

Gain-framed Buying or Loss-framed Selling? The Analysis of Near Synonyms in Mandarin in Prospect Theory

Xin Luo

Dept of Chinese and Bilingual Studies
The Hong Kong Polytechnic University
xin-tracy.luo@connect.polyu.hk

Chu-Ren Huang

Dept of Chinese and Bilingual Studies
The Hong Kong Polytechnic University
churen.huang@polyu.edu.hk

Abstract

While prospect theory (Kahneman and Tversky, 1979) has been widely used as a descriptive theory to explain various phenomena such as insurance and the relation between spending and saving, no studies have been found to look at prospect theory from linguistic perspective to investigate near synonymous verbs. This study investigates near-synonymous verbs in Mandarin Chinese under the framework of prospect theory.

Using the large-scale Gigaword2 Corpus, we examined how verbal transaction reflects gain and loss frame in terms of human decision. It is observed that mai3 'buy', mai4 'sell' and zu1 'rent' have default gain-loss frame encoded in the lexical meaning. Because of the topic-prominent typological feature of Mandarin, gain and loss frame have close relation with information structure. By using highlighting and omission of argument, the gain-loss frame can be emphasized. Our current study focuses on near synonymous verbs in Mandarin Chinese. It is hoped that more near synonymous verbs in Mandarin Chinese and in other languages can be investigated under the framework of prospect theory.

1 Introduction

According to Cruse (2022; 1986), near-synonyms can be defined as words that one or more of their senses have a sufficiently close similarity. In Chinese, mai3 'buy' and mai4 'sell' is one of the opposites pairs in Ding (2018)'s analysis of the large-scale corpus-based study on comparing the semantic

use. In fact, extensive research have shown the semantic difference of the pair of 'buy' and 'sell' in English. They can be considered to be synonym or directional opposites because they can be expressed in two ways: A buys something from B or B sells something to A (Lyons, 1977). Cruse (2000) proposed that 'buy' and 'sell' may be four-place converses as the relational predicate they denote can have 4 arguments:

John sold the car to Bill for £5,000.

Bill bought the car from John for £5,000.

Mai3 'buy', mai4 'sell' and zu1 'rent', actually have the same eventive structure involving movement of money and merchandise. So far, however, no research has been found that investigate near synonymous verbs in the domain of gain-loss framing, especially based on natural language data in corpus.

Stemmed by Bernoulli (1954), expected utility is used as a criterion to explain the choice between gambles. This work was further developed into a descriptive theory of choice called *prospect theory* (Kahneman and Tversky, 1979) to evaluate the decision making under risk. Under this framework, it is observed that people tend to risk-averse with respect to gain and risk-seeking with respect to loss in different domains including financial decision and risky gambles. For example, the computerised laboratory experiments conducted by Powell and Ansic (1997) found that males are more risk preference whereas females are more risk-aversion in the financial decision making. From linguistics prospective, Zeng et al. (2022a) found that WAR metaphors were constantly sued with gain framing effects whereas

loss-framed WAR metaphors were less frequently used. In terms of effectiveness of vaccination advocacy messages. Zeng et al. (2022b)'s experimental studies showed that gain-framed messages are more effective than loss-framed messages. To provide further investigation of prospect theory from linguistic perspective, the current study will attempt to examine whether near-synonymous verbs *mai3* 'buy', *mai4* 'sell' and *zu1* 'rent' can reflect the gain and loss frame and how the gain and loss can be reflected on lexical choice and syntactic structure in decision-making problems.

2 Literature review

2.1 Prospect theory

Prospect theory (Kahneman and Tversky, 1979) is an alternative model of expected utility theory (von Neumann et al., 1944) to describe individual decision making under risk. This classic work with enormous influence and has been used as a descriptive theory to explain various phenomena such as insurance and the relation between spending and saving.

