependent variable across all observations.
 - (2) The data exemplify the idea of “save the good stuff till last” (Johnson 2008) or a pattern of “Harmonic Alignment” (of factors) with syntactic position, as documented by Bresnan et al. (2007) and many others (Aissen 2003; Collins 1995; De Vaere et al. 2021), which suggests that in sentences, referent objects that are given, definite, animate, and shorter in length tend to precede those that are new, indefinite, inanimate, and longer in length. As shown in Table 1,³ this general pattern is reflected in the modal results: locative inversion is preferred with a given, animate, shorter location, and a new, indefinite, longer theme, whereas the uninverted variant is favoured with a given, definite, short theme, and a new, inanimate, longer (or equally long) location.

² Lin (2002) formulates two distinct representations for the verb 放 *fang* ‘place, put’ in both locative inversion and uninverted sentence, framed within Davidsonian semantics (cf. Parson 1990).

³ In Table 1, the symbol “>” represents ‘precedes’.

Table 1 Relative preferences of factor levels in locative inversion (LI) and uninverted sentence (non-LI) based on the statistical analysis of the corpus

Variables favouring LI	Location	>	Theme
i. Newness_Theme = new			new
ii. Newness_Location = given	given		
iii. Definiteness_Theme = indefinite			indefinite
iv. Animacy_Location = animate	animate		
v. Heaviness = Location <Theme	short		long
Variables favouring non-LI	Theme	>	Location
i. Newness_Theme = given	given		
ii. Newness_Location = new			new
iii. Definiteness_Theme = definite	definite		
iv. Animacy_Location = inanimate			inanimate
v. Heaviness = Location ≥ Theme	short		long (equal)

2 Experiments

To complement and enrich our findings from the corpus study and to enhance our understanding of the role of semantics and pragmatics in locative inversion, I carry out two experimental studies to investigate how the choice of variants in locative inversion is affected by the factors considered in the corpus study. Experiment 1 is to evaluate the validity of the corpus-based model that builds on a number of factors. This assessment will involve a comparison between the model's predicted outcomes, which rely on various factors, and the actual performance of the speakers in the experiment. Experiment 2 assesses the effects of newness (theme), definiteness, and heaviness on the choice of locative inversion and the relative importance of these factors in an acceptability judgement experiment.

2.1 Experiment 1

- **Testify** whether the participants' performance aligns with the predicted outcomes computed in the corpus-based logistic model.
- Following Bresnan (2007), I argue that the statistical probabilities of constructions can be examined by looking at the scores that speakers give to the naturalness of sentences. Each sentence in the corpus has a probability value that reflects its frequency as a locative inversion construction.
- Figure 3 illustrates the probability values of the 899 instances of locative inversion and the uninverted sentences that occurred in the corpus study.
- **Hypothesis:** there is a close relationship between the probabilities derived from the model and the acceptability of locative inversion.

- **Procedure:** From the corpus of 899 instances that is analysed in the corpus study, I sampled 20 instances as the experimental items, as indicated by the black triangles in Figure 3.
- **Result:** The statistical analysis shows a positive correlation between corpus probabilities and acceptability ratings. Figure 2 plotted a linear regression line, the shaded region shows the 95% confidence intervals. A p-value ($< .0001$) indicates that the corpus probabilities have a significant relationship with the acceptability ratings. There is a gradual upward slope, showing that as the corpus probability increased, so did participants' acceptability ratings of locative inversion.

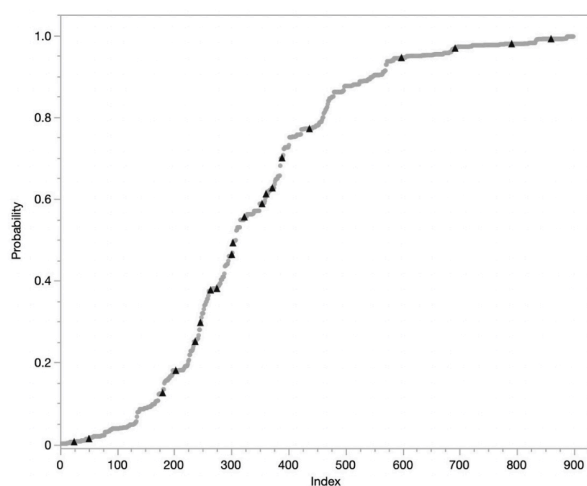


Figure 1 The probability distribution of the corpus data (899 instances)

