

Mandarin bridging: experimental data and theoretical implications

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1. Introduction

This project experimentally investigates the distribution and the licensing conditions of bridging in Mandarin, a classifier language. Bridging, also known as associative anaphora (Clark 1975, Hawkins 1978), is a phenomenon where a definite expression is licensed in a context that does not immediately seem to meet the uniqueness presupposition. Instead, it is licensed based on some relation established in the context. Schwarz (2009) distinguishes two types of bridging based on the nature of this relation: part-whole bridging where the entity is uniquely identified within a salient situation, and producer-product bridging where the entity is uniquely identified based on some relation to another discourse referent. He further shows that this difference is reflected in languages that distinguish between uniqueness-denoting definiteness and familiarity-denoting definiteness, with the former being used for part-whole bridging and the latter being used for producer-product bridging.

The way in which Mandarin marks definiteness has been investigated in a number of works, including Jenks (2018) and Dayal & Jiang (2021). The two studies propose different theoretical analyses of Mandarin definites and thus predict different patterns for Mandarin bridging. For example, Jenks (2018) predicts bare nouns to be used in part-whole bridging only and demonstrative descriptions to be used in producer-product bridging. Dayal & Jiang's (2021) analysis of Mandarin demonstratives, on the other hand, rules out the use of demonstratives in either type of bridging. In order to test these predictions against systematically collected data, we conducted a sentence rating task where participants were asked to rate the naturalness of the two types of bridging, varying the form of the definite noun between bare nouns (*che* 'car') and demonstrative constructions (*na-liang-che* 'that-CLASSIFIER-car').

Our results suggest that both bare nouns and demonstrative constructions are felicitous in both types of bridging in Mandarin, different from what Jenks and Dayal and Jiang would predict. Our results call for a more gradient view on Mandarin bridging, where both bare nouns and *na* constructions can semantically denote both types of definiteness but may have interactions at the pragmatic level that result in distributional differences.

This paper is organized as follows. Section 2 introduces the background, presenting the general claim on two types of bridging and zooming into the specific arguments about Mandarin bridging. In Section 3, we present our sentence rating study and discuss the results, which suggest that both bare nouns and demonstrative constructions are felicitous in both types of bridging in Mandarin. Section 4 concludes with a discussion of implications and remaining questions.

2. Background

2.1 Bridging

Bridging, or associative anaphora (Clark 1975, Hawkins 1978), is a phenomenon where a definite expression is licensed based on some relation to a context. Schwarz (2009) argues that

two types of bridging must be distinguished: **part-whole bridging** that identifies the target referent based on situational uniqueness, and **producer-product bridging** that identifies the target based on relational anaphora to another discourse referent.

In part-whole bridging as in (1a), the steering wheel can be identified because there is only one such wheel in the minimal situation that contains the driving event introduced in the first sentence. In producer-product bridging as in (1b), the relevant author can be identified assuming that there is a unique author that stands in a writing relation with the book introduced in the first sentence.

- (1) a. Jane was driving down the street. **The steering wheel** was cold. [part-whole]
 b. Jake bought a book today. **The author** is French. [producer-product]

Although English uses the definite article *the* for both cases, as shown in (1), there are languages that make morphosyntactic distinctions between uniqueness-denoting and familiarity-denoting definiteness, thus distinguishing between part-whole and producer-product bridging, respectively (Schwarz 2009, 2013, a.o.). For example, Fering uses the uniqueness-denoting *a* in part-whole bridging, and the anaphoricity-denoting *di* in producer-product bridging (Ebert 1971). German makes the same morphophonological distinction between uniqueness and familiarity in part-whole and producer-product bridging, respectively (Schwarz 2009).

In this work, we examine bridging in Mandarin, a classifier language that lacks an overt definite determiner. In the next section, we first introduce some preliminary empirical data on Mandarin definite expressions and then present two theoretical views on Mandarin bridging (Jenks 2018, Dayal and Jiang 2021).

2.2 Mandarin bridging

Mandarin does not have an overt definite article. Instead, bare nouns, which occur freely in the language, as well as demonstrative descriptions containing the demonstrative *na* and the classifier allow definite readings, as shown in (2).

- (2) a. **gou** yao guo malu.
 dog want cross road
 ‘The dog wants to cross the road.’
 b. **na-tiao-gou** yao guo malu.
 that-CL-dog want cross road
 ‘That dog wants to cross the road.’

Semantic analyses of definite bare nouns and demonstrative descriptions vary in the literature. In the rest of this section, we review two recent accounts of these definite expressions and discuss their empirical predictions.

