A bridge to definiteness: Identifying unique and relational definites through bridging

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Abstract

Definiteness covers a range of related meanings such as uniqueness and familiarity that are difficult to tease apart. The notion of bridging provides a testing ground for identifying the underlying mechanisms licensing definite expressions. Using this methodology, we investigate how Mandarin bare nouns and demonstratives carve up the definite space, and how they differ from English definite expressions. Through comprehension and production studies, we show that Mandarin bare nouns and demonstratives readily allow unique and relational bridging, while English demonstratives are degraded. We further show that bare nouns license relational bridging only if the bridged noun is lexically relational, while demonstratives do not have such restriction. We analyze Mandarin demonstrative *na* as a relationalizing operator that introduces an external index and a relational predicate in the restriction. This study has implications on existing analyses of Mandarin definite expressions as well as on the cross-linguistic investigation of definite meanings.

1 Introduction

Definiteness is a concept that is difficult to define. While the term 'definite determiner' morphosyntactically maps onto the determiner *the* in languages like English, the meanings associated with *the* include a range of notions from existence, uniqueness, familiarity, and more (Coppock and Beaver 2015; Heim 1983; Roberts 2003; Schwarz 2009; Wespel 2008; a.o.), many of which overlap with other morphemes such as the indefinite determiner *a* or the demonstrative determiners such as *that* and *this*. Across languages, subsets of these meanings are expressed through a range of different morphosyntactic mechanisms, further complicating the picture. Because of this complexity, it is often difficult to tease apart the different underlying semantic mechanisms of definiteness that are at play at a given time.

In this paper, we investigate a specific use of definite expressions called bridging as a proxy to identifying the underlying mechanisms of definiteness. While the term 'bridging' covers a range of phenomena that is not confined to definiteness (see Clark 1975 and below for further discussion), we focus on the notion that is used in the literature looking at the licensing conditions of definite expressions. In this literature, the term is narrowly defined to the phenomenon of a definite expression being licensed despite not having its referent introduced in the given context. When there is no clear referent available to resolve the definite expression to, speakers can make use of various strategies to resolve it for a coherent discourse, and these strategies are constrained by general pragmatic principles as well as lexical meanings of the bridged words (Asher and Lascarides 1998; Matsui 1995). For example, in (1) the referent of *the speaker* in the second sentence is not overtly given in the context, but is easily resolved by its relation to previous discourse: either through its unique existence in the situation described in the first sentence, or through its one-to-one relation to an entity introduced there (*the talk*). The second sentence out of the blue would have been degraded

due to a lack of a suitable referent for the definite description. Bridging refers to the range of links that can be drawn between the referent of a definite description and some property of the context.

(1) I attended a talk yesterday. The speaker talked about bridging.

Different bridges can be built depending on the different relations linking the previous discourse and the entity denoted by the definite expression. This means that, by manipulating the kinds of contexts in which definite descriptions appear, we can determine which semantic mechanism licenses the definite expression. This has been illustrated for languages like German, where two kinds of meanings underlying definiteness — uniqueness and familiarity — are morphosyntactically distinguished (Schwarz 2009). Schwarz (2009) shows that, in German, the uniqueness-denoting definite form shows up when the bridging link between the definite description and the context is that of uniqueness, and the familiarity-denoting definite form shows up when the bridging link is that of familiarity. Consider the two examples of bridging shown in (2).

(2) a. John's hands were freezing as he was driving down the street. The steering wheel was bitterly cold and he had forgotten his gloves. [part-whole]
b. John bought a book. The author is French. [producer-product]
[Schwarz 2009:11]

In (2a), the underlined definite description *the steering wheel* is easily identified because there is a unique steering wheel in the situation representing the information of the first sentence. In (2b), on the other hand, the minimal situation where John bought a book does not necessarily include a unique author. Instead, it is anaphoricity that licenses the definite description *the author*: since the noun *author* is relational, it semantically carries an index that refers to a book, which is anaphorically linked to the book that is mentioned in the first sentence. While English does not distinguish the uniqueness-based and the familiarity-based definite article overtly, German does, and Schwarz (2009) shows that the uniqueness-denoting article is licensed in (2a) while the familiarity-denoting article is licensed in (2b) and not vice versa.

In non-bridging uses of definite expressions where the antecedent and the definite expression refer to the same entity, it is often difficult to tease apart uniqueness from familiarity because anaphoric reference often entails uniqueness in some restricted domain. By separating the antecedent and the referent of the definite expression and focusing on bridged cases, we can tease apart anaphoric reference from situational uniqueness. Thus, we can test for different underlying mechanisms of definiteness and apply them across languages to identify the mapping between meaning and form.

We apply this strategy and present a case study with Mandarin, whose inventory of definite expressions differs greatly from that of English and German. Mandarin lacks a definite article and marks definiteness using bare nouns and demonstrative descriptions (Cheng and Sybesma 1999; Jiang 2012), and how they map onto the uniqueness/familiarity distinction of definiteness has been debated in the recent literature (Bremmers et al. 2022; Dayal and Jiang 2021; Jenks 2018; a.o.): some argue that the different meanings associated with the English article *the* are divided between bare nouns and demonstratives in Mandarin, while some argue that Mandarin demonstratives should have an interpretation that is separate from that of *the*. By testing uniqueness- and familiarity-based bridging with Mandarin bare nouns and demonstratives, we reveal the mechanisms of definiteness underlying these expressions. Through this strategy, we make several novel observations. First, we show that both bare nouns and demonstrative descriptions in Mandarin readily license uniqueness-based bridging and familiarity-based bridging (Study 1 and 2), in contrast to English where only definite descriptions, and not demonstrative descriptions, allow the two kinds of bridging (Study 3). Second, we show that familiarity-based bridging of bare nouns is only licensed if the noun is

inherently relational (Study 4). Based on these observations, we propose that Mandarin demonstrative *na* contributes a genitive relation function that can take an entity or a location as the relatum argument.

This study has several empirical and theoretical implications. As far as the authors know, bridging in Mandarin has not been tested systematically in previous works, so this study serves as an empirical basis for determining which definite expressions allow which kinds of bridging in Mandarin. Our data show that Mandarin bare nouns and demonstratives allow both uniqueness- and familiarity-based bridging, which is not straightforwardly accounted for by previous works and calls for a modified analysis. Theoretically, our analysis has implications on analyses of demonstratives and relational nouns. Across languages, demonstratives are assumed to disallow bridging altogether, and so the unavailability of bridging uses has been used as a diagnostic for identifying demonstratives from definite descriptions in typological studies (Himmelmann 1996; see Grosz 2018 for the bridging use of German demonstrative pronouns). Our study shows that an expression commonly identified as a demonstrative, one that displays all of the other properties used to identify demonstratives such as allowing deixis and anaphora, can still allow bridging, therefore suggesting that bridging is not a categorical diagnostic for distinguishing definites (which presumably allows for bridging) from demonstratives (which presumably disallows bridging) across languages. For relational nouns, our analysis of *na* implies there being two positions that can introduce the relatum argument: inside the noun denotation for inherently relational nouns, and outside the NP for non-relational nouns. We show that this aligns with the lexical and the pragmatic relational meanings identified in many other works (Barker 2011; Vikner and Jensen 2002) and links the latter use to the use of demonstratives or other external operators that contribute a relational interpretation even if the noun does not come with a lexical argument slot.

The rest of the paper is organized as follows. In Section 2, we present the background on bridging and Mandarin definite expressions. In Section 3, we present two experimental studies testing whether bare nouns and demonstratives in Mandarin allow uniqueness- and familiarity-based bridging. In Section 4, we present a parallel sentence ratings task in English, showing that English demonstratives disallow either kind of bridging. In Section 5, we propose a new analysis for *na*, where it is analyzed as adding a relational predicate and an external relatum argument to the restriction of the definite expression. Section 5.2 presents a final study looking at how relationality of nouns affects bridging for bare nouns and demonstratives. We show that bare nouns do not license bridging if the noun is not inherently relational, supporting our proposal that *na* contributes a relational argument externally while bare nouns do not. Section 6 concludes with a discussion of our study's implications.

2 Background: Bridging and Mandarin

2.1 Classic notion of bridging

The term 'bridging' can be used broadly to refer to any phenomenon where two chunks of the discourse are linked to each other via some contextual information like coreference due to restrictions such as coherence and relevance (Asher and Lascarides 1998; Hobbs 1979; Matsui 1995; Sperber and Wilson 1986; a.o.). Clark (1975) uses the term to refer to any mechanism that relates some expression like a definite description, a pronoun, or an epithet to its antecedent. There are many ways in which the intended referent of an anaphoric element can be identified from the context. According to Clark (1975), the most direct case of bridging is identity with a previously mentioned antecedent as in (3). This is a case of direct anaphora. Note that this does not count as a case of bridging under the sense we are using, but does so in this broader sense.

(3) I met a man yesterday. {The man, He, The bastard} told me a story. [Clark 1975:170]

More indirect links between the antecedent and the intended referent of an anaphoric expression include what Clark calls indirect reference by association like set membership or necessary parts as in (4) and indirect reference by characterization, as in relevant roles and causes as in (5). The idea is that given some entity or an event, the relevant parts or participants can be easily identified. The anaphoric expression is bolded and the antecedent is underlined.

(4) a. I met <u>two people</u> yesterday. **The woman** told me a story. [set membership]
b. I looked into <u>the room</u>. **The ceiling** was very high. [necessary parts]
[Clark 1975:171]

(5) a. <u>I trucked the goods to New York</u>. **The truck** was full. [necessary roles]
b. <u>John went walking at noon</u>. **The park** was beautiful. [optional roles]
[Clark 1975:171-172]

In Clark's view of bridging, the notion of bridging is not confined to definite expressions. For example, reasons that are introduced by *wh*-phrases, as in (6), and concurrences that are introduced by additive particles like *too* and *again*, as in (7), also count as bridging.

(6) <u>John fell</u>. **What he wanted to do** was scare Mary.

(7) <u>Alex went to a party last night</u>. He's going to get drunk **again** tonight.

The bridge linking the contents of the two sentences in (7) is the unsaid assumption that whenever Alex goes to a party, he gets drunk. Clark (1975) notes that bridges do not need to be 'determinate', meaning that one could in principle build an 'infinitely long bridge, or sequence of assumptions, to link one event to the antecedent of the next' (p.173). However, he proposes a general pragmatic restriction that one build 'the shortest bridge possible' for communication purposes.

While it is important to note that the phenomenon of bridging goes beyond definite expressions and can apply to any expressions that support this indirect link to their referents,[1] we focus on a narrower view of bridging confined to definite expressions in order to determine which definite mechanisms underlie the use of Mandarin bare nouns and demonstratives. We discuss in the next section the two kinds of bridging we will focus on.

2.2 Two kinds of definiteness and bridging

In English, the antecedent of a regular, non-bridged definite description such as *the linguist* in (9) can be identified through means such as situational uniqueness or familiarity (see Wespel 2008 for a discussion of other definite mechanisms). In the former case, resolution involves identifying a unique linguist in a given situation relevant to the context. In the latter case, resolution involves anaphorically referring to an antecedent introduced in previous discourse.

[1] An anonymous reviewer brings to our attention the observation in Asher and Lascarides 1998 that indefinite expressions support bridging, as demonstrated by the examples in (8).

(8) a. <u>The table</u> is wobbly. **A leg** needs fixing. [Reviewer]
b. <u>Jack was going to commit suicide.</u> He got **a rope**. [Asher and Lascarides 1998:83]

A proper analysis of the bridging uses of indefinite expressions is beyond the scope of our paper, and we leave this for future investigation. We note that these cases of indefinite bridging do not conflict with our methodology of using bridging as a testing ground for definiteness, as we focus on how definite expressions support different kinds of bridging.

(9) I met a linguist. The linguist looked happy.

While English uses *the* for both, Schwarz (2009) shows that many languages morphosyntactically distinguish the two uses. For example, Fering uses two distinct series of articles for the unique vs. familiarity uses: the *a*-series for uniqueness and the *di*-series for familiarity (Ebert 1971a). Moreover, German makes a morphophonological distinction, where only the uniqueness-denoting weak form can be contracted when preceded by a preposition. To account for this observation, Schwarz (2009) proposes two different semantics for the definite article, one for uniqueness and the other for familiarity. The uniqueness-denoting definite in (10a) takes a situation variable s_r and a predicate P and returns the unique x that is P in s_r. The familiarity-denoting definite in (10b) is similar except that it additionally takes a variable y and returns the unique x that is P in s_r and is identical to y. This y serves as the anaphoric index that refers back to the antecedent.

(10) a. $[\![\text{the}_W]\!] = \lambda s_r.\lambda P\colon \exists!x(P(x)(s_r)).\ \iota x[P(x)(s_r)]$ [Schwarz 2009:81]
b. $[\![\text{the}_S]\!] = \lambda s_r.\lambda P.\lambda y\colon \exists!x(P(x)(s_r)\ \&\ x = y).\ \iota x[P(x)(s_r)\ \&\ x = y]$ [Schwarz 2009:135]

The unique vs. familiarity distinction in definite expressions is also found in bridging. Schwarz (2009) identifies two types of bridging that correspond to these two meanings: part-whole and producer-product. Part-whole bridging is based on situational uniqueness, where the intended referent of a definite description is identified through a unique existence in the situation established by the context. For example, in (11a), the steering wheel can be identified because there is only one such wheel in the situation that contains the driving event introduced in the first sentence. Producer-product bridging is based on anaphora, where a description that has a relational noun takes an anaphoric index that refers to the antecedent. So in (11b), the relevant author can be identified because the relational noun *author* carries a variable in its denotation that anaphorically refers to the book introduced in the first sentence. While Schwarz (2009) focuses on pairs of nouns that are in a producing relation — hence the name 'producer-product' — the crucial notion involved is that of relational anaphora. In our study, we broaden the category of 'producer-product' pairs to relational noun pairs and use the term 'relational bridging' to refer to this second type of bridging.

(11) a. Jane was driving down the street. The steering wheel was cold.
[part-whole; Schwarz 2009:11]
b. Jake bought a book today. The author is French. [relational; Schwarz 2009:11]

Moreover, Schwarz (2009) argues that for languages that distinguish between uniqueness-denoting and familiarity-denoting definite markers, the mechanism which underlies bridging is reflected in the grammar. As noted above, in German, the uniqueness-familiarity distinction is reflected in the contraction of the definite article following a preposition. In (12), an example showing a case of a part-whole bridging, the contracted form of the definite article is licensed while the full form is degraded, reflecting that the underlying mechanism is uniqueness-based. In (13), where the relevant bridging is that of producer-product, hence relational, the full form of the definite article is licensed while the contracted form is not, suggesting that the underlying mechanism is familiarity-based.

(12) *Der Kühlschrank war so groß, dass der Kürbis problemlos {im / #in*
The fridge was so big that the pumpkin without a problem in-the$_{\text{weak}}$ / in
dem} Gemüsefach untergebracht werden konnte.
the$_{\text{strong}}$ crisper stowed be could
'The fridge was so big that the pumpkin could easily be stowed in the crisper.' [Schwarz 2009:34]

(13) *Hans entdeckte in der Bibliothek einen Roman über den Hudson. Dabei*
Hans discovered in the library a novel about the Hudson. In the process
fiel ihm ein, dass er vor langer Zeit einmal einen Vortrag {#vom / von
remembered he$_{\text{Dat}}$ PART that he a long time ago once a lecture {by-the$_{\text{weak}}$ / by
dem} Autor besucht hatte.
the$_{\text{strong}}$} author attended had.
'Hans discovered a novel about the Hudson in the library. In the process, he remembered that he had attended a lecture by the author a long time ago.' [Schwarz 2009:129]

For part-whole bridging, the uniqueness-based denotation as in (10a) can apply with some specification on what the relevant situation is. For relational bridging, the familiarity-based denotation in (10b) needs to be modified so that a) it takes a relational noun and b) x is not identified with the index argument but holds some relation to it. The relational version of the strong article proposed in Schwarz 2009 is shown in (14).

(14) $[\![\text{the}_{S;<s,<<e,est>,<e,e>>>}]\!] = \lambda s_r.\lambda R.\lambda z.\iota x[R(y)(x)(s_r)\ \&\ y = z]$ [Schwarz 2009:141]

To summarize, in bridging, situational uniqueness and relational anaphora can be teased apart through context manipulation. Thus, we can test different definite expressions across languages in respective contexts to determine whether uniqueness and/or familiarity play a role in licensing the expression. In this study we take bridging as a proxy to investigate what underlying mechanisms are associated with Mandarin bare nouns and demonstratives. Before we move on to our studies, we first present a background on Mandarin bare nouns and demonstratives, including some previous accounts of them.