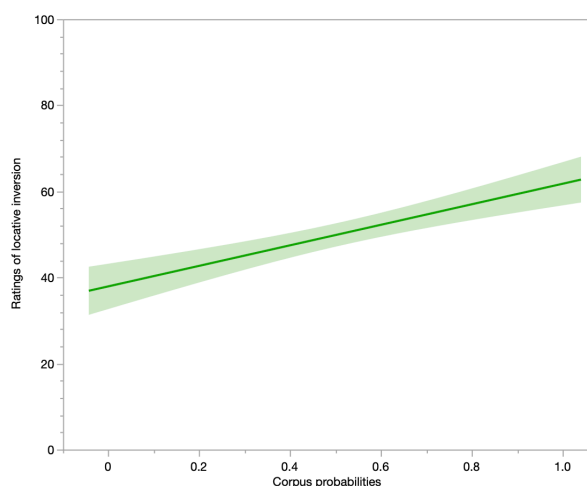


Figure 2 The linear regression with confidence intervals for probabilities (derived from the frequency of locative inversion in the corpus) and the corresponding acceptability ratings in experiment

2.2 Experiment 2

The experiment addresses the following questions:

- (a) Are newness, definiteness, and heaviness independent factors, or can the effect of one

of them be considered as merely epiphenomenal to the others?

(b) Which factor has a greater influence over constituent ordering, or what is their relative importance?

- In dative alternations, Rosenbach (2005) finds it difficult to decide whether the preference for the double object construction (4a) over the prepositional construction (4b) is primarily due to the indirect object being given, animate, and short.

- (4) a. *John gave her a book on English grammar.*
 b. *John gave a book on English grammar to her.*
 (Rosenbach 2005: (1))

- Hawkins (1994: 215) claimed, “Since there are correlations between weight and information status, it is quite conceivable that one could be in the driving seat, with the other being merely epiphenomenal.”
- The problem of correlated factors also arises in the phenomenon of locative inversion: the pattern of “Harmonic Alignment”. The corpus study shows that the preferences of different factors for the choice of locative inversion or uninverted sentences in Mandarin Chinese align with the pattern of “Harmonic Alignment”. In both constructions, the referent NP that is given, animate, short, definite appears first, followed by the referent object that is new, inanimate, long, and indefinite. This pattern can reflect an underlying mechanism of order, thus suggesting a strong correlation between these factors.

2.2.1 Experimental design and hypotheses

- an acceptability judgement test focusing on three factors: newness, definiteness, and heaviness. The question to be explored is whether any of these factors can be reduced to or explained by the influence of other factors, or whether any of them are epiphenomenal.
- I also address the question (b), which concerns the relative importance of the factors under consideration. The corpus provides evidence suggesting the order of importance as follows: **Newness (theme) > Definiteness (theme) > Heaviness** (“>” means “more important”). I expect that this hierarchy to be confirmed by the acceptability judgement test.
- Moreover, I expect that different factor levels will result in different acceptabilities for locative inversion and uninverted sentence. For instance, when newness (theme) is new, locative inversion will consistently exhibit higher acceptability compared to uninverted sentence, while keeping all other factors constant.

Table 2 Conditions based on newness (theme), definiteness (theme), and heaviness

Factors	Factor levels							
	new				given			
1. Newness (theme)								
2. Definiteness (theme)	indefinite		definite		indefinite		definite	
3. Heaviness	loc<th	loc>th	loc<th	loc>th	loc<th	loc>th	loc<th	loc>th
Condition	1	2	3	4	5	6	7	8

- (5) sentences with new theme, indefinite theme, loc < th
 此刻, 敦刻尔克地区一片狼藉, _____, 海面上尽是油污、木块。
 ‘At this moment, the Dunkirk area is a mess, _____, and the sea is full of oil stains and wood blocks.’
- a. 海滩上散落着一些来不及掩埋的尸体. (LI)
 ‘On the beach scattered some corpses that are too late to bury (There are some corpses scattered on the beach that are too late to bury).’
- b. 一些来不及掩埋的尸体散落在海滩上. (non-LI)
 ‘Some corpses that were too late to bury were scattered on the beach.’
- (6) sentences with new theme, indefinite theme, loc > th
 段誉抬起头来, 少林寺的人已经赶到, 只见 _____, 树枝不住晃动, 那人便随着树枝上下起伏。
 ‘Duan Yu looked up, the Shaolin Temple had arrived, only to see _____, the branch kept shaking, and the person went up and down with the branch.’
- a. 一株杏树的树枝上站着那个和尚. (LI)
 ‘On the branch of an apricot tree stands that monk.’
- b. 那个和尚在一株杏树的树枝上站着. (non-LI)
 ‘That monk is standing on the branch of an apricot tree.’