The gain and loss in prospect theory is measured by the outcomes. In other words, whether buying and selling are expressed positive or negative deviations (gains or losses) depends on the evaluation towards a reference point (neutral reference outcome). Notably, the variation of the reference point can determine whether an outcome is evaluated as a gain (positive) or a loss (negative) as shown in the S-shaped value function in Figure 1. An example given by Tversky and Kahneman (1981) is the cost of the purchase of a car. The transaction of the whole purchase is evaluated as positive, negative or neutral depending on various factors such as the performance of the car and the price of similar cars in the market.

Under the framework of prospect theory, Mather et al. (2012)'s experimental study examined the relationship of risk preferences and aging in domains of certain and risky gambles and Hameleers (2021) assessed the effect of gain-loss framing on risky choices and emotional response in times of the pandemic. While many of the experimental studies enrich the analysis in this field from different angles, the experiments are mainly based on survey and pre-designed tasks but rarely based on natural linguistic data. Furthermore, many of the current studies

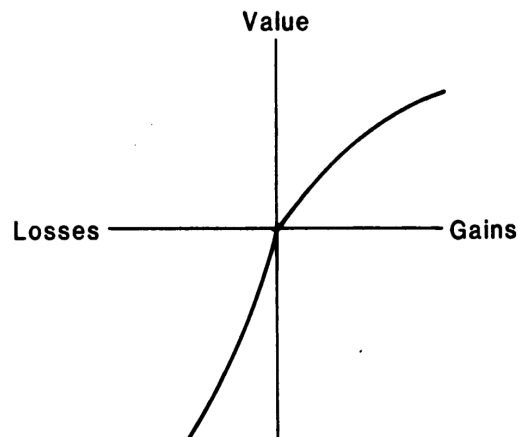


Figure 1: A hypothetical value function.

are conducted in western countries but not in China. Several others are in health domain (Kim, 2012) but not in decision-making problems.

From the linguistic perspective, there is default gain-loss frame encoded in the language which is similar to the valence of emotion words. For example, 喜歡 'like' is the positive emotion word whereas 愁 'worry' is the negative emotion word. *Mai3* generally refers to the acquiring of something, it is encoded in a gain frame from linguistic perspective. For *mai4* and *zu1*, they are directional because they involve giving away something and acquiring the money at the same time. They, therefore, can be in either gain or loss frame. When individual choose to make decision of buying rather than selling, the whole transaction is encoded in the default gain frame.

2.2 Thematic structure in Mandarin Chinese

Thematic structure which views the clause as message is made up of two distinct parts, *Theme* and *Rheme*. According to Halliday and Matthiessen (2014), the thematic structure is expressed by a Theme accompanied by a Rheme. The Theme appear in the sentence-initial position which serves as 'the point of departure of the message' and followed by Rheme, 'the part in which the Theme is developed'. The sentence-initial Theme highlights the thematic prominence information for the addressee (Halliday and Matthiessen, 2014). Some scholars have used the term *Topic* and *Comment* instead of Theme and Rheme (e.g., Li and Thomp-

son, 1981). In this study, we follow Li and Thompson (1981) and retain the terminology of Topic and Comment.

In Mandarin, topic-prominent sentence structure is a significant typological feature of Mandarin. In the topic-prominent sentence structure, word order is governed by meaning rather than grammatical function. This means that sentence with omitted subject, sentence with object at the beginning can be found in Mandarin. Topic, information known to both the speaker and the hearer, occurs in the preverbal position whereas comment, the new information occurs in the postverbal position. Take the short narrative from (Shyu, 2016) as an example.

[1]

a. 我特別喜歡讀...賈平凹的書。

wo3 te4bie2 xi3huan1 du2 jia3ping2wa4 de0 shu1
'I especially like to read books by JIA Pingwa.'

b. 這兩本書我都看爛了。

zhe4 liang3 ben3 shu1 wo3 dou1yao4 kan4 lan4
le0

'These two books are worn and torn because I have read them so often.'