2.3 Mandarin demonstratives and bridging

Mandarin is a language that does not have an obvious counterpart to the English definite determiner. Instead, bare nouns, as in (15a), which occur freely in the language, as well as demonstrative descriptions containing the demonstrative *na* and a classifier followed by the noun, as in (15b), allow definite readings. We call these expressions bare nouns and demonstrative descriptions, respectively, throughout the paper.[2]

(15) 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 in Mandarin vary in the literature. In the rest of this section, we review two recent accounts of these definite expressions. The first account we discuss is from Jenks 2018 and the second is from Dayal and Jiang 2021.

Jenks (2018) argues that the difference between the bare noun and the demonstrative description containing *na* 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

[2]In the linguistic examples throughout this paper, we translate bare nouns as English definites with 'the' to reflect their definite readings, but we note that Mandarin bare nouns also have indefinite, generic, and kind uses that are not captured by this way of translations. Moreover, we translate *na* as the English demonstrative *that*, without committing ourselves to the theoretical claim that they should be analyzed as semantic equivalents.

expressed with demonstratives, but not vice versa. He supports this argument by showing that bare nouns are licensed in uniqueness-based contexts such as (16) and (17). The difference between (16) and (17) is the size of the domain in which the unique entity is identified. In (16), *the moon* is licensed because based on our common knowledge there is a unique moon for our planet. The bare noun *yueliang* 'moon' refers to that unique moon. In (17), the domain is smaller and refers to a context where some individual finished some specific bowl of soup. The bare noun *tang* 'soup' refers to the unique soup that the individual finished.

(16) *yueliang sheng shang lai le.*
moon rise up come ASP
'The moon has risen.' [Jenks 2018:507; originally Chen 2004:1165]

(17) *Hufei he wan le tang.*
Hufei drink finish ASP soup
'Hufei finished the soup.' [Jenks 2018:504; originally Cheng and Sybesma 1999:510]

The contexts above align with those that have been shown to license unique definites in other languages (Schwarz 2009, 2013).

Especially relevant to our paper is his observation that part-whole bridging is expressed by bare nouns, as in (18).

(18) *chezi bei jingcha lanjie le yinwei mei you tiezhi zai paizhao shang.*
car PASS police intercept ASP 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 2018:508]

Jenks notes that anaphoric uses of bare nouns are much more restricted. For example, in an anaphoric context as in (19), a bare noun is infelicitous and a demonstrative is needed instead.

(19) *jiaoshi li zuo-zhe yi ge nansheng he yi ge nusheng. wo zuotian yudao*
classroom inside sit-PROG one CL boy and one CL girl I yesterday meet
#(na ge) nansheng.
that CL boy
'There are a boy and a girl sitting in the classroom. I met the boy yesterday.'
[Jenks 2018:510]

In order to account for these observations, Jenks (2018) proposes the following denotations. A definite interpretation of bare nouns involves a typeshifter presented in (20a), which takes the NP predicate and returns the unique entity in some given situation that meets the denotation of the predicate. The demonstrative *na* projects a syntactic DP and realizes (20b), which has one further argument slot for domain restriction. In addition to the NP predicate P and the resource situation s_r, the $< e, t >$ predicate Q serves to restrict the domain in which uniqueness is evaluated. The domain restriction Q differs from the index in Schwarz 2009 in that a) it can be extended to any individual-denoting element like names or pronouns and compose with the rest of the semantics through PRED (Partee 1987) which turns it into an $< e, t >$ predicate; and b) it is in the presuppositional domain.

(20) a. $[\![\iota]\!] = \lambda s_r.\lambda P_{<e,st>} : \exists! x[P(x)(s_r)].\iota x[P(x)(s_r)]$
b. $[\![\iota^x]\!] = \lambda s_r.\lambda P_{<e,st>}.\lambda Q_{<e,t>} : \exists! x[P(x)(s_r) \wedge Q(x)].\iota x[P(x)(s_r)]$

Jenks (2018) further proposes a principle that maximizes the use of index whenever possible

(*Index!*), explaining why bare nouns are ruled out and demonstratives are required in anaphoric contexts like (19), even when many anaphoric contexts entail uniqueness as well. Finally, he notes that this generalization has an exception: in subject positions, bare nouns can be anaphoric due to their topic status.

However, that bare nouns are restricted to unique contexts through *Index!* has been contested in the literature. There are many examples in Mandarin where bare nouns are licensed and resolved to antecedents present in previous discourse such as intersentential anaphora (Ahn 2019; Bremmers et al. 2022; Dayal and Jiang 2021; Jiang 2017; a.o.). For example, Bremmers et al. (2022) show through a corpus study that Mandarin bare nouns are quite readily licensed in both unique and anaphoric contexts, which is not predicted by *Index!*.

Dayal and Jiang (2021) also present arguments against the empirical generalization in Jenks 2018, arguing that bare nouns can be used in anaphoric contexts. They propose that Mandarin bare nouns be analyzed on par with English *the* and that Mandarin *na* be analyzed on par with English *that*. They argue that, as semantic equivalents, Mandarin *na* and English *that* carry an anti-uniqueness presupposition. Specifically, demonstratives with the description N require that there be another entity that meets the N description outside the minimal situation in which the main predicate is evaluated. Unless there is a reason to 'extend' the minimal situation to include other entities, demonstratives are predicted to be degraded, in English and Mandarin alike. This would explain why in (21) the English demonstrative description is degraded while the definite is fine: the continuation does not introduce a new entity, namely a roof that is not the roof of the mentioned house, so there is no reason to extend the situation and accommodate another roof in the process.

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

Given that there is a debate on how different kinds of mechanisms licensing definiteness such as uniqueness and familiarity map onto Mandarin expressions, we apply the strategy outlined above to test whether bare nouns and demonstratives license different kinds of bridging.

In Section 3, we discuss two experimental studies that explore whether bare nouns and demonstratives allow part-whole (uniqueness-based) and relational (familiarity-based) bridging. Using an off-line ratings task (Study 1) and a production study (Study 2), we show that both kinds of bridging are possible with bare nouns and demonstratives in Mandarin.

3 Study 1 and 2: Bridging in Mandarin

In this section, we present studies investigating whether definite expressions in Mandarin license part-whole and relational bridging. Studies 1 and 2 test bare nouns and demonstratives in Mandarin using an off-line ratings and a production task respectively.

Before presenting the studies, we first discuss the criteria we used to create part-whole and relational bridging contexts for our stimuli. Because cross-linguistic variation is inevitable, we try to describe our categorization of bridging as clearly as possible for potential adaptations to other languages.

3.1 Identifying different types of bridging in Mandarin

We discuss in this section how we categorized part-whole and relational bridging in Mandarin for our experimental stimuli. The general scheme we used in all of our studies contained two clauses, where the first created the relevant context for bridging and the second contained a bridged definite expression, either a bare noun or a demonstrative description. From here on, we will use the term 'antecedent' to refer to either the first sentence ('antecedent sentence') or an entity that stands in a one-to-one relation to the bridged noun ('antecedent noun'). The bridged definite expression will be called 'the bridged noun' or 'the definite expression'.

3.1.1 Part-whole bridging

For part-whole bridging, we created contexts such that there is a unique entity that meets the denotation of the bridged noun in the situation established by the previous context (Schwarz 2009). For example, in (22), the first clause establishes a context where there is a bike in the backyard. The minimal situation created contains a bike and a backyard where the bike is located. The second clause then refers to a seat. Although a seat is not previously introduced, it can be identified within the minimal situation established in the first clause because, under general assumptions, there is a unique seat to a bike.

(22) ***zixingche*** *zai houyuan li, wo zhunbei qu ca yixia* ***na ge chezuo.***
bike at backyard inside I plan go wipe once that CL seat
'The bike was in the backyard. I planned to wipe that seat.'

Other examples of part-whole bridging stimuli included pairs such as house-roof, laptop-screen, and car-brake.[3] We also included animate stimuli that paired animals and their unique body parts such as horse-forehead and cat-tail. Animate entities were not discussed in Schwarz 2009, but we included them as stimuli because animacy is one of the factors that interact with definiteness and topic-hood in many languages (Hung and Schumacher 2014; Jiang 2012; Von Heusinger and Kaiser 2003; a.o.). As we will see later, animate stimuli showed a degraded rating overall. We hypothesize that this is due to the deictic nature of body-part terms.

3.1.2 Relational bridging

The second type of bridging discussed in Schwarz 2009 is called 'producer-product' and crucially involves a producer-product relation between the antecedent noun in the first sentence and the bridged expression in the second: the entity denoted by the antecedent noun (e.g. 'a book') is 'produced' by the entity denoted by the definite expression (e.g. 'the author'). As noted in Schwarz 2009, the crucial component of the producer-product relation is that of a relational reference between

[3] An anonymous reviewer points out that a car has four brakes, rather than a unique one. This fact is reflected in English speakers' use of the noun *brake*: it often appears in the plural form, as in *cut the brakes*, all of which involved a similar kind of part-whole relationship as defined in Schwarz 2009. Therefore, the English noun pair car-brake fails to satisfy the uniqueness requirement and does not support part-whole bridging.

However, we observe that the uniqueness mapping holds for the Mandarin noun pair *che-shache* 'car-brake'. The noun *shache*, although literally translated as *brake*, often refers to the brake pedal, rather than one of the four brakes, as exemplified in (23). Since a car physically contains a unique brake pedal, the Mandarin noun pair qualifies for part-whole bridging.

(23) *Zhangsan cai xia le shache.*
Zhangsan step down ASP brake.pedal
'Zhangsan stepped on the brake pedal.'

the bridged noun and the antecedent. Namely, the bridged noun has to be relational, carrying a variable in its semantic denotation that refers to the antecedent. While Schwarz (2009) focuses on 'producer-product' bridging, the underlying link between the two nouns does not depend on the producing relation strictly, but instead on the relational nature of the bridged noun. Thus, we expanded this notion to include all kinds of relational anaphora where there is a relational link between the two nouns.

For relational bridging, we created contexts where there is a one-to-one relation between the bridged noun and the antecedent, with the bridged noun being relational, in other words requiring the presence of the antecedent conceptually. In order to exclude the possibility of the situational uniqueness mechanism being available in this group of stimuli, we made sure that the referent of the bridged noun was not physically contained inside the situation established by the antecedent sentence. For example, in (24), the author cannot be identified inside the minimal situation that contains the event of buying a book.

(24) *zuotian wo mai le **shu**. wo hen xiang jianjian na wei **zuozhe**.*
yesterday I buy ASP book I very want meet that CL author
'Yesterday I bought the book. I really want to meet that author.'

Other examples of relational bridging included pairs such as lock-key, account-password, TV-remote, phone-charger, painting-painter, film-director. We considered terms like a key, a password, a remote, and a charger to be relational. Note that while relational nouns are present across languages, it is hard to define them categorically. In general, relational nouns are assumed to take two arguments: one for the entity that meets the denotation of the description and another for an entity that holds a certain relation with the former entity (Barker 2011; cf. Asudeh 2005; Meyers 2007). There are several criteria for distinguishing relational nouns from regular sortal nouns (Barker 2011; Löbner 1985; a.o.). Unlike sortal nouns, relational nouns in English can take an additional overt argument introduced with the preposition *of*. Compare the relational noun *child* vs. the sortal noun *person*:

(25) a. child of someone
b. person (*of someone)

Semantically, relational nouns are always defined by a specific entity that they are related to. According to Barker 2011, 'a day counts as a birthday only in virtue of standing in a certain relationship to a person' (p.3). Thus, the inherent definition of the relational noun requires the related entity.

We can find a parallel diagnostic for Mandarin relational nouns with the possessive *de*, as in (26). While the relational noun *haizi* 'child' can take the additional possessor introduced with *de*, the sortal noun *ren* 'person' cannot.

(26) a. *mou-ren de haizi*
some-person DE child
'child of someone'
b. **mou-ren de ren*
some-person DE person
Intended: 'person of someone'

However, this diagnostic is not as reliable for Mandarin as for English. As shown in (27), the sortal noun *hua* 'flower' can enter this construction as well.

(27) *mou-ren de hua*
some-person DE flower
'flower of someone'

Thus, in identifying relational nouns, we relied on the syntactic criterion of allowing a genitive argument with *de* as well as semantic cues. For example, if a noun failed the *de*-test, we categorized it as a sortal noun. If a noun passed the *de*-test but does not have a conceptual requirement of another entity for the meaning to be complete (e.g. flower), then we did not use it in our relational stimuli. For example, a key passes the *de*-test (*suo de yaoshi* 'key of a lock') and semantically is defined in virtue of standing in some relation to a lock. A password also passes the *de*-test (*zhanghu de mima* 'password of an account') and is defined in virtue of standing in some relation to an account. Thus, we argue that the bridged expressions we used in our stimuli are relational and parallel to the producer nouns of producer-product as defined in Schwarz 2009.

It is not possible to concretely argue that these stimuli always triggered part-whole or relational bridging when the participants were processing them. As Clark (1975) notes, it is possible to build an infinitely long and complex bridge between the antecedent and the anaphor, and people are very good at accommodating various kinds of information to make sense of a discourse (Roberts 2002, 2003). However, given that participants are more likely to build the most salient kind of bridge available, we assume that our part-whole and relational items represented uniqueness- and familiarity-based bridging, respectively.

Given these definitions for part-whole and relational bridging, we explored in the following two studies whether Mandarin bare nouns and demonstratives allow the two kinds of bridging. The first study looked at off-line ratings, while the second study was a production study, where native speakers were asked to choose between possible expressions given different bridging contexts. We discuss each study in detail below.

3.2 Study 1: Sentence Ratings Task

Study 1 was a Sentence Ratings task where participants were presented with sentences and asked to rate how natural they were. This experiment served as the baseline for our study, because there has not been any previous work that formally tested the difference between bare nouns and demonstratives in part-whole and relational bridging. The goal was to see how bridging is rated by native speakers of Mandarin, and to identify factors that affect the relative ratings. Thus, we manipulated the BRIDGING TYPE (part-whole vs. relational) and the BRIDGED NOUN TYPE (bare noun vs. demonstrative) as our main factors.

Our stimuli also varied in ANTECEDENT NOUN TYPE. Law and Syrett (2017) show in an experimental study that the antecedent type affects subsequent anaphora. Specifically, they argue that indefinite descriptions with the numeral one and classifier followed by the NP license anaphora better than bare nouns. While this result was not evident from off-line ratings, the effect was visible in processing where sentences involving bare nouns as antecedents resulted in processing delays.[4] If relational bridging involves anaphora as argued in Schwarz 2009, then we might expect to see correlated antecedent effects, where indefinite descriptions license relational bridging more readily than other antecedent types. This would not apply to part-whole bridging, as it is based on uniqueness.

[4]Law and Syrett (2017) argue that Mandarin bare nouns have reduced anaphoric potential (i.e., bare nouns do not introduce discourse referents, but anaphora to bare nouns is possible and requires additional pragmatic steps). Therefore, they are 'discourse translucent', a property first observed for pseudo-incorporated bare noun objects in Persian (Krifka and Modarresi, 2016; Modarresi and Krifka, 2021). We note that Law and Syrett (2017) remain agnostic about whether Mandarin bare nouns are pseudo-incorporated and we also do not aim to answer this question in this paper.

Bridging type	Animacy	Syntactic position	Nominal pair (antecedent, bridged noun)
Part-whole	Inanimate	(SUBJ, SUBJ)	(laptop, screen)
Part-whole	Inanimate	(SUBJ, OBJ)	(bike, seat)
Part-whole	Inanimate	(OBJ, SUBJ)	(house, roof)
Part-whole	Inanimate	(OBJ, OBJ)	(car, brake)
Part-whole	Animate	(SUBJ, SUBJ)	(cat, tail)
Part-whole	Animate	(SUBJ, OBJ)	(shark, mouth)
Part-whole	Animate	(OBJ, SUBJ)	(dog, nose)
Part-whole	Animate	(OBJ, OBJ)	(horse, back)
Relational	Inanimate	(SUBJ, SUBJ)	(phone, charging cable)
Relational	Inanimate	(SUBJ, OBJ)	(television, remote)
Relational	Inanimate	(OBJ, SUBJ)	(account, password)
Relational	Inanimate	(OBJ, OBJ)	(lock, key)
Relational	Animate	(SUBJ, SUBJ)	(presentation, speaker)
Relational	Animate	(SUBJ, OBJ)	(film, director)
Relational	Animate	(OBJ, SUBJ)	(painting, painter)
Relational	Animate	(OBJ, OBJ)	(book, author)

Table 1: Stimuli of Study 1

Thus, our stimuli varied in whether the antecedent was an indefinite description, a bare noun, or a demonstrative.

Half of our stimuli had the bridged noun appear in the subject position while the other half had it in a non-subject position. Jenks (2018) predicts that bare nouns are sensitive to the syntactic positions and support an anaphoric use in subject positions due to their topic status, so we checked whether syntactic position affected the results significantly. Moreover, half of our stimuli involved animate entities while the other half involved inanimate entities, given a heavy empirical focus on inanimate part-whole bridging and animate producer-product bridging in previous literature.