Hypotheses:

- Newness, definiteness, and heaviness play a role in the choice between locative inversion and uninverted sentence, and no one factor can be reduced to another. (H1)
- The importance of newness, definiteness, and heaviness is weighed differently, with newness being the most important, followed by definiteness and then heaviness in succession. (H2)
- Different factor levels display different preferences for the alternating constructions. Specifically, regarding newness (theme), locative inversion is more acceptable for introducing a new theme rather than for introducing a given theme. As for definiteness (theme), an indefinite theme tends to be more acceptable in locative inversion, whereas a definite theme is more acceptable in uninverted sentence. In terms of heaviness, locative inversion tends to be more acceptable for longer themes, while uninverted sentence is more acceptable for shorter themes. (H3)

2.2.2 Materials

- 8 short passages (4 LI, 4 non-LI); 64 items
- (7) The process of constructing an experimental item with passages containing locative inversion.
 此刻, 敦刻尔克地区一片狼藉, 海滩上散落着来不及掩埋的尸体, 海面上尽是油污、木块。
 ‘At this moment, the Dunkirk area is a mess, on the beach scattered some corpses that are too late to bury (there are some corpses scattered on the beach that are too late to bury), and the sea is full of oil stains and wood blocks.’
- a. Adapted to fit Condition 1, involving a new, indefinite, and longer theme:
 海滩上散落着一些来不及掩埋的尸体

Haitan-shang sanluo-zhe yixie laibuji yanmai de shiti
 beach-on scatter-IPFV some late bury NMLZ corpse
 ‘On the beach scattered some corpses that are too late to bury.’

Lit. There are some corpses scattered on the beach that are too late to bury.

- b. Converting locative inversion into uninverted sentence as the alternative choice:

一些来不及掩埋的尸体散落在海滩上

Yixie laibuji yanmai de shiti sanluo zai haitan-shang
 some late bury NMLZ corpse scatter at beach-on

‘Some corpses that were too late to bury were scattered on the beach.’

Modification of factors

- **Newness (new/given)** refers to whether a reference object is explicitly mentioned, or implied in the previous context. A passage is modified to change the informational status of the theme to “given” by introducing a sentence before the context to establish the necessary information. As shown in (12b), the passage is modified to contain a given theme by adding a given prior information (bold).

- (8) a. The original passage containing a new theme

段誉抬起头来，只见一株杏树的树枝上站着一人，树枝不住晃动，那人便随着树枝上下起伏。

‘Duan Yu raised his head and saw on the branch of an apricot tree stands a man, the branch kept shaking, and the person went up and down with the branch.’

- b. Modified to contain a given theme by adding prior information

段誉抬起头来，少林寺的人已经赶到，只见一株杏树的树枝上站着一人，树枝不住晃动，那人便随着树枝上下起伏。

‘Duan Yu raised his head, **the people from Shaolin Temple had arrived**, and saw on the branch of an apricot tree stands a man, the branch kept shaking, and the person went up and down with the branch.’

- **Definiteness (indefinite/definite)** A theme is made definite by using demonstratives like 这 *zhe* ‘this’, 那 *na* ‘that’, and is made indefinite by using the form “yi ‘one’ + classifier”, 一些 *yixie* ‘some’, 很多 *henduo* ‘many’. The presence of definiteness (theme) in each passage is exemplified below.