2.2.1 Jenks (2018)

Jenks (2018) argues that the difference between a bare noun and a *na* construction aligns with the uniqueness vs. familiarity distinction made in Schwarz (2009), where uniqueness-based definiteness is expressed with bare nouns and familiarity-based definiteness is expressed with *na* constructions. Jenks discusses three observations that support the claim about Mandarin

bare nouns. First, larger-situation definites in Mandarin are expressed by bare nouns. These definites are licensed by general world knowledge. For example, in (3), the bare noun *yueliang* ‘the moon’ is licensed because their descriptive content mandates that there is a unique moon.

- (3) **Yueliang** sheng shang lai le.
 moon rise up come LE
 ‘The moon has risen.’

Second, immediate-situation definites are expressed by bare nouns. In (4), the sentence is interpreted in a specific context, where a specific individual finished a specific bowl of soup that is unique in the relevant situation. Hence, definiteness is licensed, and it is expressed by the bare noun *tang* ‘soup’.

- (4) Hufei he-wan-le **tang**.
 Hufei drink-finish-LE soup
 ‘Hufei finished the soup.’

Third and most relevant to our project, he observes that part-whole bridging is expressed by bare nouns, as in (5).

- (5) Chezi bei jingcha lanjie le yinwei mei you tiezhi zai **paizhao** shang.
 car PASS police intercept LE because NEG have sticker at license.plate on
 ‘The car was intercepted by the police because there wasn’t a sticker on the license plate.’

Jenks notes that anaphoric uses of bare nouns are much more restricted. For example, in an anaphoric context as in (6), a bare noun is infelicitous and a demonstrative construction is needed instead.

- (6) Jiaoshi li zuo-zhe yi-ge-nansheng he yi-ge-nusheng.
 classroom inside sit-PROG one-CL-boy and one-CL-girl
 Wo zuotian yudao **#(na-ge)-nansheng**.
 I yesterday meet that-CL-boy
 ‘There are a boy and a girl sitting in the classroom. I met the boy yesterday.’

Based on these observations, Jenks argues that Mandarin bare nouns carry a uniqueness-based *iota* operator, while *na* constructions carry an indexed *iota* operator, which resolves referent through anaphora. He further proposes that there is a principle that maximizes the use of index whenever possible (*Index!*), explaining why bare nouns are ruled out and *na* constructions are realized in anaphoric contexts in Mandarin. Finally, he notes that there is an exception to this generalization, which is that in subject positions, bare nouns can be anaphoric due to their topic status.

Jenks’ analysis of Mandarin bare nouns and *na* constructions make specific predictions on their distribution with respect to the two kinds of bridging. Jenks predicts that bare nouns would be reserved for part-whole bridging, while *na* constructions would be reserved for producer-product bridging. Bare nouns are predicted to be felicitous in producer-product bridging only if they appear in the subject position.

2.2.2 Dayal and Jiang (2021)

Dayal and Jiang (2021, see also Dayal 2021) argue that *na* constructions are similar to English *that*, and that both demonstratives carry an anti-uniqueness presupposition. In other words, there is another entity that meets the description outside the minimal situation in which the main predicate is evaluated. As English demonstrative *that* constructions cannot be used as anaphora in bridging, as shown in (7), Mandarin *na* constructions are ruled out for the same reason.

- (7) Mary bought a house.
 a. **The** roof needed to be replaced.
 b. #**That** roof needed to be replaced.

Moreover, Dayal and Jiang note that the antecedent noun type might play a role in Mandarin producer-product bridging. They observe the contrast in (8), noting that non-subject bare nouns can also be used in producer-product bridging. They note that this observation is in conflict with what is predicted in Jenks (2018).

- (8) a. #Paul renwei **na shou shi** hen youmei, jishi ta bu renshi **shiren**.
 Paul think that CL poem very beautiful although he NEG know poet
 ‘Paul thinks that poem is very beautiful although he doesn’t know of the poet.’
 b. Paul du-le **yi ben youqu-de shu**. Ta xiang jian **zuozhe**.
 Paul read-LE one CL interesting book he want meet author
 ‘Paul read an interesting book. He wants to meet the author.’

Dayal and Jiang thus predict the felicitousness of bare nouns in bridging contexts to be more gradient, especially based on the type of antecedent used. They, however, predict *na* constructions to be ruled out in any kind of bridging contexts because the unavailability of bridging uses is one of the main characteristics of English *that*, whose distribution they claim overlaps completely with that of *na*.