3.2.1 Methodology

Our target stimuli contained 8 part-whole bridging and 8 relational bridging sentence pairs. Within each item, we manipulated the bridged noun type (bare noun vs. demonstrative) and the antecedent noun type (indefinite, bare, and demonstrative). The 16 target items were evenly distributed based on the syntactic position (subject vs. object) of the antecedent and the bridged noun and the animacy of the nouns. The English translations of the stimuli are presented in Table 1.

We now discuss each factor in detail. The first factor was the bridging type, which varied between part-whole and relational bridging, and was designed based on our criteria discussed in Section 3.1.

Second, we manipulated the noun type of the antecedents and bridged nouns. The antecedent was either a bare noun, such as (28a), a demonstrative construction with *na* and a classifier, such as (28b), or an indefinite noun phrase with the indefinite article *yi* 'one' and a classifier, such as (28c). The bridged noun was either a bare noun or a demonstrative construction.

(28) a. *che*
car

'car' (BN)

b. *na liang che*
that CL car
'that car' (DEM)

c. *yi liang che*
one CL car
'one car' (INDEF)

Each target item involved one of four possible syntactic configurations. The antecedent and bridged nouns appeared either in the subject position or the object position of a simple declarative sentence, thus forming the following combinations: subject-subject, subject-object, object-subject, and object-object. We coded these combinations using two letters: OS for an object antecedent noun with a subject bridged noun and so on. Half of the items involved animate nouns, while the other half involved inanimate ones, as shown in Table 1. The most typical examples of relational bridging involve producer-product bridging between an animate producer/bridged noun (like 'the author') and an inanimate product/antecedent (like 'the book'). In other cases of relational bridging, the antecedent is paired with some uniquely related entity and both the antecedent and the bridged noun are inanimate. The full set of stimuli items is found in Supplementary Materials.

We present two target stimuli as examples in (29): (29a) shows a part-whole bridging item with an inanimate bare noun in the subject position as the antecedent and an inanimate bare noun in the object position as the bridged noun, and (29b) shows a relational bridging item with inanimate nouns in the subject positions where the antecedent is an indefinite noun phrase and the bridged noun is a demonstrative construction.

(29) a. ***zixingche*** *zai houyuan li, wo zhunbei qu ca yixia* ***chezuo.***
bike at backyard inside I plan go wipe once seat
'The bike was in the backyard. I planned to wipe the seat.'

b. ***yi bu shouji*** *mashang jiuyao meidian le, dan* ***na ge chongdianqi*** *qiahao huai le.*
one CL phone soon will no.battery ASP but that CL charger happen.to break ASP
'**A phone** is running out of battery, but **that charger** happens to be broken.'

The 16 sets of target stimuli, with the factors varied within subjects as above, resulted in a total of 96 target stimuli. We adopted a within-subject design, but 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 that were either semantically odd, pragmatically odd, or neutral. Participants were asked to rate how natural the given sentences are. We discuss the motivations for the particular instruction language we used and the control stimuli below.

Instruction language It is known that the methods used in an experiment such as the instruction and the response scale have a considerable impact on the results (Kirk 2012; Myers 2017; Schütze 2005; Sprouse et al. 2013). This is especially the case for studies looking at semantic and pragmatic oddness, since the ratings often measure subtle differences. In order to maximize the information we get from the rating responses and to ensure consistency in the measurement, we designed our ratings study based on Zhu and Ahn 2023. In Zhu and Ahn 2023, it was shown that the term 'natural' (and *ziran* ('natural') in Mandarin) in the instruction maximizes the rating difference between semantically and pragmatically odd sentences in both English and Mandarin, though the

two languages show differences in the range of responses, highlighting the importance of language-specific and study-internal norming procedure.

Thus in our ratings task, we presented participants with sentences involving different kinds of bridging and definite expressions and asked them to rate how 'natural' the sentences are. The instruction we used is shown in (30).

(30) *qing gei juzi de ziran chengdu dafen. 1 fen wei zui bu ziran, 7 fen wei zui ziran.*
please give sentence DE natural degree rate 1 point be most not natural 7 point be most natural
'Please rate the naturalness of the sentence(s). 1 means least natural, and 7 means most natural.'

Control stimuli As discussed above, different languages show different ranges of responses, meaning that it is impossible to directly compare the rating responses between two languages. To form a standard for comparison, we added control stimuli as filler items, following Zhu and Ahn 2023: 8 sentences that were semantically odd, 8 sentences that were pragmatically odd, and 8 sentences that were neutral. Semantically odd sentences included logical contradictions or thematic mismatch, as shown in (31a). Pragmatically odd sentences included repetitions of information as in (31b). Neutral sentences did not have any obvious linguistic violations, as shown in (31c).

(31) a. *Zhang Xiaoming shi ge jie-le-hun-de danshenhan, wo he ta hen shu.*
Zhang Xiaoming be CL married bachelor I and he very close
'Zhang Xiaoming is a married bachelor. He and I are very close.' [semantically odd]

b. *zuotian xiayu de shihou xiayu le.*
yesterday rain DE time rain ASP
'Yesterday it was raining when it was raining.' [pragmatically odd]

c. *Xiaoxue zhengli hao keben, jueding jintian qu-shangxue.*
Xiaoxue organize complete textbook decide today go.to.school.
'Xiaoxue organized the textbooks and decided to go to school today.' [neutral]

By comparing the ratings of the target sentences against these three types of control stimuli, we can more precisely pinpoint where the target sentences lie in terms of naturalness against a scale that covers different kinds of linguistic violations.

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 ratings task. Participants were paid $2–3 for their time.

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

3.2.2 Results

We fit a Cumulative Link Mixed Model via the ordinal package (Christensen 2022; Bross 2019) in R to compare ratings in different conditions. Our model included five fixed effects (BRIDGING TYPE, ANTECEDENT NOUN TYPE, BRIDGED NOUN TYPE, ANIMACY, SYNTACTIC POSITION) and two random effects (PARTICIPANT and ITEM). The modeling results showed a main effect of **bridging**

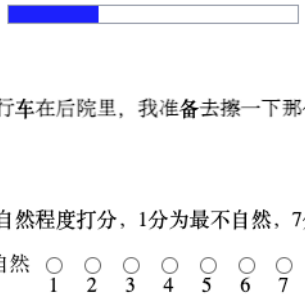


Figure 1: Sample question (a target item [INDEF antecedent, DEM anaphor, part-whole]) in Study 1

type ($p < 0.05$), a marginal interaction between bridging type and antecedent noun type ($p < 0.1$), a marginal three-way interaction between bridging type, antecedent noun type, and bridged noun type ($p < 0.1$), and a marginal four-way interaction between bridging type, animacy, antecedent noun type, and syntactic position ($p < 0.1$). These interactions justified a subset analysis, where we grouped the data by their bridging type and fit a Cumulative Link Mixed Model for each group. The modeling results are reported below.

Fig. 2 and Fig. 3 plot the average ratings for part-whole and relational bridging, respectively. Both figures show the average ratings of the control sentences: semantically odd sentences (red dashed line), pragmatically odd sentences (orange dashed line), and neutral sentences (black dashed line) for comparison. The plots of ratings in each syntactic configuration are included in the Appendix.

On average, part-whole bridging sentences were rated 5.52 (5.55 for bare nouns as bridged nouns and 5.49 for demonstratives as bridged nouns) and relational bridging sentences were rated 4.94 (5.01 for bare nouns as bridged nouns and 4.86 for demonstratives as bridged nouns).

For **part-whole bridging** (Fig. 2), our results showed a main effect of **animacy** ($p < 0.001$) and **syntactic position** ($p < 0.001$). In the animate group (yellow boxes), we found a main effect of the syntactic position ($p < 0.05$) and a significant interaction between bridged noun type and syntactic position ($p < 0.001$). In the inanimate group (blue boxes), we found a main effect of syntactic position ($p < 0.001$) and a significant interaction between antecedent and syntactic position ($p < 0.05$). Crucially, in both groups, no significant main effect was found for either antecedent or bridged noun type ($p > 0.1$), meaning that participants' ratings were not significantly affected by whether the antecedent or the bridged noun was a bare noun or a demonstrative (or an indefinite for the antecedent).

For **relational bridging** (Fig. 3), our results showed a marginal main effect of the **syntactic position** ($p < 0.1$) and a significant interaction between antecedent noun type and syntactic position ($p < 0.001$).

Overall, demonstratives are rated lower than bare nouns in part-whole bridging, while there is no visible difference between their ratings in relational bridging. Animate part-whole bridging stimuli are rated lower for both bridged noun types. Moreover, antecedent type does not show any effect in the relative ratings for either kind of bridging. We also note that the ratings of all bridging sentences are significantly above the ratings of pragmatically odd and semantically odd sentences ($p < 0.001$).

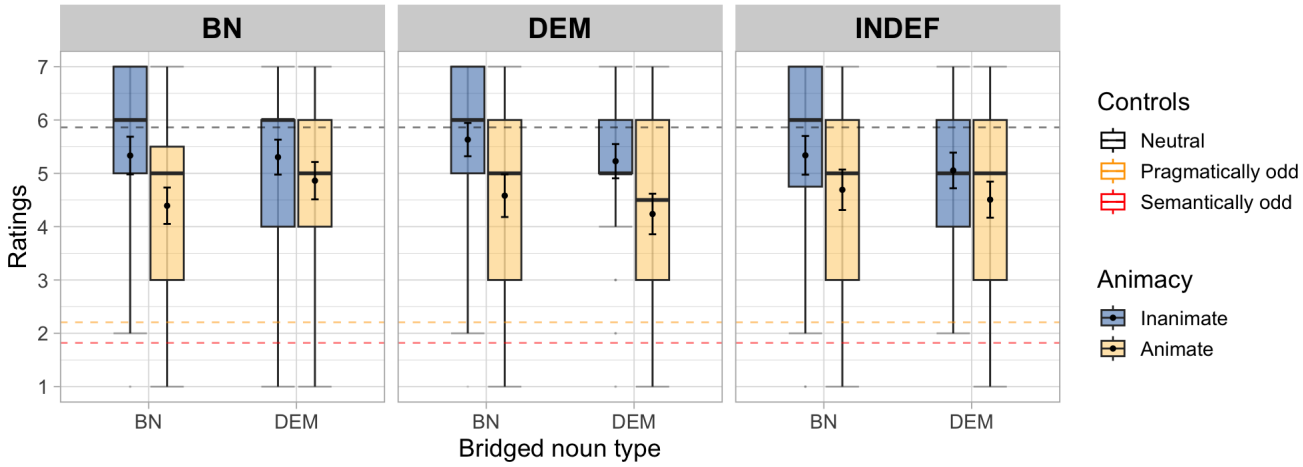


Figure 2: **Part-whole bridging**: Ratings as function of bridged noun type (bottom), grouped by antecedent noun type (top), and color-coded for animacy (box color) in Study 1

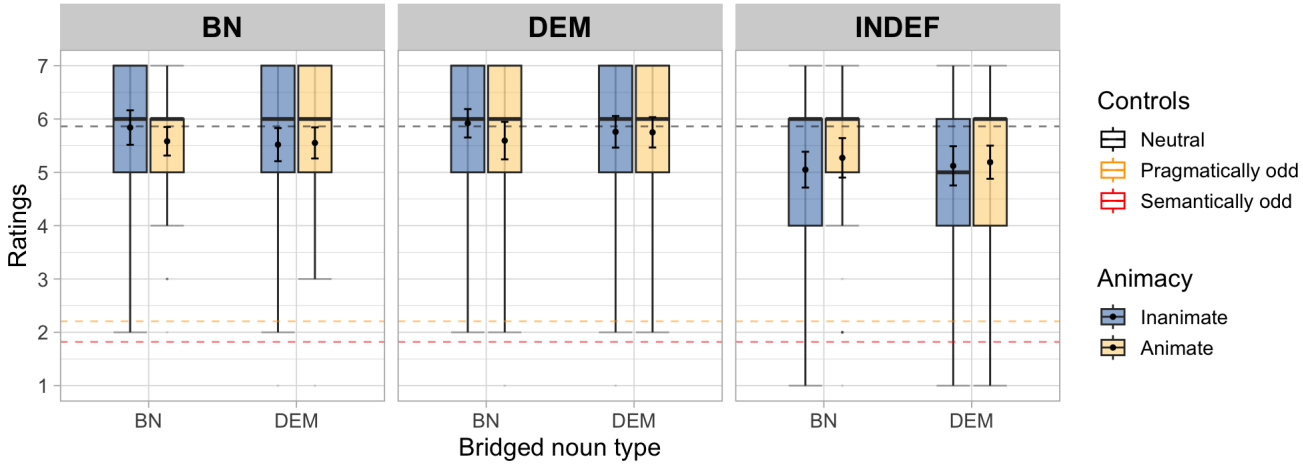


Figure 3: **Relational bridging**: Ratings as function of bridged noun type (bottom), grouped by antecedent noun type (top), and color-coded for animacy (box color) in Study 1

3.2.3 Discussion

Our results show that both bare nouns and demonstratives are felicitous in part-whole and relational bridging. While demonstratives are systematically rated lower than bare nouns in part-whole bridging, this difference is not significant.

For part-whole bridging, animacy had a significant effect. Both bridged noun types are rated high if the bridged noun is inanimate, and lowered if the bridged noun is animate. As for the lowered animate ratings, we hypothesize that this is due to the use of body-part terms in our stimuli. Body-part words often have particular characteristics, and we did not control for such effects. For example, Mandarin speakers tend to use body-part words in bare forms to refer to their own body parts, which might have made the stimuli less natural overall. The use of the distal, anaphoric demonstrative *na* with body parts of one's own might also have been an independent cause for the lower ratings.

It is also worth noting that while antecedent noun type did not have any effect in part-whole bridging, indefinite antecedents lower the ratings for relational bridging. We had predicted the opposite effect where indefinite antecedents would facilitate relational bridging given that indefinite nouns license anaphora better than bare nouns. One reason for this might be that indefinite nouns are indeed better for licensing anaphora, but only direct anaphora and not relational ones like in relational bridging. Given the likelihood of direct anaphora occurring in the second sentence, the occurrence of a bridged noun might have been surprising and less straightforward to resolve, resulting in the lower ratings.

Finally, we did not find any significant effect of animacy in our relational bridging contexts, meaning animate and non-animate relational bridging showed the same behavior. This justifies our broadening of the producer-product bridging from Schwarz 2009 to relational bridging: regardless of whether there is a producing relation or whether the relational noun is animate, native speakers rate the bridged use of bare nouns and demonstratives in these contexts similarly.

3.3 Study 2: Production study

In this production study, we manipulated the linguistic context in a short message exchange to explore which nominal form(s), between bare nouns and demonstratives, are chosen by native Mandarin speakers. We closely followed the design of a comprehension task in Dillon (2023) in designing this production study.

3.3.1 Methodology

Stimuli We designed 55 message exchanges with the following three components: (i) a background sentence that provided the linguistic context; (ii) a test sentence with a blank to be filled by a nominal; and (iii) a semantically uninformative reply (*oh*) that simply suggests the naturalness of the previous messages. Fig. 4 presents a sample item, which is glossed in (32).

(32) a. *Wang Yawen zhengzai yong diannao*
Wang Yawen PROG use computer
'Wang Yawen is using the computer.'

b. *ta faxian* _____ *haoxiang turan huai le*
she find _____ seem.to suddenly break ASP
'She found that _____ seemed to have broken all of a sudden.'

c. *o ...*
oh
'Oh...'

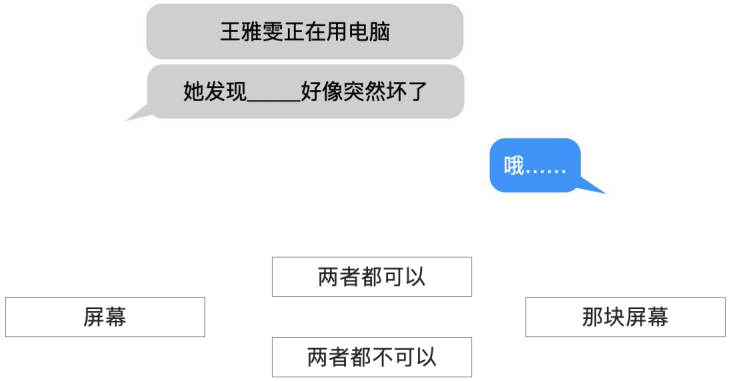


Figure 4: Sample item in Study 2

Below each image stimulus, there were four text options for participants to choose from: a bare noun (e.g. *pingmu* 'screen'), a demonstrative description (e.g. *na kuai pingmu* 'that screen'), and options that read *both forms are acceptable* and *both forms are unacceptable*.