Passage	Definite	Indefinite
1	那台相机 <i>na-tai xiangji</i> DEF-CLF camera 'that camera'	一台相机 <i>yi-tai xiangji</i> one-CLF camera 'a camera'
2	那些尸体 <i>naxie shiti</i> DEM corpse 'those corpses'	一些尸体 <i>yixie shiti</i> some corpse 'some corpses'
3	那盆青稞苗 <i>na-pen qingkemiao</i> DEF-CLF highland barley seedling 'that highland barley seedling'	一盆青稞苗 <i>yi-pen qingkemiao</i> one-CLF highland barley seedling 'a highland barley seedling'
4	那个和尚 <i>na-ge heshang</i> DEF-CLF monk 'that monk'	一(个)和尚 <i>yi(-ge) heshang</i> one-CLF monk 'a monk'
5	这些足迹 <i>zhexie zuji</i> DEM footprints 'these footprints'	很多足迹/足迹 <i>henduo zuji</i> many footprints 'many footprints'
6	那位侍卫 <i>na-wei shiwei</i> DEF-CLF guard 'that guard'	一位侍卫 <i>yi-wei shiwei</i> one-CLF guard 'a guard'
7	那些教学内容 <i>naxie jiaoxue narong</i> DEM teaching staff 'those teaching staff'	一些教学内容 <i>yixie jiaoxue neirong</i> some teaching staff 'some teaching staff'
8	那(几)个'教'字 <i>na-(ji)ge 'jiao' zi</i> DEF-CLF 'teach'(teach) character 'that/several 'teach'(teach) characters'	一些/不少'教'字 <i>yixie/bushao 'jiao' zi</i> some 'teach'(teach) character 'some 'teach'(teach) characters'

- **Heaviness (loc < th/loc > th)** I made the NP longer by adding a modifier, such as adjectives, PPs, genitives, coordinate compounds.

2.2.3 Participants and procedure

- **Participants** 118 native speakers of Mandarin Chinese (18-28 years old; mean 21); speak and use Putonghua in daily life
- **Procedure** read 20 passages (12 fillers), and then (i) select the more natural option from the two provided choices to fill in the blank, and (ii) subsequently rate the naturalness of the two options by moving a blue circle along a rating bar.

第四, 英国希望___, 可以供英国商人居住及贮货, 如同葡萄牙人在澳门一样。

'Fourthly, Britain wants that ___, to house British merchants and store goods, just as the Portuguese did in Macau.'

- 中国把一个小岛给她 'China gave an island to her'
- 中国给她一个小岛 'China gives her an island'

(请移动圈圈打分) *please move the circle to score*

所选项得分(score of selected)

未选项得分(score of unselected)

x

100-x



Figure 3 An example of pretests in Experiment 2

2.2.4 Results

- Figure 4 presents the number of selected LI and non-LI according to factors. When the theme is new, more LI are chosen than when the theme is given. However, more non-LI are chosen in the presence of given themes than in the presence of new themes. The chi-square test suggests a significant association between newness and chosen construction type ($\chi^2 = 5.37, p < .05$).
- LI is chosen more often with indefinite themes than with definite themes, while non-LI is chosen more often with definite themes than with indefinite themes.
- When the location is shorter than the theme, more LI are chosen than when the location is longer than the theme. Reversely, when the location is shorter than the theme, fewer non-LI are chosen than when the location is longer than the theme. However, both definiteness and heaviness are not significant factors of choice by participants ($\chi^2 = 1.70, p > .05$ and $\chi^2 = 0.76, p > .05$, respectively).

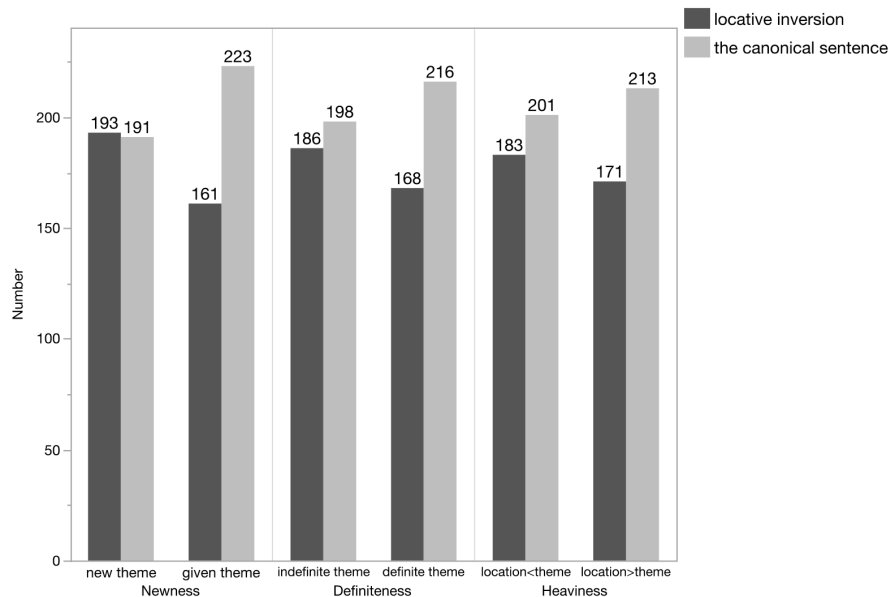


Figure 4 The selection of locative inversion and uninverted sentence based on newness (theme), definiteness (theme), and heaviness