In summary, Jenks predicts the two noun types are reserved for different types of bridging and for bare nouns to only allow producer-product bridging in subject positions, while Dayal and Jiang predict that Mandarin demonstratives to be ruled out in bridging contexts altogether.

In this work, we tested the two predictions presented above to better understand the distribution of bare nouns and *na* constructions in bridging. Because the empirical claims in the two papers differ, we conducted a rating task against a larger number of Mandarin speakers, carefully manipulating the possible factors that can affect the interpretation.

3. Experiment

We conducted a sentence rating task looking at Mandarin bridging constructions. The two main factors we investigated were a) the bridging type (part-whole vs. producer-product), and b) the definite expression (bare noun vs. *na* construction). In addition to the two main independent variables, we further manipulated the antecedent type to address the effect of antecedent in bridging discussed in Dayal and Jiang (2021), as well as the syntactic position in which the definite expression occurs in the second sentence, based on Jenks’ (2018) argument that subject bare nouns allow an anaphoric reading. This section summarizes our methodology and the

results.

3.1 Stimuli

Our target stimuli contained 8 part-whole bridging and 8 product-producer bridging sentence pairs. Within each item, we manipulated the anaphor noun type (bare noun vs. demonstrative), the antecedent noun type (indefinite, bare, and demonstrative), and the syntactic position of the anaphor. Half of the stimuli involved animate nouns, while the other half had inanimate nouns. We discuss each factor in detail below.

First, bridging type included part-whole and producer-product bridging. Part-whole bridging is defined as a relation where the entity labeled as the “part” is physically contained in the entity labeled as the “whole”. Producer-product bridging is defined as a relation where the entity labeled as “product” has a one-to-one correspondence to the entity labeled as the “producer”. In order to avoid a context where both kinds of bridging might be available, we made sure that the producer-product bridging did not contain any relations where the “product” was physically contained within the “producer”. The complete list of entities are presented in (9).

(9) a. Part-whole relations:

Inanimate group: (brake, car), (roof, house), (seat, bike), (screen, laptop);

Animate group: (forehead, horse), (nose, dog), (mouth, shark), (tail, cat).

b. Producer-product relations:

Inanimate group: (key, lock), (password, account), (remote, TV), (charger, phone);

Animate group: (author, book), (painter, painting), (director, film), (speaker, presentation).

Second, we manipulated the different syntactic forms that the antecedents and anaphors may take. The antecedent was either a bare noun, such as (10a), a demonstrative construction with *na* and a classifier, such as (10b), or an indefinite noun phrase with the indefinite article *yi* ‘one’ and a classifier, such as (10c). The anaphor was either a bare noun or a demonstrative construction. Crucially, the two theories have different predictions on which noun form(s) the two types of bridging would use (Section 3.3).

(10) a.	che		
	car		
	‘car’		[BARE]
b.	na	liang	che
	that	CL	car
	‘that car’		
			[DEM]
c.	yi	liang	che
	one	CL	car
	‘one car’		
			[INDEF]

Third, we varied the syntactic positions where the referents (antecedents and anaphors) appear. The syntactic positions are limited to the subject and object of a simple declarative sentence.

Finally, half of the items involved animate nouns while half of the items involved inanimate ones, as shown in the full list in (9). Previous literature consistently use inanimate

objects as part-whole bridging examples, and animate ones for producers in the narrowly defined producer-product bridging (i.e., animate producers and inanimate products). The mix-match of the two variables, (in)animacy and bridging type, in the stimuli allows us to examine whether a noun form is reserved for a certain bridging type.

We present two example target stimuli in (11): a part-whole bridging item with inanimate referents in object positions, where both the antecedent and the anaphor are bare nouns, as in (11a); a producer-product bridging item with inanimate referents in subject positions, where the antecedent is an indefinite noun phrase and the anaphor is a demonstrative construction, as in (11b).

- (11) a. qu-nian wo mai le **che**. Wo zong wangji jiancha **shache**.
 Last-year I buy asp car I always forget check brake
 ‘I bought the car last year. I always forget to check the brake.’
- b. **yi-bu-shouji** mashang jiuyao meidian-le, dan **na-ge-chongdianqi** qiahao huai-le.
 One-CL-phone soon will no.battery-LE but that-CL-charger happen.to break-LE
 ‘A phone is running out of battery, but that charger happens to be broken.’