We included 24 target items, where the antecedent noun in the bridging relation was present in the background and the bridged noun was given in the options. The bridging type (part-whole vs. relational) was varied by manipulating the noun in the options. For example, in (32a), the background sentence introduces an antecedent noun *diannao* 'computer'. Half the participants saw the options in (33a) (and (33c)), where the antecedent is in a part-whole relation with the bridged noun *pingmu* 'screen'. The other half saw the options in (33b) (and (33c)), where the antecedent is the relatum argument with the relational bridged noun *chongdianqi* 'charger'.

(33) a. *pingmu* 'screen'
na kuai pingmu 'that screen'
b. *chongdianqi* 'charger'
na kuai chongdianqi 'that charger'
c. *liangzhe dou keyi* 'both forms are acceptable'
liangzhe dou bu keyi 'both forms are unacceptable'

Control items In addition to the target items, we included 31 control items that did not involve bridging, divided into four groups. The first control group had a **S**ingular indefinite **N**oun phrase in the background sentence (5 SN controls in total). The same noun was used in the options, when participants were asked to fill in the blank in the test sentence by selecting the acceptable nominal form(s).

(34) *Wang Yawen zhengzai yong* ***yi tai diannao****; ta faxian* {***diannao***, ***na tai diannao***}
Wang Yawen PROG use one CL computer she find computer that CL computer
haoxiang turan huai le
seem.to suddenly break ASP
'Wang Yawen is using a computer. She found that _____ seemed to break all of a sudden.'

The second group of controls had a **P**lural indefinite **N**oun phrase instead in the background sentence

(5 PN controls in total). Again, participants were asked to choose between the bare noun and demonstrative forms of the noun from the background sentence to fill in the blank in the test sentence.

(35) *Wang Yawen zhengzai yong* ***liang tai diannao****; ta faxian* {***diannao, na tai diannao***} *haoxiang turan huai le*
Wang Yawen PROG use two CL computer she find computer that CL computer seem.to suddenly break ASP
'Wang Yawen is using two computers. She found that _____ seemed to break all of a sudden.'

The third control group featured a bare noun in the background sentence. The bare **N**oun was **R**epeated in the test sentence, which characterizes the anaphoric use of a nominal. There were 12 RN controls in total.

(36) *Wang Yawen zhengzai yong* ***diannao****; ta faxian* {***diannao, na tai diannao***} *haoxiang turan huai le*
Wang Yawen PROG use computer she find computer that CL computer seem.to suddenly break ASP
'Wang Yawen is using the computer. She found that _____ seemed to break all of a sudden.'

The fourth and last group of controls had **N**o **N**ominal antecedent in the background sentence (10 NN controls in total). Participants were asked to fill in the blank in the test sentence with a novel noun, which was either bare or accompanied by a demonstrative. Note that NN controls should be distinguished from part-whole bridging with no linguistic antecedent in the background sentence, since in (37), one cannot uniquely identify a computer from the working situation.

(37) *Wang Yawen ganggang zai gongzuo; ta faxian* {***diannao, na tai diannao***} *haoxiang turan huai le*
Wang Yawen just.now PROG work she find computer that CL computer seem.to suddenly break ASP
'Wang Yawen was just working. She found that _____ seemed to break all of a sudden.'

We also included two attention checkers that asked participants to choose either 'both forms are acceptable' or 'both forms are unacceptable'. This was to ensure that participants successfully loaded the images and paid attention to our instructions. A full list of stimuli used in Study 2 is included in Supplementary Materials.

Participants and procedure We recruited 100 native Mandarin speakers (age-balanced and gender-balanced) via Prolific. Participants were redirected to a PCIbex survey, where they were asked to provide demographic and language background information. Participants were paid $2–3 for their time.

Each participant was presented with 12 target items and 31 controls in randomized order. We adopted a within-subject design, but a participant saw only one variation (either part-whole or relational bridging) within each set of target items. Upon selecting one of the four options below the image stimuli, participants were directed to a new page to click *continue* to proceed to the next item.

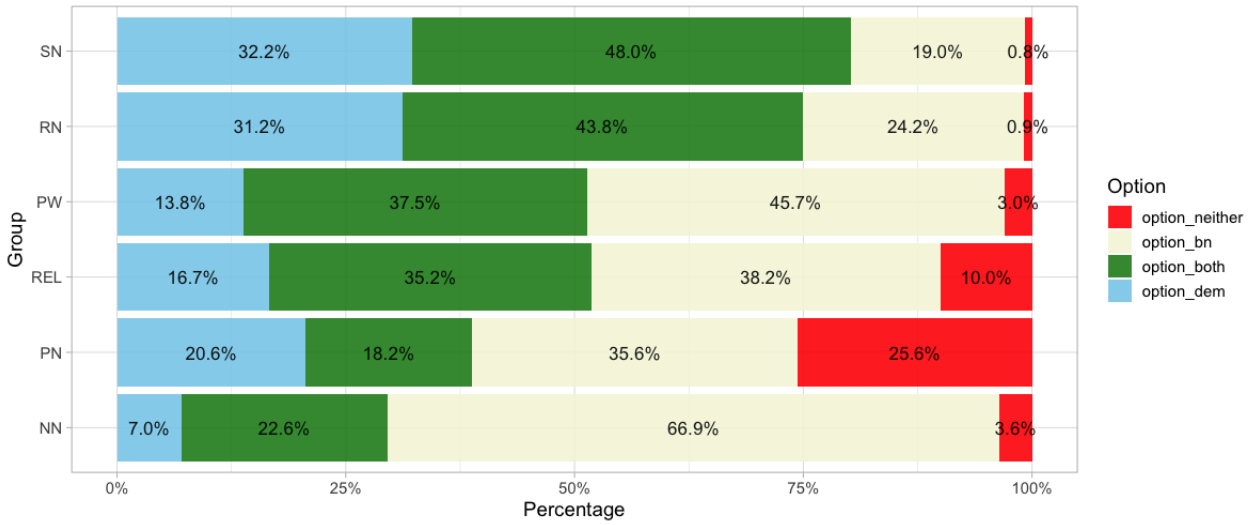


Figure 5: Rate of expression choice by condition in Study 2

3.3.2 Results

Fig. 5 plots the percentages of selecting each option in each condition. Below we report the results for the target items (PW (part-whole) and REL (relational) in the middle rows of the figure) and then the control items, including the baseline conditions (NN (no noun) and PN (plural noun) in the last two rows of the figure) and the anaphoric conditions (SN (singular noun) and RN (repeated noun) in the first two rows of the figure).

Target items For the target items, we calculated the percentages of participants who accepted demonstratives as the bridged noun (i.e. who selected either OPTION_DEM or OPTION_BOTH): 51.3% accepted demonstratives in part-whole bridging, and 51.9% accepted demonstratives in relational bridging. For bare nouns, the percentages are 83.2% for part-whole bridging and 73.4% for relational bridging.

We conducted a McNemar's test[5] to examine the association between two factors: the bridging type (PART-WHOLE and RELATIONAL) and participants' acceptance of a specific nominal form. For the latter factor, we collapsed the four options presented to the participants into two groups: the options indicating that participants accepted demonstratives, DEM_GOOD (including OPTION_DEM and OPTION_BOTH), and the options indicating the reverse, DEM_BAD (including OPTION_BN and OPTION_NEITHER). The null and alternative hypotheses for the test are presented in (38).

(38) a. **Null Hypothesis (H0):** The bridging type is not associated with participants' choice. Participants' acceptance of demonstratives does not vary as the bridging type varies.

b. **Alternative Hypothesis (H1):** The bridging type is associated with participants' choice. Participants acceptance of demonstratives varies as the bridging type varies.

[5]We thank an anonymous reviewer for pointing out that the regular chi-square test (used in a previous version of the analysis) assumes that all observations are independent, but the within-subject design of our experiment results in non-independent observations because every participant was exposed to different conditions. Therefore, we switched to the McNemar's test, a chi-square test that is applicable to non-independent observations.

Condition	Linguistic antecedents	% accepting DEM	% accepting BN
NN	none	29.6%	89.5%
PN	plural, 'two CL NOUN'	38.8%	53.8%
SN	singular, 'one CL NOUN'	80.2%	67%
RN	bare noun, 'NOUN'	75%	68%

Table 2: Percentages of participants accepting DEM/BN in control items in Study 2

The McNemar's tests showed a chi-squared statistic of 0.59867, with 1 degree of freedom. The p-value was 0.4391, greater than 0.05. Therefore, we failed to reject the null hypothesis. The statistical results therefore suggested that participants' acceptance of demonstratives did not vary, in part-whole and relational bridging alike.

We further conducted a second McNemar's test to examine the association between the bridging type and participants' acceptance of bare nouns. The four options were collapsed differently, but again into two groups, based on whether participants accepted bare nouns as the bridged noun form: BN_GOOD (including OPTION_BN and OPTION_BOTH) and BN_BAD (including OPTION_DEM and OPTION_NEITHER). In contrast to the test results for demonstratives, the McNemar's test for bare nouns showed a chi-squared statistic of 212.42, with 1 degree of freedom. The p-value was 2.2e-16, far less than 0.05. Therefore, we successfully rejected the null hypothesis. The results suggested a significant association between the bridging type and participants' acceptance of bare nouns.

Taken together the percentages and the results from the McNemar's tests, we concluded that (i) participants accepted demonstratives as the bridged noun form in both types of bridging alike, but that (ii) participants accepted bare nouns as the bridged noun form significantly more in part-whole bridging than in relational bridging.

Control items Table 2 presents the percentages of participants accepting demonstratives and bare nouns in the control conditions, respectively. Fewer participants accepted demonstratives in the baseline conditions NN and PN, as compared to conditions with a linguistic antecedent that can be understood as a singular referent (SN and RN).

3.3.3 Discussion

The results from the target items show that Mandarin speakers accept demonstratives in both part-whole and relational bridging to a similar extent. The McNemar's test results indicate that bare nouns are more readily accepted in part-whole bridging than in relational bridging.

Our baseline conditions (NN and PN) confirmed that demonstratives are degraded without linguistic antecedents or with plural antecedents (although to different extent). In the NN condition, where no overt linguistic antecedent was provided, we predicted that bare nouns would be chosen the most. The prediction is borne out: most participants chose the 'OPTION_BN' response. In contrast, demonstratives across languages are known to prefer contexts where the antecedent is linguistically introduced (Patel-Grosz and Grosz 2017; Roberts 2002; Schwarz 2009). Indeed, the NN condition shows the lowest rate of 'OPTION_DEM + OPTION_BOTH' responses.

In the PN condition with plural bare nouns as antecedents, the highest rate of the 'OPTION_NEITHER' response is expected. However, the proportions of 'OPTION_DEM' and 'OPTION_BN' were higher than expected. The high acceptance of demonstratives might be due to other readings of *na*, which also

allow deictic and affective readings (Himmelmann 1996; Lakoff 1974; Potts and Schwarz 2010; a.o.). The high rate of bare nouns can be attributed to their ability to refer anaphorically, which we account for in the analysis in Section 5.

The difference in percentages of BN-acceptance between the PN-condition (53.8%) and the SN/RN-conditions (67% and 68%) might result from a singular bias of the nouns we used as the experimental items: even though all bare nouns are syntactically number-neutral and allow for both singular and plural interpretations, some bare nouns show a singular bias, preferring to be interpreted as semantically singular, while others show a plural bias, preferring to be interpreted as semantically plural. This property of bare nouns is experimentally attested in Modarresi (2014) and Law and Syrett (2017), both using pronominal anaphora as a proxy to identifying the contextual number bias of bare nouns. Specifically, a bare noun with a singular/plural bias prefers to be picked up by a pronoun with a matching number. In our results, the lowered percentages in the PN-condition can then be explained by the conflict between the semantic plurality marked by the numerals and the contextual singular bias of the bare nouns.

Lastly, the results in the SN and RN conditions confirmed the availability of the anaphoric use of both demonstratives and bare nouns. The high rate of demonstratives can be attributed to their anaphoric use. The high rate of bare nouns in anaphoric uses coincides with elicitation and corpus findings in previous works (Bremmers et al. 2022; Dayal and Jiang 2021).

4 Comparison: Study 3 English Sentence Ratings Task

We conducted an English version of our sentence ratings task (Study 1) to see if the English demonstrative *that* patterns like Mandarin *na*. Based on the ratings from 120 native speakers of English, we observe that demonstrative constructions are rated significantly lower than definite descriptions in all conditions ($p < 0.001$). Our experimental results confirm the commonly adopted assumption that demonstratives are dispreferred in bridging — whether it be part-whole or relational — though judgment is not as categorical as one might predict. In this section, we report this study in detail.

4.1 Methodology

Our target stimuli were English translations of stimuli from our Mandarin sentence ratings task (Study 1). There were 8 part-whole and 8 relational bridging sentence pairs in English. We manipulated the antecedent noun type (indefinite descriptions with *a(n)*, definite descriptions with *the*, and demonstrative constructions with *that*) and the bridged noun type (definite vs. demonstrative). Like in Study 1, the target items were evenly distributed in syntactic positions of the antecedent and bridged noun, and we manipulated animacy. The list of bridging pairs we used is presented in Table 1 (the translations of stimuli in Study 1).

We show examples of two target stimuli in (39): (39a) is a part-whole bridging item with inanimate definite descriptions in subject and object positions for the antecedent and the bridged noun, and (39b) is a relational bridging item with inanimate nouns in subject positions, where the antecedent is indefinite and the bridged noun is a demonstrative description.

(39) a. **The bike** is in the backyard. I'm planning to clean **the seat**.
b. **A phone** is running out of battery, but **that charger** happens to be broken.

Like in Study 1, we included 24 syntactically well-formed controls: 8 sentences with semantic oddness, 8 sentences with pragmatic oddness, and 8 sentences that were neutral.

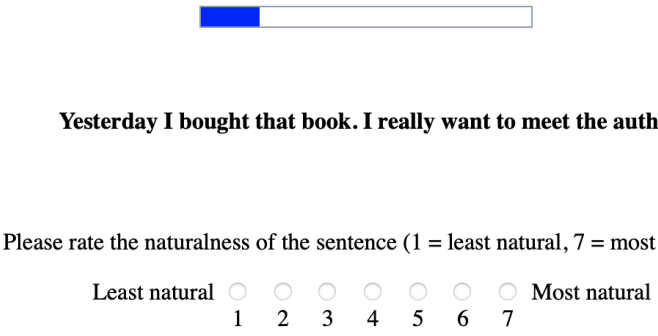


Figure 6: Sample question (a test item [DEM antecedent, DEF anaphor, relational] in Study 3

We recruited 126 native English speakers (18–64; gender-balanced) via Prolific. Participants were redirected to a PCIbex survey, where they were asked to first provide demographic and language background information and then complete the sentence ratings task. Participants were paid $2–3 for their time. Each participant was presented with a total of 40 stimuli, randomized in order: 16 bridging sentences and 24 controls. Participants were asked to rate the naturalness of these sentences on a 7-point Likert scale, as in Fig. 6.

4.2 Results

We removed data from 6 participants who rated the neutral controls below 4. In this section, we report the results based on the data from 120 participants. We fit a Cumulative Link Mixed Model via the ordinal package (Christensen 2022) in R to compare ratings. Our models included five fixed effects (BRIDGING TYPE, ANTECEDENT NOUN TYPE, BRIDGED NOUN TYPE, ANIMACY, SYNTACTIC POSITION) and two random effects (PARTICIPANT and ITEM). Model comparisons via ANOVA suggest that including an interaction between BRIDGED NOUN TYPE and other fixed factors does not improve model fit.

The modeling results showed a main effect of **bridged noun type** ($p < 0.001$), **bridging type** ($p < 0.01$), and **syntactic positions** ($p < 0.01$). We further observed an interaction between bridging type and animacy ($p < 0.05$), an interaction between bridging type and syntactic position ($p < 0.01$), a marginal interaction between animacy and syntactic position ($p < 0.1$), an interaction between bridging type, animacy, and syntactic position ($p < 0.05$), an interaction between bridging type, antecedent, and syntactic position ($p < 0.05$), a marginal interaction between animacy, antecedent, and syntactic position ($p < 0.1$), and a marginal interaction between bridging type, animacy, antecedent, and syntactic position ($p < 0.1$). The multiple interactions provided justifications for a subset analysis: we grouped the data by their bridging type and fit a Cumulative Link Mixed Model for each group. The modeling results are reported below.

Fig. 7 and Fig. 8 plot the average ratings of part-whole and relational bridging sentences, respectively. Both figures show the average ratings of controls: semantically odd sentences (red dashed line), pragmatically odd sentences (orange dashed line), and neutral sentences (black dashed line). The plots of ratings in each syntactic position combination are included in the Appendix.