The first sentence [1a] is in canonical sentential order of SVO. The underlined post-verbal object, books written by JIA Pingwa, is the new information and also the focus of the sentence. When additional information is added to the two books in [1b], the definite nominal 這兩本書 'these two books' becomes the shared/old information at the sentence-initial position with remaining comment clause to elaborate on.

3 Methodology and research questions

This study adopts a corpus-based approach to investigate the usage of three transitive verbs mai3 'buy', mai4 'sell' and zu1 'rent' from a linguistic point of view under the framework of prospect theory. The data are extracted from the large-scale corpus of Gigaword2 in Chinese Word Sketch (CWS) (Huang, 2009) which is one of the largest balanced corpora of collected news texts from Taiwan, Mainland China and Singapore. As a *topic-prominent* language, the 'topic' which is the given information usually occur in the pre-verbal position and followed by new in-

formation in Mandarin Chinese. Based on the topic-prominent feature in Mandarin Chinese, we examined how verbal transaction reflect gain and loss frame in terms of human decision.

4 Findings and Discussion

The following sessions present the findings and discussion of the results. From the search results in Chinese WordNet in Figure 2, these transitive verbs have the same eventive structure but in different directions. The default gain-loss frame encoded in the verbal transaction can be observed in general definition of the words. The linguistic encoding of mai3 'buy' is a default gain frame because people gain the merchandise. However, mai4 'sell' and zu1 'rent' are directional because they involve movement of money and merchandise. Therefore, mai4 'sell' and zu1 'rent' can be in gain or loss frame.

Table 1 shows the PoS of mai3 'buy', mai4 'sell' and zu1 'rent' and their frequency in Gigaword 2 Corpus. Mai3 'buy' has the highest frequency of 45,553 in Gigaword 2, followed by mai4 'sell' and zu1 'rent'. In terms of part of speech, mai3 'buy' is a transitive verb which has an object to take the argument role whereas mai4 'sell' and zu1 'rent' are ditransitive verbs which have two objects to take the argument role.

Verb	PoS	Frequency
mai3 'buy'	VC31	45,553
mai4 'sell'	VD1	29,494
zu1 'rent'	VD	5,938

Table 1: PoS of mai3 'buy', mai4 'sell' and zu1 'rent'

4.1 Gain-loss frame encoded in buying

Table 2 shows the subject and object of mai3 'buy' with the top five MI values. Mai3 'buy' is a two-argument verb that takes a subject (the one that pay) and an object (the merchandise to be gained). It is found that the subject of mai3 is usually the person to pay such as 顧客 'customer', 我 'I', 你 'You' and 自己 'self'. In addition, 錢 'money' can also be the subject. The merchandise to be gained such as 房子 'house', 東西 'thing' are usually take the object position.

買 ㄇㄞˋ mai3

詞義 01: 及物動詞, VC

領域

釋義 付出金錢以取得物品的所有權。

語義關係 同義詞「購買(0101)」、「買下(0100)」、「買下來(0100)」、「購(0100)」、「置(0500)」

英文對譯 buy, 01511279V,

例句

- 1、 每種股票都<買>相同的單位, 譬如各<買>兩千股, 或對某一種股票多<買>一份, 這完全看個人喜好。
- 2、 人要節慾, 不然就會被自己的慾望埋沒掉了。例如女人愛<買>衣服, 那天就會夢見自己被衣服給埋起來了。
- 3、 我花二十萬裝了一臺CD音響, 在聽音樂時會想, 以前花五萬元<買>的音響, 聽起來的感覺似乎和現在的感覺差不多。