The 16 sets of target stimuli, with the factors varied as above, resulted in a total of 96 target stimuli. Each participant only saw one variation within each stimuli set, thus seeing 16 target sentences in total. In addition to the target stimuli, we included 24 syntactically well-formed controls with semantic oddness (12a), pragmatic oddness (12b), or no linguistic violations (12c). This set of control sentences were added in order to have a more systematic understanding of what the ratings mean. Comparing the participants’ ratings of the target sentences against semantically odd, pragmatically odd, and felicitous sentences allows us to locate the target ratings against a larger set of Mandarin data, and also helps us determine whether an infelicity of a sentence is due to semantic or pragmatic violations. The details of the control stimuli can be found in Zhu and Ahn (2022).

- (12) a. Zhang Xiaoming shi ge jie-le-hun-de danshenhan, wo he ta hen shu.
 Zhang Xiaoming is CL married bachelor I and he very close
 ‘Zhang Xiaoming is a married bachelor. I’m close to him.’ [semantically odd]
- b. Zuotian xiayu de shihou xiayu le.
 yesterday rain DE time rain LE
 ‘Yesterday it was raining when it was raining.’ [pragmatically odd]
- c. Xiaoxue zhengli hao keben, jue ding jintian qu-shangxue.
 Xiaoxue organize good textbook decide today go.to.school
 ‘Xiaoxue organized the textbooks and decided to go to school today.’ [neutral]

In Zhu and Ahn (2022), we determined that an instruction asking Mandarin speakers to rate based on ‘naturalness’ best captures distinctions between semantically odd and pragmatically odd sentences. Based on this, we used the instruction shown in (13).

- (13) Qing gei juzi de ziran chengdu dafen.
 Please give sentence DE natural degree rate.
 1 fen wei zui-bu-ziran, 7 fen wei zui-ziran.
 1 point is most-not-natural 7 point is most-natural
 ‘Please rate the naturalness of the sentence(s). 1 means least natural, and 7 means most natural.’

3.2 Participants and procedure

We recruited 120 native Mandarin speakers (18-64; gender-balanced) via Prolific. Participants were redirected to a PCIbex survey, where they were asked to first provide some demographic and language background information, and then complete the sentence judgment task. Participants were compensated \$2-3 for their time.

Each participant was presented with 40 stimuli, randomized in order: 8 part-whole and 8 producer-product bridging sentences (pseudo-randomized in referent noun type, animacy, and syntactic position), as well as 24 controls. Participants were asked to rate the naturalness of these sentences on a 7-point Likert scale, as in Fig. 1.

早上起床以后，张三闻到了三点钟。

请给句子的自然程度打分，1分为最不自然，7分为最自然。

最不自然 ○ ○ ○ ○ ○ ○ ○ 最自然
 1 2 3 4 5 6 7

Figure 1: Sample question (a control item with semantic violations)

3.3 Predictions

Jenks (2018) predicts that bare nouns are reserved for part-whole bridging, while demonstratives are reserved for producer-product bridging, with the exception that bare nouns are felicitous in producer-product bridging in subject positions. Therefore, anaphor noun type would significantly change the sentence ratings under the same bridging type. Bare noun anaphors would lead to higher ratings in part-whole bridging, while demonstrative constructions would lead to higher ratings in producer-product bridging. Bare nouns in subject positions would also lead to higher ratings in producer-product bridging.

Dayal & Jiang (2021) predict that Mandarin demonstrative *na* is ruled out in bridging contexts altogether, similar to English *that*. Therefore, demonstrative constructions would lead to lower ratings in any type of bridging. In contrast, bare noun anaphors would lead to higher ratings in both part-whole and producer-product bridging contexts. Moreover, they predict that gradient differences would be observed for bare nouns in bridging contexts, when antecedent noun type varies.

3.4 Results

We fit a Cumulative Link Mixed Model in R to compare ratings in different conditions. For part-whole bridging (Fig. 2), our results showed a main effect of **animacy** ($p < 0.001$) and **syntactic position** ($p < 0.05$). In the animate group (blue bars), no significant difference was

found for either **antecedent** or **anaphor** noun type ($p > 0.1$). In the inanimate group (yellow bars), we identified a main effect of **anaphor** noun type ($p < 0.01$). Moreover, Fig. 2 (as well as Fig. 3) indicates the average ratings of controls, including semantically odd sentences (red solid line), pragmatically odd sentences (red dashed line), and neutral sentences (black line).