On average, part-whole bridging sentences were rated 5.20 (5.62 for definites and 4.74 for demonstratives as the bridged noun) and relational bridging sentences were rated 4.24 (4.61 for definites and 3.84 for demonstratives as the bridged noun).

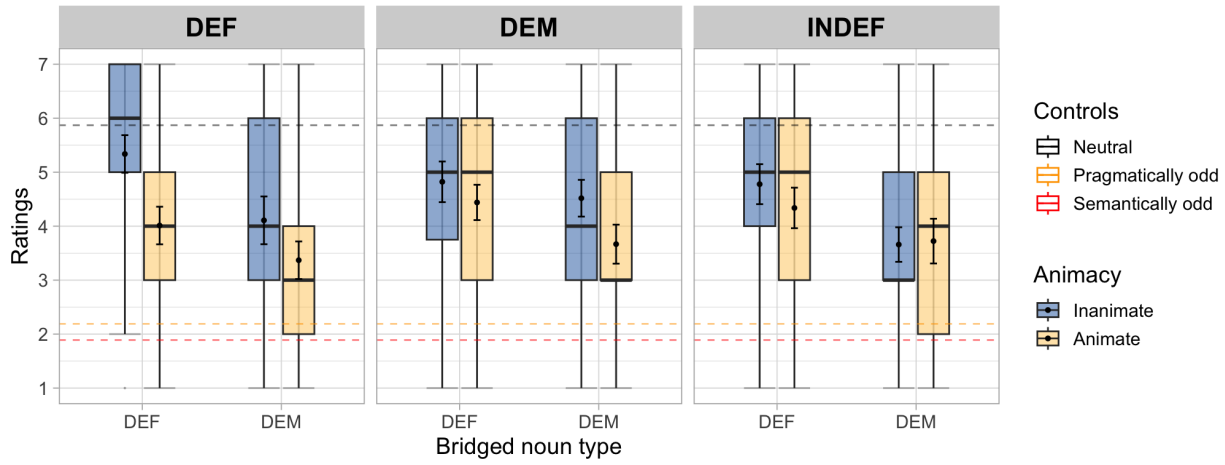


Figure 7: **Part-whole bridging:** Ratings as function of bridged noun type (bottom), grouped by antecedent noun type (top), and color-coded for animacy (box color) in Study 3

For part-whole bridging (Fig. 7), our results showed a main effect of **bridged noun type** ($p < 0.05$) and **syntactic position** ($p < 0.001$), and a marginal effect of **animacy** ($p < 0.1$). In the animate group (yellow boxes), we found a main effect of bridged noun type ($p < 0.001$) and syntactic position ($p < 0.001$). In the inanimate group (blue boxes), we found a main effect of syntactic position ($p < 0.001$). No significant interaction was found for part-whole bridging.

For relational bridging (Fig. 8), our results showed a main effect of **bridged noun type** ($p < 0.01$) and **animacy** ($p < 0.001$). We also found a significant interaction between antecedent noun type and syntactic position ($p < 0.001$). In the animate group (yellow boxes), we found a main effect of bridged noun type ($p < 0.05$) and a significant interaction between antecedent noun type and syntactic position ($p < 0.001$). In the inanimate group (blue boxes), we found a main effect of syntactic position ($p < 0.05$) and a significant interaction of antecedent noun type and syntactic position ($p < 0.001$).

Lastly, we observed that the ratings of all bridging sentences are significantly above the ratings of semantically or pragmatically odd sentences ($p < 0.001$).

4.3 Discussion

Our results show that English demonstrative descriptions (with *that*) are generally dispreferred in bridging sentences, in comparison to English definite descriptions. In English, bridged noun type had a significant effect: demonstrative constructions were systematically rated lower than definite descriptions, regardless of the bridging type. This effect is in line with the common assumption that demonstratives disallow bridging (Dayal and Jiang 2021; Himmelmann 1996). This differs from what we found for Mandarin where bridged noun type did not have a significant effect.

In English, too, the comparison between target and control stimuli indicates that all of the bridging sentences received significantly higher ratings than the semantically or pragmatically odd controls. This may be due to several possible reasons. First, the difference between definite and demonstrative descriptions in English bridging might be less categorical for speakers. Second, participants may have taken the demonstrative description to have an affective reading, similar

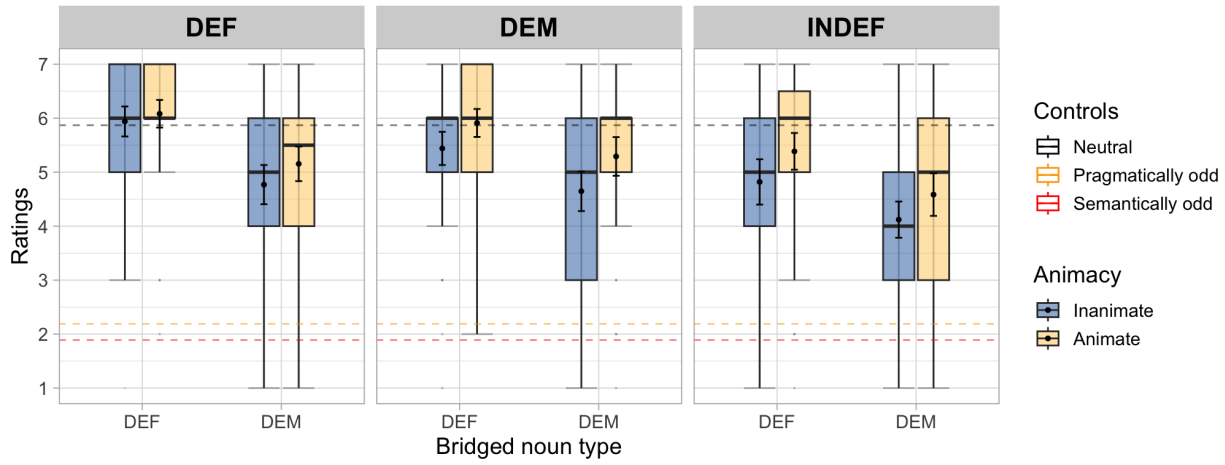


Figure 8: **Relational bridging:** Ratings as function of bridged noun type (bottom), grouped by antecedent noun type (top), and color-coded for animacy (box color) in Study 3

to what we predicted for the production data in Study 2. Finally, participants may have tried to make their responses more fine-grained by varying their ratings according to the specific type of linguistic violations in the stimuli. To tease apart these possibilities, a follow-up study with a different empirical methodology would be necessary. For now, it is sufficient for us to observe a clear difference between English and Mandarin, where demonstratives receive significantly lower ratings than definite descriptions in bridging in the former but not in the latter.

Finally, in English, animacy had a marginal effect in part-whole bridging and a main effect in relational bridging. For part-whole bridging, the effect of animacy can be attributed to the peculiarity of body-part terms, as we discussed in Section 3.2.3. For relational bridging, the significant effect of animacy might have been caused by one particular pair of items in our stimuli. Specifically, we observed a huge rating difference between the two items in (40), which had indefinite antecedents in the subject position and definite descriptions as the bridged nouns. The average rating for (40a) was significantly lower than the average rating for (40b), and this might be due to the unnaturalness of referring to some TV in (40a). Thus, idiosyncratic differences across items might have been reflected as differences caused by animacy.

(40) a. A TV is too loud. But I couldn't find the remote anywhere. [average rating: 3.4]
b. A film premiered yesterday. We ran into the director afterwards. [average rating: 5.9]

5 Proposal

Taken as a whole, our results from the three studies suggest that Mandarin bare nouns and demonstratives readily allow both part-whole and relational bridging. Study 1 shows that in an offline sentence ratings task, Mandarin speakers rate bare nouns and demonstratives similarly in both part-whole and relational bridging. Study 2 shows that in production tasks, while speakers prefer bare nouns in part-whole bridging, they allow demonstratives and bare nouns equally in relational bridging. Thus, the general pattern surfacing is a preference for bare nouns in part-whole bridging, but demonstratives being licensed in both kinds of bridging.

Comparing our results from Mandarin to English, we observe a sharp contrast between Mandarin *na* and English *that*. Specifically, while in Mandarin the difference between *na* demonstrative descriptions and bare nouns was marginal at best, English *that* was rated significantly lower than definite descriptions in both kinds of bridging. Admittedly, there are many factors that go into play to affect the speakers' rating, interpretation, and use of certain expressions. Moreover, cross-linguistic comparison is very difficult without extensive norming steps. In order for a better comparison, we included in the stimuli semantically odd, pragmatically odd, and neutral control sentences in both English and Mandarin and compared how displaced the ratings of test sentences were from these control sentences. We see that demonstratives were rated generally lower in English, further away from the neutral controls and closer to semantically and pragmatically odd sentences. In Mandarin, ratings of demonstratives were closer to the neutral control sentences. Thus, we conclude that Mandarin demonstratives more readily allow bridging than English demonstratives.

How do existing analyses account for the pattern we present here? First of all, we note that our findings are not predicted by the analysis proposed in Dayal and Jiang 2021 because a) *na* does not behave like English *that*, and b) *na* is licensed in contexts that do not meet the anti-uniqueness presupposition that Dayal and Jiang assume for *na*'s denotation. While this analysis accounts for the more flexible use of demonstratives with the assumption that anti-uniqueness can be satisfied in extended situations, it is unclear exactly how situation extension can be constrained. Even if we adopt their assumptions of situations being extended through adding new discourse referents or events (see Saha et al. 2023 for an implementation of this idea), our stimuli did not have these features that would license extending of situations.

The empirical pattern is also not fully compatible with the predictions of Jenks 2018. The main issue is that bare nouns and demonstratives are expected to be in complementary distribution given the principle *Index!* defined in terms of *Maximize Presupposition!*. In Jenks 2018, Mandarin *na* is analyzed as carrying a uniqueness-operator *iota* with an index, where the index is a presupposed predicate of type $< e, t >$, while bare nouns only carry the *iota* operator without the index. *Maximize Presupposition!* (Heim 1991) requires that *na* be used over bare nouns when its presupposition is met — namely when the context supports anaphora and the index can be bound — and so the prediction of Jenks 2018 is that *na* would be required whenever anaphora is possible. So this proposal does not account for why both bare nouns and demonstratives are licensed in the two kinds of bridging, especially in contexts where anaphora is possible such as relational bridging. Recall that Dayal and Jiang (2021) and Bremmers et al. (2022) also show that Mandarin bare nouns do not behave like uniqueness-denoting definites, unlike German weak and strong definites. Thus, our study together with Bremmers et al. 2022 and Dayal and Jiang 2021 pose an empirical challenge for the *Index!* principle. That said, we show below that once we remove *Index!* from the analysis, the denotations Jenks proposes can be minimally modified to account for our data.

Taking stock, based on our results, we conclude that demonstratives are not anti-unique (cf. Dayal and Jiang 2021) or exclusively required for anaphoric uses (cf. Jenks 2018). The main data that need to be accounted for are as follows: a) bare nouns allow both part-whole and relational bridging; b) *na* allows both part-whole and relational bridging; c) there is a preference for bare nouns over demonstratives in part-whole bridging; d) Mandarin *na* differs from English *that* in allowing bridging more readily. In the next section, we propose a modified account of Mandarin bare nouns and demonstrative descriptions that can derive these empirical facts.

5.1 A new analysis of Mandarin definite expressions

The denotations of the two iota operators underlying the definite bare noun and the demonstrative description in Jenks 2018 are repeated below:

(41) a. $[\![\iota]\!] = \lambda s_r.\lambda P_{<e,st>} : \exists!x[P(x)(s_r)].\iota x[P(x)(s_r)]$
b. $[\![\iota^x]\!] = \lambda s_r.\lambda P_{<e,st>}.\lambda Q_{<e,t>} : \exists!x[P(x)(s_r) \wedge Q(x)].\iota x[P(x)(s_r)]$

Following Jenks 2018, we assume that Mandarin nouns are cumulative predicates that contain both individuals and pluralities closed under sum (Link 1983; Schwarzschild 1996), and that classifiers take these as arguments and return atomic predicates (Chierchia 1998b), represented as AT.[6]

(42) a. $[\![\text{N}]\!] = \lambda x \lambda s.P(x)(s)$
b. $[\![\text{CL}]\!] = \lambda P \lambda x \lambda s.P(x)(s) \wedge AT(x)$ [adopted from Jenks 2018:513]

Our first divergence from Jenks 2018 is the removal of the *Index!* principle. Others have already shown that bare nouns in Mandarin allow both unique and anaphoric uses readily (Ahn 2019; Bremmers et al. 2022; Dayal and Jiang 2021). Our data in Study 1 and 2 also show that bare nouns allow both part-whole and relational bridging. Following Schwarz 2009, we assume that part-whole bridging is licensed through situational uniqueness while relational bridging is licensed through an anaphoric reference to the relatum argument. That bare nouns allow relational bridging poses a further challenge to *Index!* because the principle would predict the non-indexed iota operator to be unavailable due to *Maximize Presupposition!*. Instead, we argue that both mechanisms of definite reference — namely uniqueness and familiarity — be available and be subject to pragmatic competition which can result in more gradient interaction between the expressions.

The second change is the modification of the denotation of the anaphoric definite in (41b). As shown in (41b), the domain restriction predicate $Q(x)$ is a predicate that holds of x, typeshifted from an individual-denoting item of type e. This can derive directly anaphoric uses of *na*, but not the bridging use because Q is a one-place predicate that holds of x, the bridged noun, directly. We propose to replace the domain restriction predicate Q with a genitive relation, whose content is contextually determined. In analyzing relational nouns and nouns that have turned relational, various possessive relation functions have been proposed in the literature (Barker 2011; Vikner and Jensen 2002; a.o.). For example, Vikner and Jensen (2002) propose a number of lexically-determined relation functions as well as a pragmatically-determined relation function Prag, as in (43), which can turn a non-lexically-relational noun W into a relational noun that takes an individual y in addition to x and requires that y and x stand in some relation. Similarly, Barker (2011) discusses a type-shifting operator π defined in (44) that can take a non-relational noun and turn it into a relational one, where 'R is a free (pragmatically controlled) variable standing for the possession relation' (p.1114).

(43) $\text{Prag}(W) = \lambda y \lambda x[W(x)\ \&\ \text{related-to}(y)(x)]$ [Vikner and Jensen 2002:211]

(44) $\pi = \lambda P \lambda x \lambda y.P(y) \wedge R(x, y)$ [Barker 2011:1114]

We propose to build the denotation of this relationalizer (specifically π) to the meaning of *na* to make it a relationalizing operator as in (45).[7]

(45) $[\![\text{na}]\!] = \lambda s_r.\lambda P_{<e,st>}.\lambda z : \iota x[\pi(P)(z)(x)(s_r)]$
$= \lambda s_r.\lambda P_{<e,st>}.\lambda z : \iota x[P(x)(s_r) \wedge R(z, x)(s_r)]$

In this analysis, *na* takes a resource situation s_r, a predicate P and a variable z as arguments and returns the unique entity x that is P in s_r and stands in some relation R with z in s_r. For R,

[6] We have simplified the denotations and removed the kind vs. individual distinction (Dayal 2004), and refer the reader to Jenks 2018 for more discussion.

[7] We thank our anonymous reviewer for suggesting this connection.

we follow Vikner and Jensen 2002, Barker 2011 in assuming that it is either a generic 'related-to' predicate or a free variable for some possession relation.

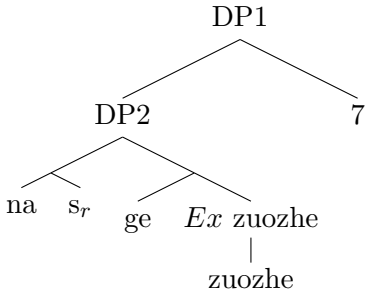
We leave the denotation for non-indexed ι in (41a) as is and assume that bare nouns receive a definite interpretation through uniqueness without a slot for an index. Below, we show how our analysis can derive the data presented in our empirical studies.

We start with *na* in relational bridging. In Studies 1 and 2, we showed that *na* is licensed in contexts of relational bridging. Note that we specifically made use of relational nouns for the stimuli. Since *na* in (45) is defined to take a non-relational noun and turn it into a relational noun, we need to further assume a detransitivizing type-shifter Ex, as defined in (46), which applies to a relational noun before the noun composes with the rest of the DP structure.