賣 ㄇㄞˋ mai4

詞義 01: 及物動詞, VD

領域

釋義 將物品所有權轉移以取得金錢。

語義關係 同義詞「售(0100)」、「販售(0101)」、「銷售(0101)」、「販賣(0101)」、「銷(0101)」

英文對譯 sell, 01535023V,

例句

- 1、 今年一月, 法國巴拉杜內閣決定與中共重修友好, 不再權任何法國廠商<賣>武器給臺灣。
- 2、 客戶有了基本功能的電腦後, 等到需要高性能電腦時, 先去找原本<賣>電腦給他們的廠商。
- 3、 張志賢解釋, 取名中華「生協」是效法日本生(活)協(會)直接<賣>東西給消費者的做法, 以降低通路層級。

租 ㄗㄨˋ zu1

詞義 01: 及物動詞, VD; 名詞, nom

領域

釋義 限期借他人的物品使用, 並支付費用。

語義關係

英文對譯 rent, 01676348V, 上位詞

Figure 2: Search result of mai3 ‘buy’, mai4 ‘sell’ and zu1 ‘rent’ in Chinese WordNet.

However, because of the topic-prominent sentence structure in Mandarin Chinese, the Topic of a sentence is placed preverbally. The Topic is the given information which the speaker and listener already know, as in the following examples.

- [2]
- a. 房子買在山東。
fang2zi mai3 zai4 shan1 dong1。
‘The house was bought in Shandong.’
 - b. 他在溫哥華買了一棟房子。
ta1 zai4 wen1 ge1 hua2 mai3 le0 yi1 dong4 fang2zi0
He bought a house in Vancouver.
 - c. 兩萬塊錢買個烏紗帽。

Subject of mai3	Frequency	MI value
錢(money)	635	56.7
顧客(customer)	103	37.8
我(I)	237	34.1
你(you)	111	33.5
自己(myself)	290	32.4
Object of mai3	Frequency	MI value
房子(house)	864	65.4
東西(thing)	1280	64.7
書(book)	811	54.8
衣服(cloth)	335	49.1
房(house)	219	47.1

Table 2: Most frequent subject and object for mai3 ‘buy’.

liang3 wan4 kuai4 qian2 mai3 ge4 wu1 sha1 ma04
‘The black gauze cap costs 20 thousand dollars.’

房子 ‘house’ in [2a] is the given information because it is the person known to speaker and listener. When additional information is added to describe who purchases the house, 房子 ‘house’ becomes the new information in [2b]. When the numeral-measure phrase occurs in the preverbal position, it signals its status that speaker and listener already know the amount of money, the more informative is 烏紗帽 ‘the black gauze cap’ obtained with this amount toward the end of the sentence as in [2c].

It is observed that the monetary payment can be placed in between the subject and the verb mai3 ‘buy’. The monetary payment can give additional neutralized information, as in [3a] and [3b] or mitigate the gain frame of the sentence, as in [3c-3e].

- [3]
- a. 老百姓掏錢買房子。
lao3bai3xing4 tao1 qian2 mai3 fang2zi0。
Ordinary people spend money to buy houses.
 - b. 15歲時勞達向奶奶借錢買了一輛大眾牌二手車。
15 sui4 shi2 lao2 da2 xiang4 nai3nai0 jie4 qian2 mai3 le0 yi1 liang4 da4 zhong4 pai2 er4shou3 che1
‘When Lauda was 15, he borrowed money from his grandmother to buy a second-handed Volkswagen.’
 - c. 家長抱怨其子女花費太多錢買耶誕節卡片

和禮物。

jia1chang2 bao4yuan4 qi2 zi3nv3 hua1fei4 tai4duo1 qian2 mai3 ye2dan4jie2 ka3pian4 he2 li3wu4。

‘Parents complain that their children spend too much money on Christmas cards and presents.’

d. 這車子是貸款買的，車主還是車行。

zhe4 che1 zi0 shi4 dai4kuan3 mai3 de0, che1zhu3 hai2 shi4 che1hang2

‘The car was bought on loan. The owner is still the car dealer.’

e. 野村證券高價買股票彌補主要客戶的損失。

ye3cun1 zheng4quan4 gao1 jia4 mai3 gu3piao4 mi2bu3 zhu3yao4 ke4hu4 de0 sun3shi1

‘Nomura bought shares at high prices to cover the losses of key clients.’