- A similar pattern is found in the rating task (see Figure 5: where new, indefinite, and longer themes make locative inversion more acceptable, while given, definite, and shorter themes are less acceptable in this context. **Therefore, H3 is confirmed.**

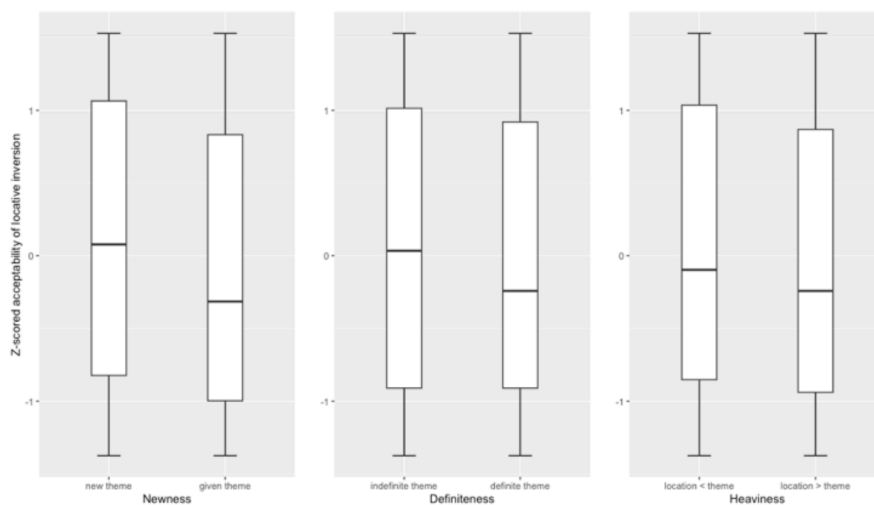


Figure 5 Z-scored acceptability of locative inversion in the rating task according to newness (theme), definiteness (theme), and heaviness

- The statistical analysis results demonstrate that there is no significant correlation between newness (theme), definiteness (theme), and heaviness. I fitted a mixed-effects regression model with newness (theme), definiteness (theme) and heaviness as fixed factors and participants and contexts as the random effects. The model is tested for multicollinearity using Variance Inflation Factors (VIF).
- The tests found no signs of a noticeable correlation between the factors. Newness (theme), definiteness (theme), and heaviness each provide independent and unique information in explaining the variation in the acceptability score. As a result, **H1 is supported by the data, neither factors can be reduced to the other.**
- The findings suggest a ranking of importance: newness > definiteness \geq heaviness. **(H2 is borne out.)**
- In both force-choice task and rating task, newness (theme) demonstrates a more pronounced effect compared to definiteness (theme) and heaviness, with a statistically significant effect ($p < .05$). Definiteness (theme) and heaviness, on the other hand, are comparable, exhibiting similar weights of importance.

Conclusion

- 1 newness plays a significant role in the choice of locative inversion and uninverted construction, exerting a larger effect compared to definiteness and heaviness. Definiteness and heaviness exhibit comparable weights of importance.
- 2 factor levels display different preferences for specific constructions.
- 3 the effect of each factor cannot be reduced or explained solely by the presence of the other factors.

Table 4 The standard coefficient table of fixed effects in the rating task results

Fixed effects	Estimate	Std.Error	t value	Pr (> t)
(Intercept)	39.677	6.954	5.706	0.000434 ***
Newness(theme)=new	7.469	2.115	3.532	0.000442 ***
Definiteness(theme)=indefinite	3.245	2.115	1.534	0.125423
Heaviness=location<theme	4.599	2.115	2.175	0.030007 *

(Signif. Codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1)

Table 3 The standard coefficient table of fixed effects in the force-choice task results

Fixed effects	Estimate	Std.Error	z value	Pr (> z)
(Intercept)	-0.6989	0.5195	-1.345	0.17847
Newness(theme)=new	0.4521	0.1687	2.680	0.00735 **
Definiteness(theme)=indefinite	0.2551	0.1682	1.517	0.12938
Heaviness=location<theme	0.1702	0.1681	1.013	0.31126

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