(46) $Ex = \lambda R \lambda x \exists y R(x, y)$ [Barker 2011:1114]

This kind of type-shifter is independently motivated for licensing relational nouns without overt possessors and for interpreting a relational noun with an overt possessor in a pragmatically-defined way rather than the lexically-defined way. For example, Barker (2011) discusses that the phrase *John's brother* does not only have the lexically-defined reading where we refer to a person who is born to be John's brother, but also has a pragmatically-licensed meaning, referring to 'some male person who has a sibling and who is related to John through some kind of circumstantial association' (p.1115).[8] For the latter reading, Barker gives the denotation $\pi(Ex(\llbracket \text{brother} \rrbracket)) = \lambda x \lambda y. \exists z \text{brother}(z, y) \wedge R(x, y)$. Given how readily π and Ex can apply to shift the denotation of nouns between relational and non-relational, we assume that Ex is freely available for a relational noun when it combines with *na*. The R can be contextually provided, or can pick up the lexically-determined relation from the noun, thus allowing both pragmatic and lexical relation to hold between x and z. For the *book-author* example, *na-ge zuozhe* ('that author') would receive the following denotation, which would be translated to English as 'the unique individual x such that x is an author of some y and stands in some relation to $g(7)$'.

(47)



(48) $\llbracket \text{zuozhe} \rrbracket^g = \lambda z \lambda x \lambda s. author(z, x)(s)$
$\llbracket Ex \text{ zuozhe} \rrbracket^g = \lambda x \lambda s. \exists y. author(y, x)(s)$
$\llbracket \text{ge } Ex \text{ zuozhe} \rrbracket^g = \lambda x \lambda s. \exists y. author(y, x)(s) \wedge AT(x)$
$\llbracket \text{DP2} \rrbracket^g = \lambda z. \iota x [\exists y. author(y, x)(s_r) \wedge AT(x) \wedge R(z, x)(s_r)]$
$\llbracket \text{DP1} \rrbracket^g = \iota x [\exists y. author(y, x)(s_r) \wedge AT(x) \wedge R(g(7), x)(s_r)]$

If interpreted lexically, then R would pick up the author-book relation and return the unique x such that x is an author of something and is an author of the book $g(7)$. If interpreted pragmatically, then R can pick up some salient relation and return the unique x such that x is an author of

[8] In case this use is hard to imagine for some readers: suppose a family has three brothers — Andy, Billy, and Cindy — and John and two of his friends must each pair up with one of the brothers to dance. Then the description *John's brother* may refer to the brother who pairs up with John.

something and stands in some relation to $g(7)$. This can be applied to all of our relational stimuli.

One prediction of this analysis is that *na* should be able to take a non-relational noun as its argument and turn it into a pragmatically-relational noun that stands in some relation to the index argument z. We test this prediction in Study 4 presented in Section 5.2 and show that this prediction is borne out.

With *na* in part-whole bridging, we can keep the same denotation as in (45) and simply add that z can be an index for not only individuals but also locations. That an anaphoric variable can be not just of entities but locations is evidenced by the fact that (demonstrative) pronouns in many languages also have locational versions, such as *there* in addition to *that*. The locational variable z would then pick up the salient location described in the previous sentence and return the unique x that is located there. For the pair *bike-seat*, for example, *na ge chezuo* ('that seat') would return the unique x that is a seat in s_r and stands in some relation to the salient location picked up by the index z in the previous discourse. It is noted in Barker 2011 that in some languages, prepositions are 'frozen possessives', supporting this kind of expansion of entity variables to location variables.

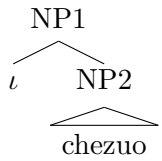
(49) $[\![\text{na ge chezuo } 7]\!]^g = \iota x[seat(x)(s_r) \wedge AT(x) \wedge R(g(7), x)(s_r)]$

a. $g(7)$: location of the bike

b. R: located-at

For bare nouns, part-whole bridging is straightforwardly accounted for using the same logic in Jenks 2018. We assume that ι typeshifts the predicative noun into an individual-denoting entity by feeding it a situation variable and returning the unique entity that meets the noun denotation. The situation can be bound by the topic situation, which in turn can be fixed to the relevant question under discussion (Schwarz 2009), licensing part-whole bridging.

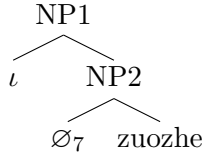
(50)



(51) $[\![\text{NP1}]\!]^g = [\![\iota \text{ chezuo}]\!]^g = \iota x.seat(x)(s_r)$

Finally, the licensing of bare nouns in relational bridging is not straightforwardly predicted by Jenks 2018, but we argue that the denotation in (41a) can indeed derive relational bridging cases as well, *if* we make one change from the assumptions in Schwarz 2009. Schwarz (2009) argues that relational bridging involves anaphoricity because the strong definite introduces an index outside the complement noun. He further argues that only when the possessor is overtly expressed can it appear inside the head noun as a complement. For Mandarin, we argue that the relatum argument can be a covert variable, thus providing an argument to the relational noun before it combines with the *iota* operator. This is possible in Mandarin because this language more readily allows argument drop than languages like English and German (Huang 1984; Liu 2014; a.o.). Once the noun itself contains a relatum argument as its complement, there is no need for an external index argument, thus licensing the bare noun.

(52)



(53) $[\![\text{NP2}]\!]^g = [\lambda z \lambda x \lambda s.author(z, x)(s)](g(7))$

$[\![\text{NP1}]\!]^g = \iota x.author(g(7), x)(s_r)$

Note that all of our relational bridging stimuli in Study 1 and 2 were lexically-relational nouns, which are argued to take two argument slots. The analysis above is only possible if the noun itself carries a relatum argument inside its denotation and does not need an external index to be hosted by the demonstrative *na*. In other words, we expect relational bridging to be only possible for bare nouns if the predicate is lexically relational. This is exactly what Schwarz (2009) finds for German: while the anaphoric definite article appears for relational bridging, if the relatum argument is overtly expressed inside the complement of the head noun, the unique definite article is licensed instead. The only difference between Mandarin and German is that this internal relatum argument can be dropped for Mandarin but not for German.

Our analysis of bare nouns in relational bridging makes a prediction that if the noun is not lexically relational, it would not allow bridging. Together with the analysis for *na*, we predict that a non-lexically-relational noun would license bridging only with *na* and not with the bare noun. Testing this prediction is crucial in strengthening our analysis because we argue that the uniqueness-based analysis of definite bare nouns in Jenks 2018 can be maintained to account for what looks like an anaphoric reference on the surface. Thus, we tested our prediction by designing another sentence ratings task (Study 4) that investigated the availability of bridging of (non-)relational nouns with bare nouns and demonstratives. Our analysis predicts that demonstratives would license bridging regardless of whether the noun is lexically relational or not, since the demonstrative *na* itself is a relationalizer that introduces an external relatum argument. On the other hand, bare nouns are predicted to only license bridging if the noun is lexically relational. Otherwise, the bare noun would not have a slot to host the relatum argument that licenses bridging. This prediction is borne out. In the next section, we present our data.

5.2 Study 4: Relational Ratings Task

5.2.1 Methodology

This sentence ratings task explored whether bare nouns and demonstratives in Mandarin license bridging when the bridged noun is lexically-relational or non-lexically-relational. We adopted a 2×2 design, manipulating two factors: NOMINAL TYPE (bare nouns vs. demonstratives) and RELATIONALITY (relational vs. non-relational).

Target stimuli We included 6 groups of target stimuli (24 sentences in total) evenly distributed in NOMINAL TYPE and RELATIONALITY. For example, one representative group of stimuli is presented in (54), where the indefinite antecedent *xiaoshuo* 'novel' is uniquely associated with the relational noun *zuozhe* 'author' or the non-relational noun *xiaoshuo-jia* 'novelist'. We manipulated the nominal type of these bridged nouns via the presence and absence of the demonstrative *na* and a classifier before the noun.

(54) *Wang Yawen xihuan shoucang tushu. ta mei-ci zhao-dao le yi ben xihuan de*
Wang Yawen like collect book. she every-time find-arrive ASP one CL like DE
***xiaoshuo**, zuihou dou hui faxian ziji du-guo {(na wei) **zuozhe**, (na wei)*
novel, finally always will discover self read-pass that CL author that CL
***xiaoshuo-jia**} xie de ling yi ge gushi.*
novel-person write DE another one CL story
'Wang Yawen likes to collect books. Every time she finds **a novel** that she likes, she eventually realizes that she has read another story written by **the author**/**the novelist**.'

In designing these noun pairs, we adopted two strategies presented in Schwarz 2009. The first strategy used for the first three examples was simply coming up with minimal pairs of synonyms where one was relational and the other was not, like 'author' and 'novelist'. The second strategy was that of compounding. Schwarz (2009) notes that if the relatum argument is overtly present and forms a compound with the relational noun, then the noun is no longer relational. Using this strategy, we created noun pairs by taking a relational noun and making a compound with an overt relatum argument. An example of this is 'author' vs. 'fairy.tale-author'. The complete list of the target stimuli can be found in Supplementary Materials.

To decide whether or not a noun is lexically relational, we made use of the genitive *de* diagnostic as in Barker 2011. As discussed above, in English, relational nouns can appear with an *of*-possessive, while non-relational nouns cannot. This contrast is demonstrated in (55).

(55) a. the author of a novel
b. *the novelist of a novel

We extended this diagnostic to Mandarin nouns. Specifically, Mandarin possessive constructions are expressed with a genitive marker *de*, as shown in (56), and only relational nouns (e.g. *zhuren* 'owner' in (56a)) are allowed after *de* in this construction, in contrast to non-relational nouns (e.g. *ren* 'person' in (56b)).

(56) a. *yi zhi mao de zhuren*
one CL cat DE owner
'the owner of a cat'
b. **yi zhi mao de ren*
one CL cat DE person
'the person of a cat'

Based on this diagnostic, we conducted a small-scale norming study ($n = 8$), asking native speakers to rate the naturalness of Mandarin *de*-constructions with the nouns in our stimuli. For example, in (57), *zuozhe* 'author' received a high naturalness rating and was labelled as relational, while *xiaoshuo-jia* 'novelist' received a low rating and was labelled as non-relational.

(57) a. *na ben xiaoshuo de zuozhe*
that CL novel DE author
'the author of that novel' [Average rating: 4.88/5]
b. **na ben xiaoshuo de xiaoshuo-jia*
that CL novel DE novelist
'the novelist of that novel' [Average rating: 1.50/5]

We present the list of nouns used in our stimuli in Table 3. In the norming study, the relational nouns received an average naturalness rating of 4.5 or above, while the non-relational nouns received an average naturalness rating of 1.5 or below.

Control stimuli In addition to the target stimuli, we included 12 pairs of control stimuli (24 sentences in total): 4 pairs of BOTHGOOD stimuli where the linguistic context does not prefer either BN or DEM, 4 pairs of BNGOOD stimuli where the linguistic context requires a generic reading or a unique reading of the nominal and therefore BN is preferred, and 4 pairs of DEMGOOD stimuli where the linguistic context requires an anti-unique reading or includes a pre-nominal noun modifier and therefore DEM is preferred. Taken together, the control stimuli can be divided into 5 groups. The complete list of the control stimuli can be found in Supplementary Materials.

Antecedent	Relational noun	Non-relational noun
novel	author	novelist
painting	creator	artist
solo concert	performer	musician
song	singer	jazz singer
literary work	author	fairy tale author
restaurant	owner	diner owner

Table 3: Stimuli of Study 3

Participants and procedure We recruited 100 native Mandarin speakers (age-balanced and 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 ratings task. Participants were paid $2–3 for their time.

Each participant was presented with a total of 18 pairs of stimuli (36 sentences in total): 6 pairs of target stimuli and 12 pairs of control stimuli. The presentation order within each pair was pseudo-randomized, and the presentation order of all of the pairs was randomized. The experiment had a between-subject design: each participant saw only the relational condition or only the non-relational condition. For each trial, participants were shown two sentences in a pair side by side (following Marty et al. 2020; Bryant 2022) and asked to rate the naturalness of these sentences on a 7-point Likert scale, as demonstrated by the sample stimuli in Fig. 9.

5.2.2 Results

Target stimuli We fit a Cumulative Link Mixed Model via the ordinal package (Christensen 2022; Bross 2019) in R to compare ratings in different conditions. Our model included two fixed effects (NOMINAL TYPE and RELATIONALITY) and two random effects (PARTICIPANT and ITEM).

The modeling results showed a main effect of **nominal type** ($p < 0.001$) and **relationality** ($p < 0.05$), as well as a significant interaction between the two factors ($p < 0.001$). The interaction justified a subset analysis: we fit a Cumulative Link Mixed Model for each relationality condition. In the relational group, NOMINAL TYPE is not significant ($p = 0.732$), while in the nonrelational group, NOMINAL TYPE has a main effect ($p < 0.001$).

Fig. 10 plots the average ratings in each of the four conditions. On average, relational bare nouns were rated 5.37; relational demonstratives were rated 5.2; non-relational bare nouns were rated 4.82; non-relational demonstratives were rated 5.48. In addition, Fig. 11 plots the distribution of ratings in each condition.

Control stimuli We fit a Cumulative Link Mixed Model for each group of the control stimuli. Our model included one fixed effect (NOMINAL TYPE) and one random effect (PARTICIPANT). For two of the groups (BNGOOD_GENERIC and DEMGOOD_ANTIUNIQUE), the modeling results showed a singular fit, which suggested that the random effect was redundant, and thus motivated us to fit a Cumulative Link Model with no random effect considered. In all five groups of control stimuli, we found a main effect of **nominal type** ($p < 0.001$). The average ratings for each group and condition are summarized in Table 4. The box plots that visualize the average ratings for each group can be found in the Appendix.

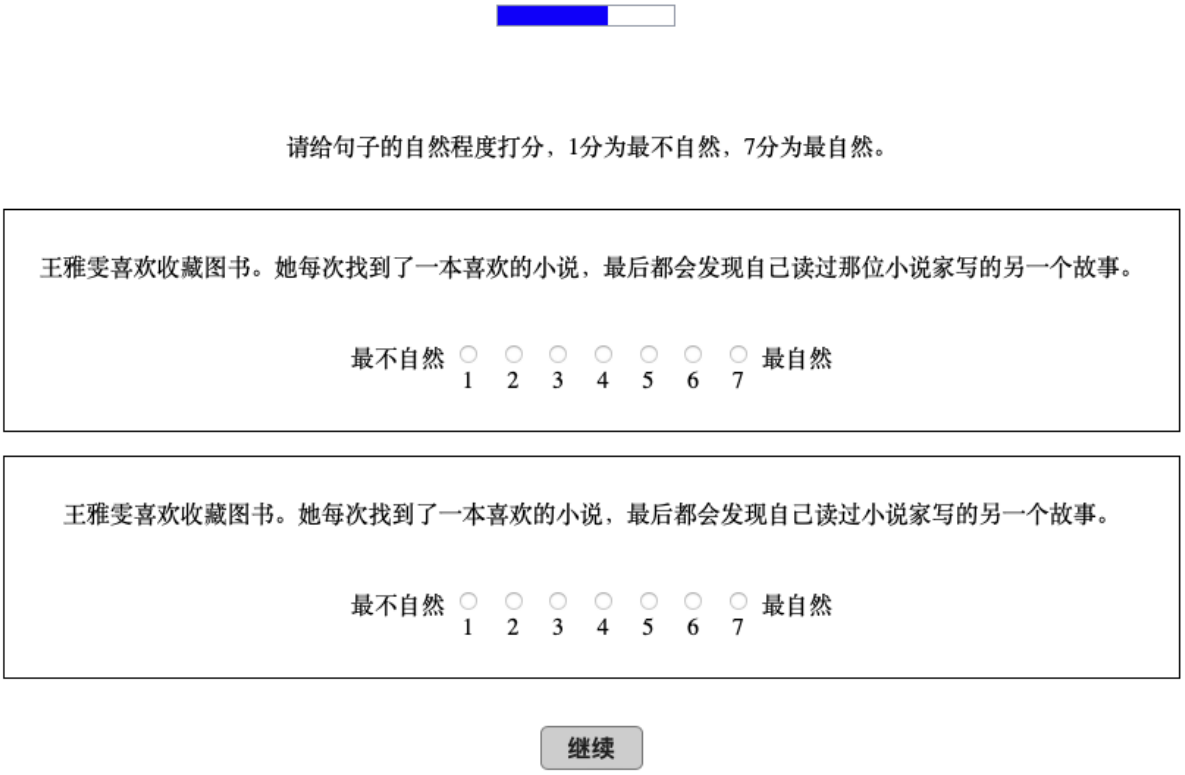


Figure 9: Sample stimuli in Study 4

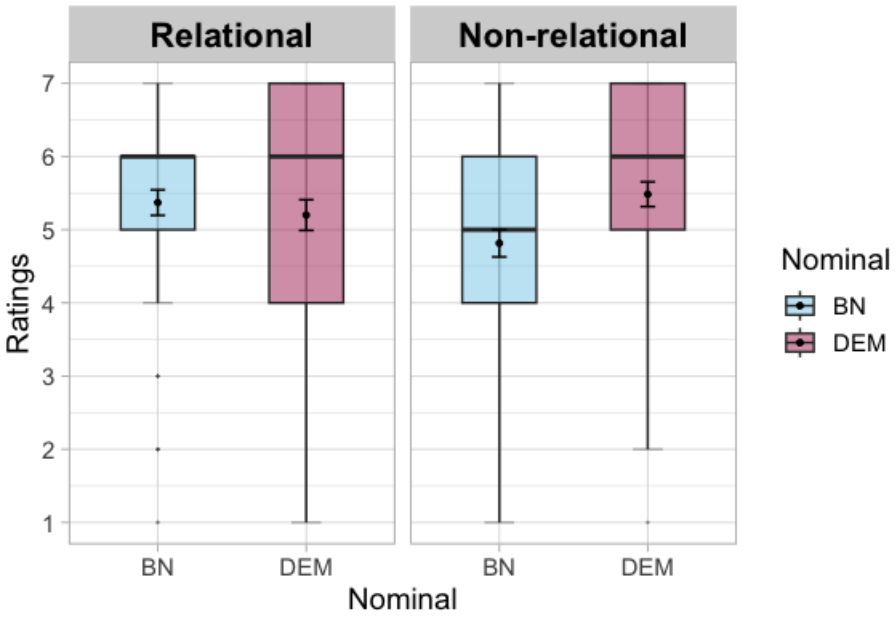


Figure 10: Ratings as function of nominal type (bottom & box color), grouped by relationality (top) in Study 4