In [3a] and [3b], 掏錢 ‘spend money’ is in a preverbal position, which signifies the relation between the verb and the nominal phrase. Likewise, 向奶奶借錢 ‘borrow money from grandma’ provides additional information of the monetary exchange. In contrast, the preverbal monetary payment can emphasize certain loss. 花費太多錢 ‘spend too much money’ in [3c], 貸款 ‘on loan’ in [3d] and 高價 ‘bought at high prices’ in [3e] have weakened the gain frame by highlighting certain loss. Furthermore, the verb of mental activity 抱怨 ‘complain’ in [3c] further confirm the mitigation of gain frame. Likewise, 車主還是車行 ‘The owner is still the car dealer’ in [3e] and 彌補損失 ‘to cover the losses’ are new information which further strengthen the mitigation of gain frame.

From the above observation, we found that mai3 has a predominant structure of gain frame. However, the gain frame can be mitigated or weakened by certain loss of money or compensation which occur in the preverbal position.

4.2 Gain-loss frame encoded in selling

Mai4 is a ditransitive verb which involves one subject (an agent who initiates the transfer) and two objects (a theme that is transferred and a beneficiary or maleficiary who receives or loses the theme).

[4] 任何人不得賣酒給二十一歲以下的年輕

Subject of mai4	Frequency	MI value
門票	38	29.9
菜	28	29.1
專輯	29	25.4
農副產品	23	24.8
低價	14	19.8
Object of mai4	Frequency	MI value
菜	607	69.3
價錢	299	61.2
錢	395	40.3
肉	112	40.2
假貨	60	38.7

Table 3: Most frequent subject and object for mai4 ‘sell’.

人。

ren4he2 ren2 bu4de2 mai4 jiu3 gei3 er4shi2yi1 sui4 yi3xia4 de0 nian2 qing1 ren2

‘No one can sell alcohol to young people under twenty-one.’

In example [4], 任何人 ‘anyone’ is the agent who initiates the wine selling. Two objects in this example are young people (goal) and the wine as the theme. Table 3 shows the subject and object of mai4 ‘sell’ of top five MI values. Different from mai3 ‘buy’, the nouns which take the subject position for mai4 ‘sell’ are usually the products to be sold whereas the object would be the price or the products.

Mai4 ‘sell’ usually involves double movement of money and merchandise, as shown in [5a]. However, the argument can be omitted to change the focus of the sentence. Compare the following examples.

[5]

a. 這位44歲的彝族壯漢和他的妻子一道靠賣土豆賺了不少錢。

zhe4 wei4 44 sui4 de0 yi2zu2 zhuang4 han4 he2 ta1 de0 qi1zi0 yi1 dao4 kao4 mai4 tu3dou4 zhuang4 le0 bu4shao3 qian2

‘The 44-year-old man from Yi ethnic group makes a lot of money by selling potatoes with his wife.’

b. 這位44歲的彝族壯漢和他的妻子一道賣土豆。

zhe4 wei4 44 sui4 de0 yi2zu2 zhuang4 han4 he2

ta1 de0 qi1zi0 yi1 dao4 mai4 tu3dou4

‘The 44-year-old man from Yi ethnic group sells potatoes with his wife.’

c. 這位44歲的彝族壯漢和他的妻子一道賺了不少錢。

zhe4 wei4 44 sui4 de0 yi2zu2 zhuang4 han4 he2 ta1 de0 qi1zi0 yi1 dao4 zhuan4 le0 bu4shao3 qian2

‘The 44-year-old man from Yi ethnic group and his wife make a lot of money.’