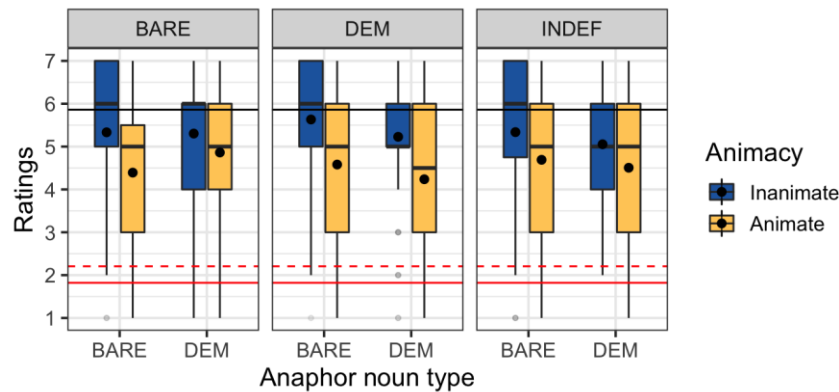


Figure 2: Ratings as function of anaphor noun type, grouped by antecedent noun type, in part-whole bridging.

For producer-product bridging (Fig. 3), we found a main effect of **syntactic positions** ($p < 0.01$) and significant interaction of antecedent noun type **INDEF** in **subject** positions ($p < 0.05$).

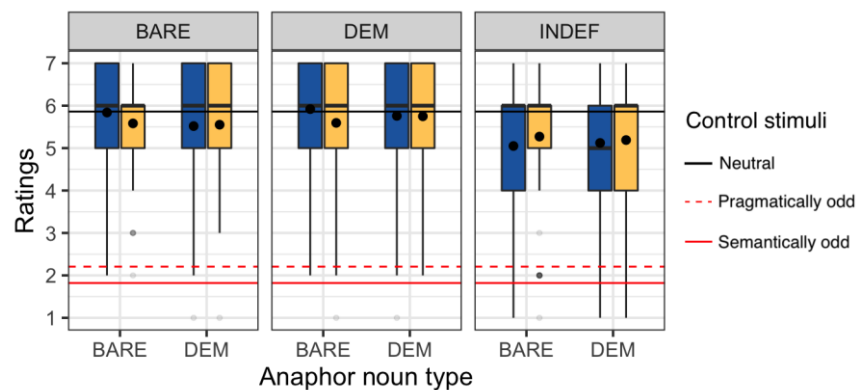


Figure 3: Ratings as function of anaphor noun type, grouped by antecedent noun type, in producer-product bridging.

For both bridging types, neither anaphor noun type nor antecedent noun type leads to significant rating differences ($p > 0.1$). Furthermore, the ratings of all bridging sentences are significantly above the ratings of pragmatically odd and semantically odd sentences ($p < 0.001$).

4. Discussion and conclusions

We have provided systematic empirical observations for Mandarin bridging. Our results show that both bare nouns and demonstrative constructions are felicitous in part-whole and producer-product bridging.

First, our results are not accounted for by Jenks' analysis. Jenks argues that demonstratives are preferred in producer-product bridging with the exception of bare nouns in subject positions. However, bare noun anaphors are actually rated higher than demonstratives in both types of

bridging. Hence, Jenks' prediction is not borne out. The only exception exists in inanimate part-whole bridging, where bare noun anaphors are indeed rated higher than demonstratives. The absence of this contrast in the animate part-whole bridging might be due to examples with body-parts such as *nose* and *forehead*. The tendency for bare nouns referring to body parts to refer to the speaker's own seems to have interfered with the rating. We suspect this might have led to the observed interaction of animacy and anaphor noun type. We plan to launch a follow-up reading time task to evaluate Jenks' theory in more depth.

Second, Dayal and Jiang (2021) makes too strong a prediction for Mandarin demonstratives, with their anti-presupposition analysis. In contrast to their prediction, Mandarin demonstrative constructions with *na* are in fact felicitous in both types of bridging, unlike English demonstratives. Moreover, the antecedent noun type did not lead to significant rating differences of bare nouns in bridging contexts. The observed interaction between indefinite antecedents and subject positions can be explained away by the dispreference of indefinite expressions in subject positions in Mandarin.

We further note that the difference between anaphor type is not categorical as predicted by Jenks' analysis. Instead, all ratings were significantly higher than pragmatically and semantically odd control sentences we included in the experiment. We argue that this calls for a more gradient view of bridging in Mandarin, where both bare nouns and *na* constructions can denote familiarity. There have been some recent discussions on the competition between different definite expressions in a given context, including definites and demonstratives (Patel-Grosz and Grosz 2017, Schlenker 2005, a.o.). These definite expressions have shown varying, gradient distributions, which are not categorical, similar to what we have observed for Mandarin bridging.

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