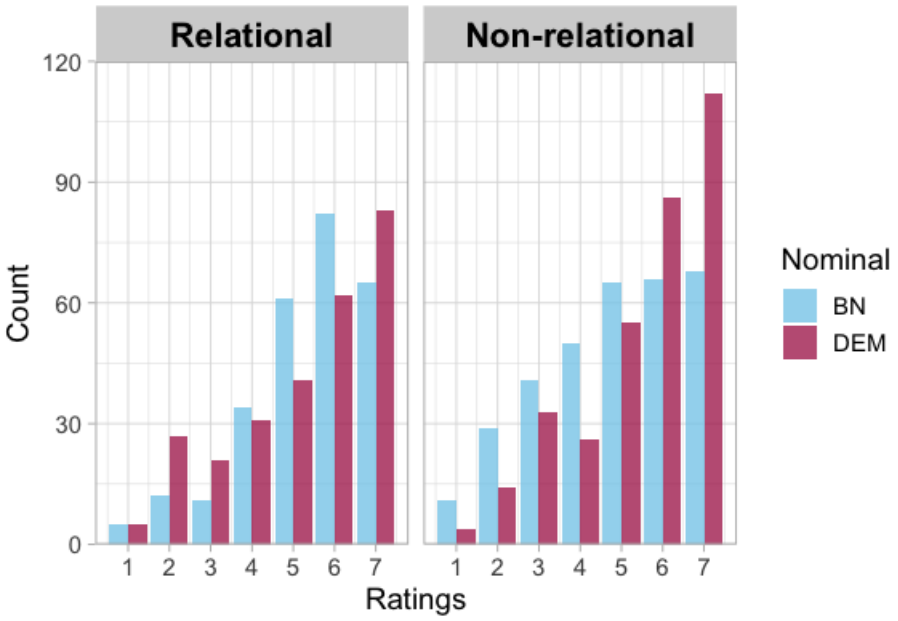


Figure 11: Distribution of ratings by nominal type (color) and relationality (top) in Study 4

Group	BN	DEM
BOTHGOOD	6.07	4.93
BNGOOD_GENERIC	6.40	2.89
BNGOOD_UNIQUE	6.22	3.60
DEMGOOD_ANTIUNIQUE	3.15	6.14
DEMGOOD_NOUNMODIFIER	4.03	6.32

Table 4: Average ratings of control stimuli in Study 4

5.2.3 Discussion

Our results show that bare nouns and demonstratives differ in their ability to license bridging with non-relational nouns. For lexically-relational nouns, both bare nouns and demonstratives are licensed for bridging. For non-relational nouns, however, demonstratives readily license bridging while bare nouns are significantly degraded. The results thus confirm the prediction of our analysis, where bare nouns rely on the relational predicate to be equipped with the relatum index internally while demonstratives can add their own external index to license relational bridging.

As for the control stimuli, our results show a general preference for bare nouns over demonstratives in the BOTHGOOD condition. This preference can be explained by a pragmatic competition between the two definite forms, where bare nouns are simpler in form and thus more economical than demonstratives (see the discussion in Section 6.1.1 on how to derive their competition). We further observe that when nominals have a generic reading or refer to an inherently unique entity, bare nouns are preferred. In contrast, when the linguistic context establishes multiple possible referents or contains a pre-nominal noun modifier, demonstratives are much preferred. These results confirm the predictions of existing literature on bare nouns and demonstratives.

6 Conclusion

Studies 1 through 4 together draw the following empirical picture. For part-whole bridging which is argued to be based on situational uniqueness, Mandarin bare nouns and demonstrative descriptions are licensed, though there is a preference for bare nouns. For relational bridging involving lexically-relational nouns, bare nouns and demonstratives are both licensed. For relational bridging involving non-lexically-relational nouns, only demonstratives are licensed. For English, demonstratives are significantly degraded in comparison to definite descriptions for both part-whole and relational bridging.

These observations are accounted for by our analysis of Mandarin bare nouns and demonstratives. For bare nouns, we adopt the analysis of Jenks 2018 that they are uniqueness-denoting expressions that cannot take an external index. Part-whole bridging is derived readily because all it requires is uniqueness in some relevant situation. Relational bridging with lexically-relational nouns is also possible because the nouns themselves bring a relatum argument which can be covert in Mandarin. Relational bridging with non-relational nouns is not possible for bare nouns because there is no slot for a relatum argument. For the demonstrative *na*, we argue that it is a relationalizer, introducing a relational predicate in the restriction of the ι. This analysis differs from that of Jenks 2018 in that a) the index argument is now a relatum argument introduced by the relational predicate, and b) the relational predicate is in the restriction of ι rather than in the presupposed content. Part-whole bridging is possible with demonstratives because the external index can refer to locations and the salient relation R can be that of physical containment. Relational bridging is possible for *na* regardless of whether the noun is lexically relational or not because the external index serves as the relatum argument that stands in some salient (lexical or pragmatic) relation with the referent of the demonstrative description. In the remainder of this paper, we discuss the main implications of our study.

6.1 Implications

6.1.1 Mandarin definite expressions

Definite bare nouns denote uniqueness. Our analysis has implications that contribute to the debate on how Mandarin divides up the definite space morphosyntactically. As discussed above, how

Mandarin definite expressions map onto different meanings of definiteness has been debated in the literature. Our view aligns better with that of Jenks 2018 which argues that bare nouns track with unique definites and demonstrative descriptions track with anaphoric definites, though with some crucial differences. We agree with Jenks that definite bare nouns should be analyzed as requiring uniqueness and not carrying an external index. This restriction has been contested in the literature, with anaphoric uses of bare nouns being reported (Ahn 2019; Bremmers et al. 2022; Dayal and Jiang 2021). However, while this can be seen as an argument against the *Index!* principle which requires bare nouns to be blocked whenever the demonstrative is licensed, that bare nouns are licensed in anaphoric contexts is not an argument against the analysis of bare nouns as uniqueness-denoting definites for at least two reasons. First, it is easy to construe anaphoric contexts as involving smaller situations where uniqueness holds (Elbourne 2005), thus recasting 'anaphoric' uses of bare nouns as 'unique' uses in smaller domains. Second, our data where non-relational nouns cannot be bridged with bare nouns cannot be explained if bare nouns can also carry indices.

***na* is a relational determiner.** We diverge from Jenks 2018 for the analysis of *na*. Instead of arguing that it is directly anaphoric to some given entity, we broaden the notion to that of 'relational anaphora', where an index is introduced as Jenks argues, but is not predicated directly to the referent but instead added as an argument to a contextually-salient relation. Thus, *na* behaves as a nominal possessive in our analysis, and not as an anaphoric definite. This view of demonstratives aligns with existing analyses of demonstratives where they take locations as arguments and return the unique entity in that location (see Ahn 2022).

Deriving the competition between bare nouns and demonstratives. How does this account derive the different distributional pattern of the bare noun and the demonstrative in Mandarin? Instead of *Index!*, we propose that the two expressions compete under a pragmatic principle of economy when they are truth-conditionally equivalent. Such pragmatic principles have been motivated independently in other works (Meyer 2014; Schlenker 2005) to account for competition between definite expressions (see Ahn 2019; Blumberg 2020). The idea is that if the bare noun and the demonstrative description refer to the same individual, then the bare noun is pragmatically ranked higher because it is semantically simpler. One important difference between our analysis and that of Jenks 2018 is that the relational predicate is inside the restriction of the ι operator in our account, rather than being a presupposition. This allows *na* and the bare noun to be subject to pragmatic competition like *Minimize Restrictors!* (Schlenker 2005), which derives different distributional patterns of the two expressions.

The pragmatic competition can explain why in examples like (58) the demonstrative description is degraded when referring to the unique moon.[9]

(58) *(#na ge) yueling sheng shang lai le.*
that CL moon has-risen
'The moon has risen' [Jenks 2018:507]

We do not argue that the degradedness of *na* here is due to some lexical property such as anti-uniqueness (Dayal and Jiang 2021). Instead, we assume that both *na* and the bare noun are in principle available to resolve the referent but compete for pragmatic economy. First, note that the degradedness of *na* in (58) is restricted to out-of-the-blue contexts. In such contexts, the bare noun resolves the referent through situational uniqueness, referring to the unique moon in a given situation. The demonstrative can resolve to the same referent if R can be set as a location

[9] We thank an anonymous reviewer for bringing up this example.

relation with z being the relevant location under discussion. While both expressions resolve to the same entity, the demonstrative description has one additional restriction, namely the R relation. Schlenker (2005) proposes that redundant restrictions of a definite description are blocked unless they have a pragmatic function. For example, 'my tall brother' is degraded if the speaker has only one brother and tallness does not serve a pragmatic purpose in the conversation. We can use the same logic to explain why the demonstrative would be degraded in (58).

6.1.2 Unifying the two variants of the strong article in Schwarz 2009

In Schwarz 2009, two versions of the strong definite article are proposed to account for the directly anaphoric use and the bridging use. That there is a relational variant of the strong article is left as a future problem to be investigated (Schwarz 2009:142). In our analysis, *na* is analyzed as a relational element, with direct anaphora being one of its possible uses where the salient relation R is that of identity. This aligns with the view in Clark 1975 where identity is assumed to be the shortest bridge that can be drawn between the antecedent and the referent of the bridged expression. If we extend this argumentation to German, we would be able to unify the anaphoric and the relational uses of the strong article without requiring separate denotations for the same article. Whether this unified view of anaphoric and relational definites can be extended to all languages that have been shown to distinguish weak vs. strong definites is an open and interesting question that can be investigated in the future.

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Appendix

Study 1 Mandarin Sentence Ratings Task: Additional plots

Fig. 12 and Fig. 13 plot the ratings in each syntactic position combination.

Study 3 English Sentence Ratings Task: Additional plots

Fig. 14 and Fig. 15 plot the ratings in each syntactic position combination.

Study 4 Relational Ratings Task: Additional plots

Fig. 16 through 20 plot the ratings in each control condition.

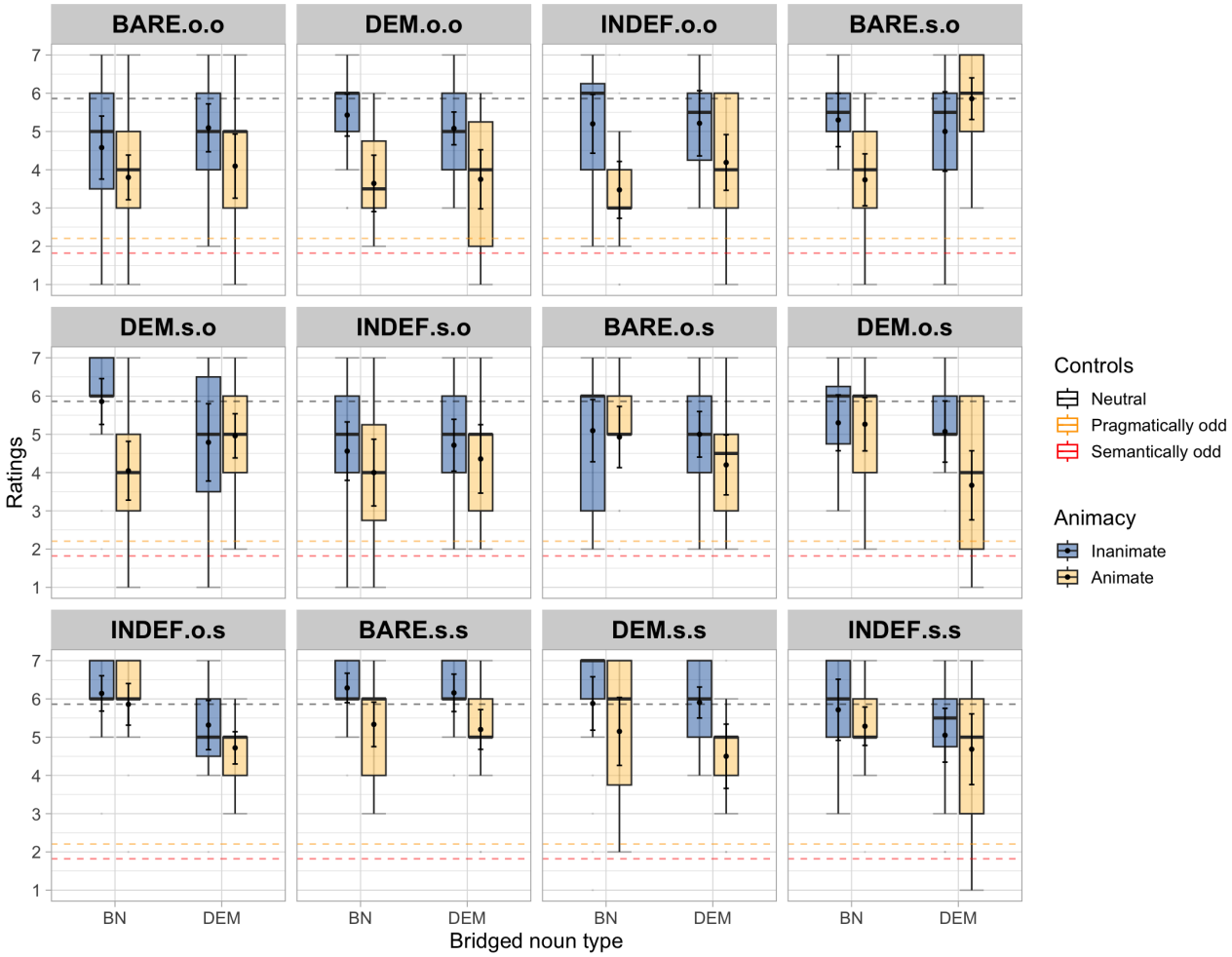

Figure 12: **Mandarin part-whole bridging**: Ratings as function of bridged noun type (bottom), grouped by antecedent noun type and syntactic positions (noun_type.antecedent.anaphor; top) and color-coded for animacy (box color) in Study 1