In these examples, the given information is the same while the emphasis of the sentences is different. In [5b], the sentence focuses on the merchandise to be sold but omit the money they made. The loss frame is emphasized. In contrast, the products that being transferred can be omitted by highlighting the money obtained, as in [5c]. The gain frame is emphasized. Note that using omission of argument (the object being transferred or the money), the gain or loss frame for mai4 ‘sell’ can be emphasized. Similarly, the gain frame of getting a good price is highlighted by omitting the argument of what to be transferred in [6]

[6] 三兩年內保證能賣上好價錢。

san1 liang3 nian2 na4 bao3zheng4 neng2 mai4 shang4 hao3 jia4qian2

‘Guaranteed a good price in a couple of years.’

In addition, the patient of the action 黎明粵語專輯 ‘Leon’s album’ occupies the subject position while the agent phrase does not appear. The *topic-comment* sentences are commonly used in Mandarin Chinese to package the flow of information. When 黎明粵語專輯 ‘Leon’s album’ occurs at the preverbal position as the topic, it represents the speaker and listener wants to discuss again as a piece of the given information. The new information is the attractiveness of Leon’s album. The *topic-comment* sentence in [8] is similar to that in [7] in that the 肉類 ‘meat’ appears in the preverbal position to represent a piece of old information while the focus of the sentence is 好賣 ‘sells well’. Mai4 ‘sell’ becomes intransitive and the price will not be mentioned.

[7] 黎明粵語專輯在香港大賣。

li2ming2 yue4 yu3 zhuan1ji2 zai4 xiang1gang3 da4 mai4

‘Leon’s Cantonese album sells well in Hong Kong.’

[8] 肉類依然好賣。

rou4 lei4 yi1ran2 hao3 mai4

‘Meat still sells well.’

4.3 Gain-loss frame encoded in renting

Subject of zu1	Frequency	MI value
土地	58	29.4
國有地	5	18.4
水	11	14.3
人士	5	4.1
政府	10	3.7
Object of zu1	Frequency	MI value
住處	337	65.7
船	75	35.8
公寓	41	31.6
場地	50	29.6
攤位	32	29.1

Table 4: Most frequent subject and object for zu1 ‘rent’.

In section 4.1 and 4.2, we have investigated the gain-loss frame in association with mai3 ‘buy’ and mai4 ‘sell’. Similar to mai4 ‘sell’, zu1 ‘rent’ is a ditransitive verb which involves two objects to take the argument role. However, zu1 is directional in either being a beneficiary to receive the theme or maleficiary who loses the theme. Table 4 shows the most frequent subject and object for zu1 ‘rent’ in Gigaword2 Corpus.

[9]

a. 這些衛星也可部分地「租」給民用了。

zhe4 xie1 wei4xing1 ye3 ke3 bu4fen de0 「zu1」 gei3 min2yong4 le0

‘These satellites can also be partly “leased” to civilian use.’

b. 長榮航空向英國MONARCH租得的兩架波音七六七。

chang2 rong2 hang2kong1 xiang4 ying1guo2 MONARCH zu1 de2 de0 liang3 jia4 bo1yin1 qi1liu4qi1

‘Eva Air leases two Boeing 767s from Britain’s MONARCH.’

c. 自己租了一輛大客車。

zi4ji3 zu1 le0 yi1 liang4 da4ke4 che1
'I rented a bus.'

d. 自己花了100塊租了一輛大客車。
zi4ji3 hua1 le0 100 kuai4 zu1 le0 yi1 liang4
da4ke4 che1
'I rented a bus for 100 yuan.'

In [9a], the beneficiary of zu1 'rent' is introduced by 給 'give' which emphasizes the loss frame. In [9b], the source is introduced by 向 'to'. It is the gain frame marked by 向...租得 'rent...to'. 長榮航空 'EVA Air' is the beneficiary who gains the money. In [9c], 一輛大客車 'a bus' occurs at the postverbal position, gain frame is thus emphasized. In [9d], the gain frame for zu1 can be mitigated by certain loss of 100 yuan.