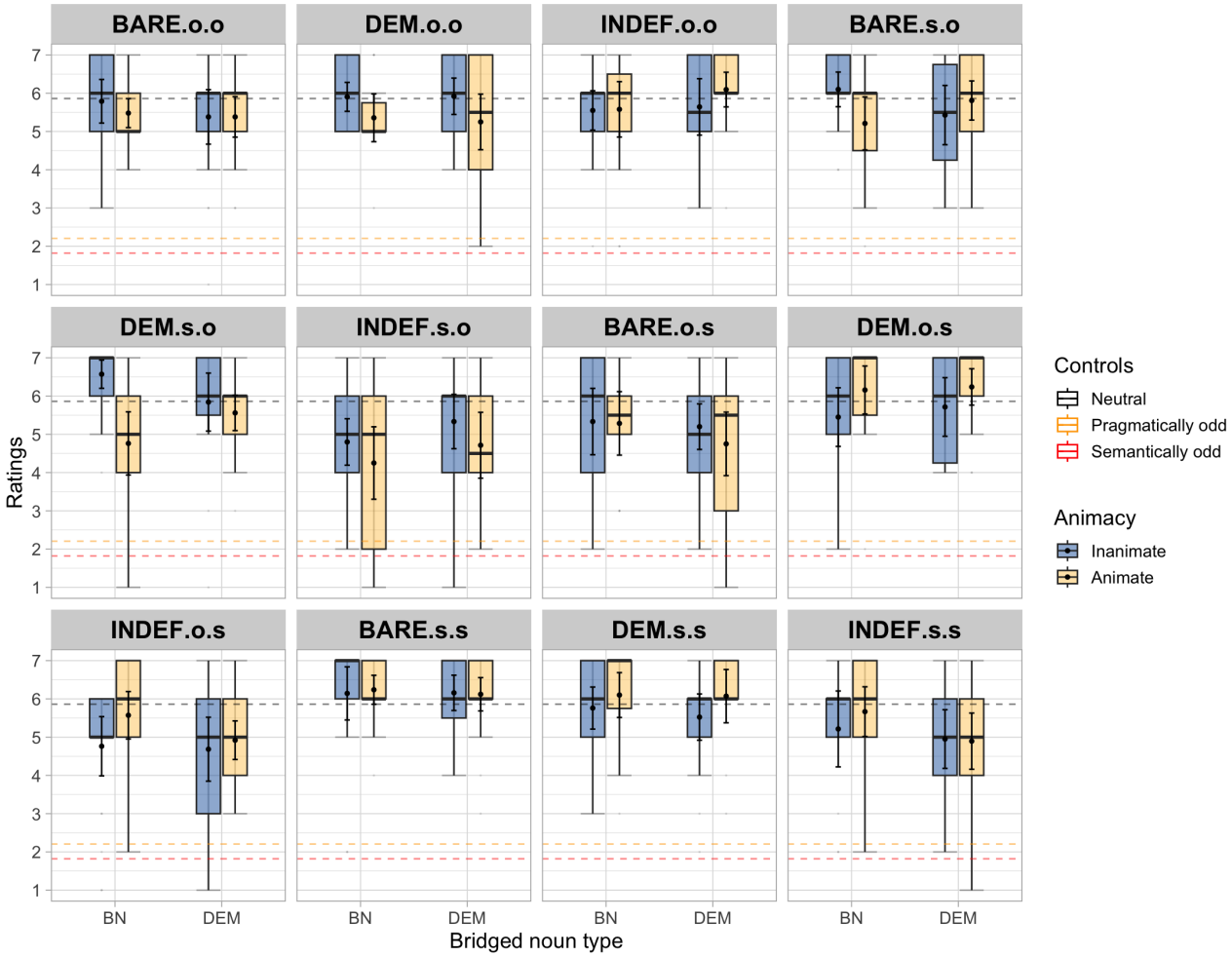

Figure 13: **Mandarin relational bridging**: Ratings as function of bridged noun type (bottom), grouped by antecedent noun type and syntactic positions (noun_type.antecedent.anaphor; top) and color-coded for animacy (box color) in Study 1

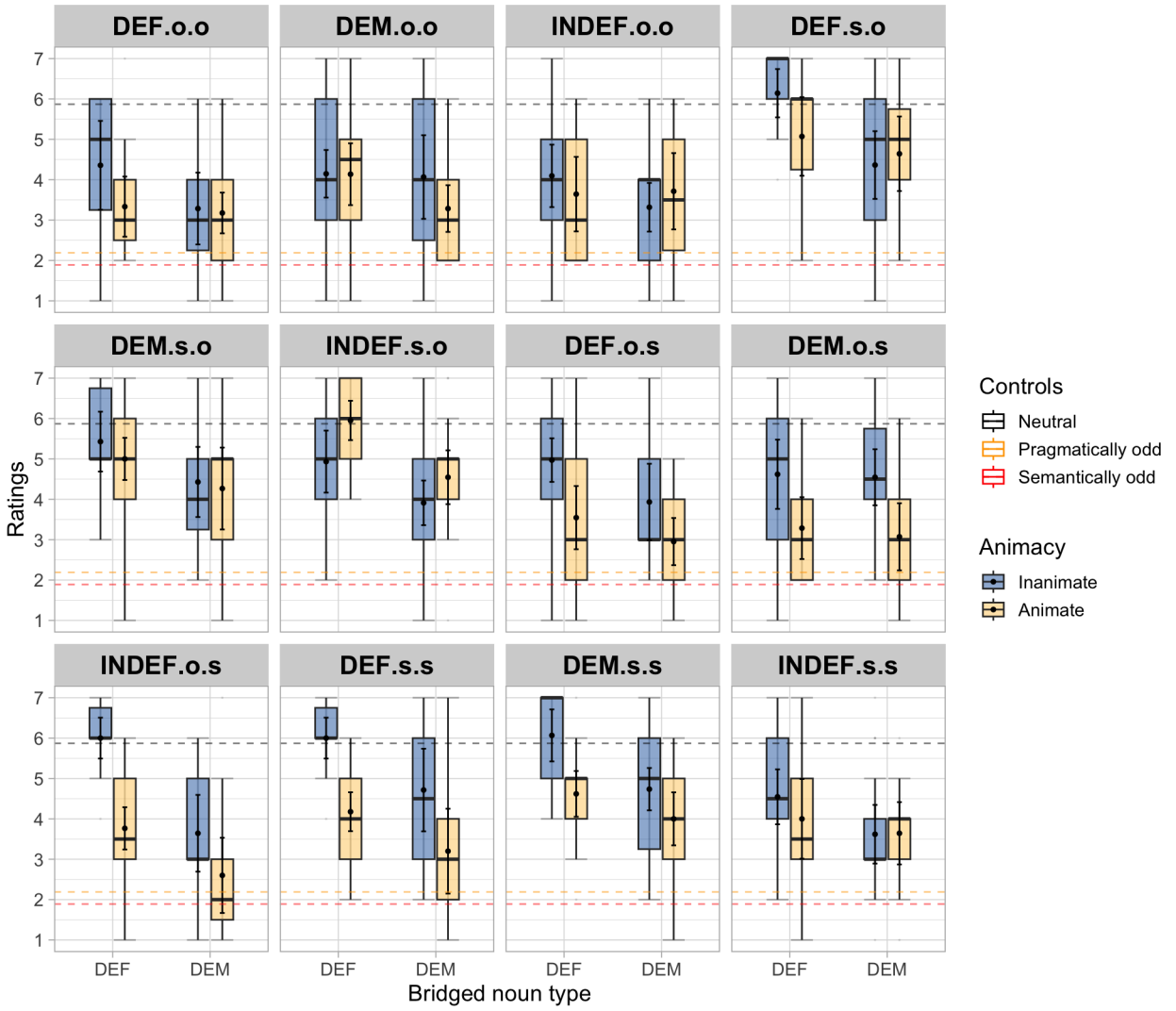

Figure 14: **English part-whole bridging**: Ratings as function of bridged noun type (bottom), grouped by antecedent noun type and syntactic positions (noun_type.antecedent.anaphor; top) and color-coded for animacy (box color) in Study 3

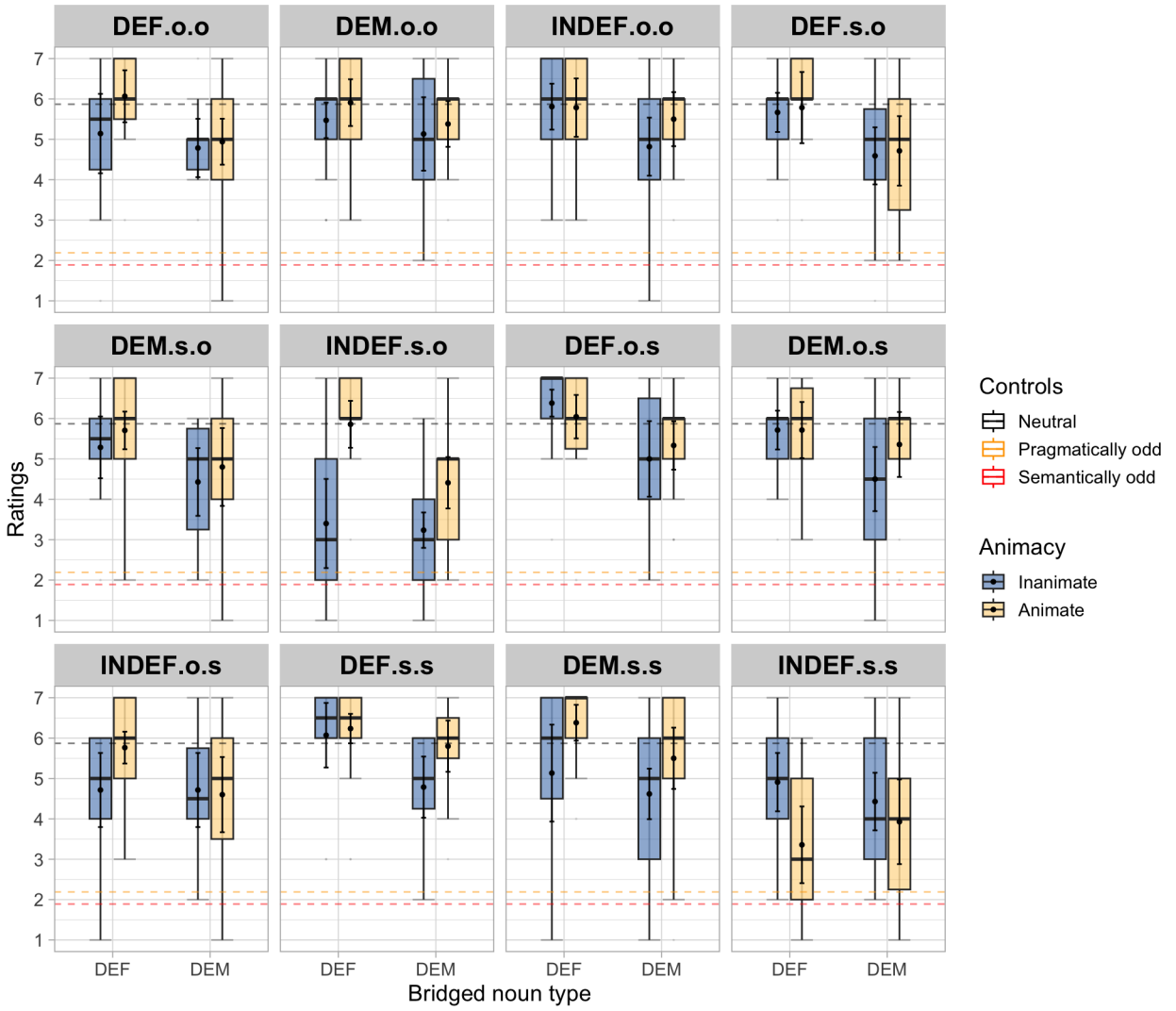

Figure 15: **English relational bridging**: Ratings as function of bridged noun type (bottom), grouped by antecedent noun type and syntactic positions (noun_type.antecedent.anaphor; top) and color-coded for animacy (box color) in Study 3

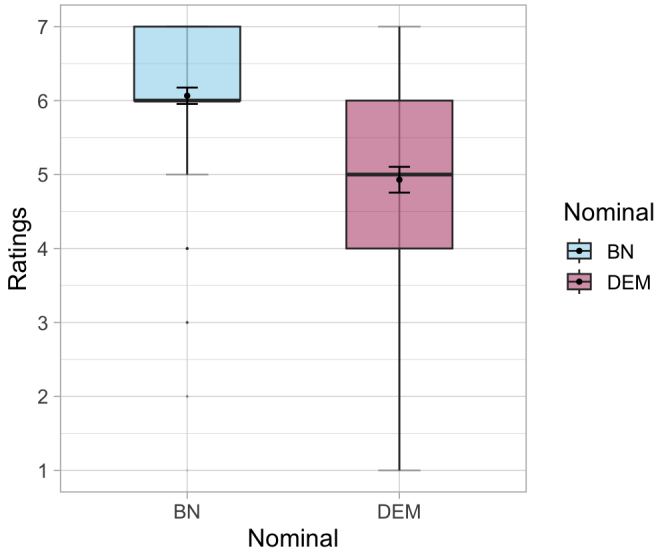

Figure 16: Ratings as function of nominal type (color/bottom) in BOTHGOOD

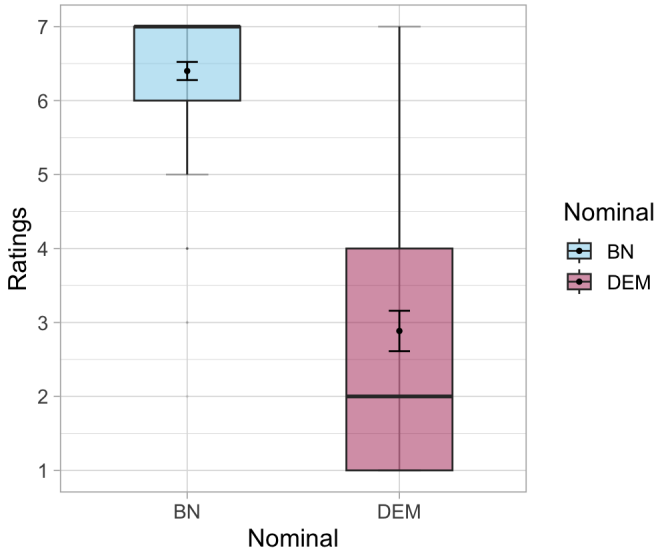

Figure 17: Ratings as function of nominal type (color/bottom) in BNGOOD_GENERIC

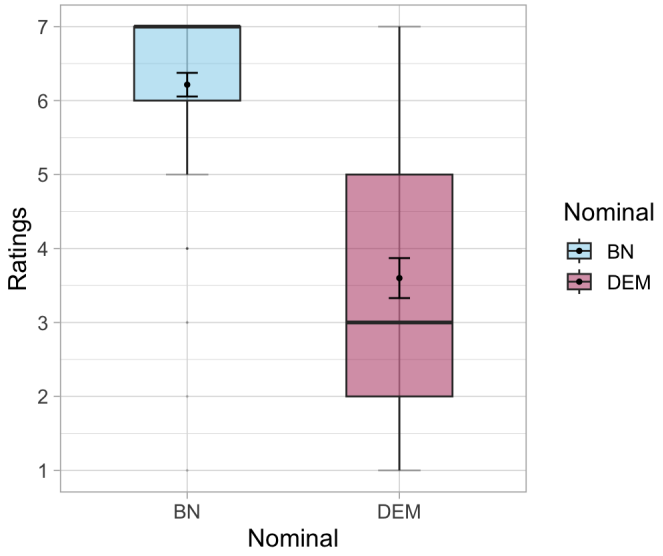

Figure 18: Ratings as function of nominal type (color/bottom) in BNGOOD_UNIQUE

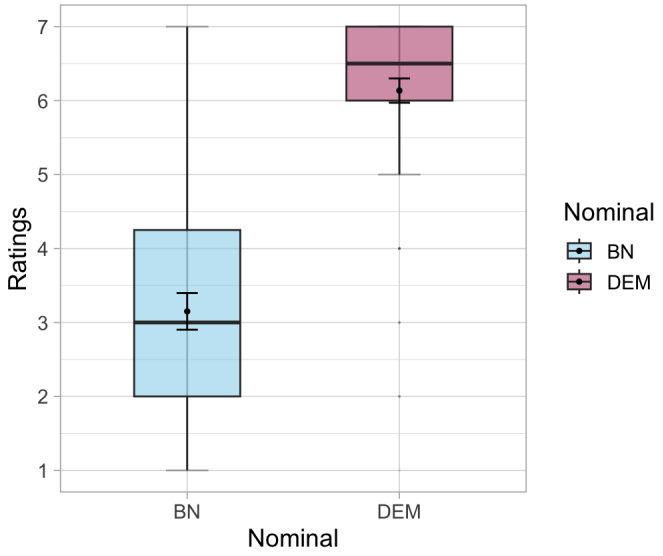

Figure 19: Ratings as function of nominal type (color/bottom) in DEMGOOD_ANTIUNIQUE

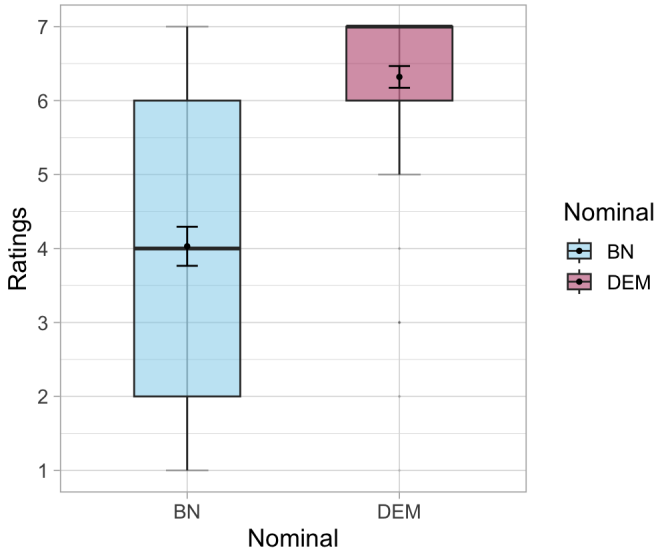

Figure 20: Ratings as function of nominal type (color/bottom) in DEMGOOD_NOUNMODIFIER