5 Conclusion

Across the corpus-based study we look at prospect theory from a linguistic perspective to investigate the three near-synonymous verbs. We found that verbal transaction can reflect gain and loss frame in terms of human decision. It is observed that mai3 'buy', mai4 'sell' and zu1 'rent' have a default gain-loss frame encoded in the lexical meaning. Specifically, it is observed that mai3 has a predominant gain frame whereas mai4 and zu1 can be in gain or loss frame.

In addition, it is found that gain and loss frame have close relation with information structure because of the topic-prominent characteristic in Mandarin Chinese. By using highlighting and omission of argument, the gain-loss frame can be emphasized. Our current study focuses on near synonymous verbs, we hope the current study can be extended to study more near synonymous verbs in Mandarin Chinese and near synonymous verbs in other languages.

Acknowledgments

We would like to thank the anonymous reviewers for their insightful and helpful comments.

References

Daniel Bernoulli. 1954. Exposition of a new theory on the measurement of risk. *Econometrica*, 22(1):23–36.

- D. A. Cruse. 1986. *Lexical Semantics*. Cambridge University Press.
- D. A. Cruse, 2000. *Meaning in Language : An Introduction to Semantics and Pragmatics.*, chapter 9, pages 163–176. Oxford Textbooks in Linguistics. OUP Oxford.
- D. A. Cruse. 2022. *A Glossary of Semantics and Pragmatics*. Edinburgh University Press.
- Jing Ding. 2018. *A Lexical Semantic Study of Chinese Opposites*. Springer Singapore.
- Michael A.K. Halliday and Christian Matthiessen, 2014. *Clause as Message*, volume 1, page 88–133. Routledge.
- Michael Hameleers. 2021. Prospect theory in times of a pandemic: The effects of gain versus loss framing on risky choices and emotional responses during the 2020 coronavirus outbreak—evidence from the us and the netherlands. *Mass Communication and Society*, 24(4):479–499.
- Chu-Ren Huang. 2009. Tagged chinese gigaword version 2.0.
- Daniel Kahneman and Amos Tversky. 1979. Prospect theory: An analysis of decision under risk. *Econometrica*, 47(2):263–291.
- Hyo Jung Kim. 2012. The effects of gender and gain versus loss frame on processing breast cancer screening messages. *Communication Research*, 39(3):385–412.
- Charles N. Li and Sandra A. Thompson. 1981. *Mandarin Chinese: a Functional Reference Grammar*. University of California Press, Berkeley.
- John Lyons, 1977. *Structural semantics II: sense relations*, volume 1, page 270–335. Cambridge University Press.
- Mara Mather, Nina Mazar, Marissa A Gorlick, Nichole R Lighthall, Jessica Burgeno, Andrej Schoeke, and Dan Ariely. 2012. Risk preferences and aging: The “certainty effect” in older adults’ decision making. *Psychology and aging*, 27(4):801.
- Shu-Ing Shyu, 2016. *Information structure*, page 518–576. Reference Grammars. Cambridge University Press.
- Amos Tversky and Daniel Kahneman. 1981. The framing of decisions and the psychology of choice. *Science*, 211(4481):453–458.
- John von Neumann, Oskar Morgenstern, Harold W. Kuhn, and Ariel Rubinstein, 1944. *Formulation of the Economic Problem*, pages 1–45. Princeton University Press.
- Huiheng Winnie Zeng, Chu-Ren Huang, and Kathleen Ahrens. 2022a. Fighting against the pandemic: A gain-framed or loss-framed war? *Presented at the 30th Joint Workshop on Linguistics and Language Processing (JWLLP 2022)*, University of Macau, 26 March 2022.

Huiheng Winnie Zeng, Yin Zhong, Kathleen Ahrens, and Chu-Ren Huang. 2022b. Effects of gain/loss framing on pandemic vaccination responses. *To be presented at the 15th conference of the Association for Researching and Applying Metaphor (RaAM 15)*, University of Bialystok, Poland, 21-24 September 2022.