An Investigation of the Effect of Sentence Constraints and Chinese Classifiers on Cognitive Load in Listening

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Abstract. As a unique part of Chinese language, Chinese classifiers play an important part in Chinese sentences. This study examines the influence of sentence constraints on sentences with different Chinese classifiers and readers' cognitive load in Mandarin Chinese listening comprehension. It aims to explore how these classifiers affect processing in sentences with varying context levels. Participants listen to structured sentences and predict nouns based on classifiers, with their reaction times being analyzed. The study is intended to enrich the understanding of cognitive processes in Mandarin Chinese and contribute to the limited research on Chinese classifiers. The anticipated outcome is that participants will respond more quickly in high-context sentences, offering insights into language comprehension dynamics.

Keywords: Chinese classifiers, cognitive load, sentence constraints, reaction time, listening comprehension.

1 Introduction

In the realm of psycholinguistics, studies on Chinese classifiers, particularly the ones that involve experimental research, remain relatively sparse. This study aims to bridge the research gaps between the existing literatures by focusing on the cognitive load of participants in two linguistic contexts, specifically examining the role of classifiers in high and low context sentences in Mandarin Chinese.

Participants will listen to sentences with similar structures, ending in a noun preceded by a classifier. They will be tasked with predicting the noun based on the classifier and choosing the corresponding image from two options. Their reaction times in high and low context sentences will be compared.

The anticipated outcome is that participants will demonstrate shorter reaction times in making correct choices in high context sentences compared to any response in low context sentences. This research is supposed to be necessary as it may contribute to the limited body of studies on Chinese classifiers, despite notable works such as Yi (2009) [12], Wang et al. (2022) [9], and Wu, Kaiser, & Andersen (2009) [11]. By exploring this under-researched area, the study aims to enhance our understanding of

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cognitive processing in Mandarin Chinese, particularly in relation to the use of classifiers.

2 Literature Review

When it comes to psycholinguistics, the exploration of language comprehension involves a nuanced understanding of various interrelated theoretical frameworks, including cognitive load theory Tang (2005) [8], sentence constraint theory (Kumar, 2021) [3], cloze probability (Taylor, 1953) [9], the study of Chinese classifiers (Li, Bates, & MacWhinney, 1993) [5], and the application of reaction time (Smith & Levy, 2013) [7] as a measure in linguistic studies. These frameworks collectively provide a comprehensive view of the cognitive processes involved in language processing, particularly in complex linguistic contexts such as Mandarin Chinese.

In psycholinguistic research, the exploration of cognitive processes in language comprehension necessitates a detailed analysis of several interrelated concepts: cognitive load, sentence constraints (including both highly constrained and low constrained sentences), cloze probability, and Chinese classifiers. This comprehensive approach is supported by various studies, such as Krath, Schürmann, & Von Korflesch's (2021) [4] work on cognitive load, Kumar‘s (2021) [3] research on sentence constraints, Wang et al.'s (2022) [9] introduction of cloze probability, and Li, Bates, & MacWhinney's (1993) [5] examination of Chinese classifiers. Together, these elements provide a holistic understanding of the mechanisms that underpin language processing.

Cognitive load, a central concept in cognitive psychology, refers to the mental effort required in the working memory for tasks such as language comprehension [4]. Research indicates that this load is influenced by the complexity and predictability of linguistic input. Chun et al. (2021) [1] demonstrated that syntactic complexity, achieved by adding various constituents to a simple sentence, especially in second language prediction, significantly impacts cognitive load, highlighting how complex linguistic structures increase cognitive demands during sentence processing. Additionally, Gibson (1998) [2] discussed how linguistic complexity, particularly in terms of syntactic dependencies, influences cognitive processing during language comprehension.

Reaction time is a critical measure in psycholinguistic studies, reflecting the efficiency of language processing. It is an indicator of how quickly an individual can comprehend and respond to linguistic information, influenced by factors such as cognitive load and sentence predictability [7].

Sentence constraints in psycholinguistics refer to the extent to which the context of a sentence limits or determines the possible continuations, affecting its predictability and the cognitive load required for processing [3]. For instance, in a highly constrained sentence, certain words or phrases are much more likely to occur, making them more predictable and easier to process. Such sentences, characterized by their predictable nature, facilitate more efficient processing and reduce cognitive load [3].

Conversely, low constrained sentences, which offer less predictability, increase cognitive load, and make comprehension more challenging.

The concept of sentence predictability in psycholinguistics, referring to the likelihood that a specific word or phrase can be correctly anticipated based on the given context, is a key aspect of language comprehension [5]. The predictability of a sentence is often quantified using cloze probability, a measure of the likelihood that a specific word will complete a sentence in a given context. This concept is particularly relevant in understanding how listeners or readers use contextual cues to anticipate upcoming linguistic information.

Finally, in languages like Chinese, unique syntactic features such as classifiers, for example, "个" (gè) as in "一个苹果" (yī gè píngguǒ, "an apple"), add another layer of complexity to language processing. Chinese classifiers are morphemes that are typically used in noun phrases to denote the class or category of the noun, thereby providing semantic information about the noun [5]. This usage affects the sentence structure and meaning, as classifiers categorize nouns into different groups based on their inherent characteristics[6]. The correct usage of classifiers influences cloze probability, which is the likelihood of a specific word completing a sentence in a given context [9]. In the case of Chinese classifiers, their presence or absence can significantly alter the predictability of the noun that follows, thereby affecting the cognitive load required for language comprehension. For instance, the presence of a specific classifier can narrow down the range of possible nouns that can logically follow, making the sentence more predictable and easier to process.

By exploring these concepts in unison, researchers can gain a deeper understanding of the cognitive processes involved in language comprehension. This is particularly pertinent in linguistically complex contexts, such as understanding the role of Chinese classifiers, where these factors interact in nuanced ways to influence language processing efficiency.

3 Methods

3.1 Participants

This study will recruit 30 participants. The decision to recruit 30 participants for this study is informed by a review of similar experiments in the field, where a sample size of around 30 participants is commonly used. This number represents a manageable yet sufficiently large sample size that strikes a balance between feasibility and statistical power. A sample of this size is relatively easier to recruit and manage, especially considering the specific demographic criteria of the study. Additionally, it helps in keeping the costs, including participant compensation, within reasonable limits. The choice of participants is specifically targeting undergraduate and postgraduate students aged 18 to 26 who are native speakers of Mandarin Chinese. This demographic selection ensures a consistent level of language proficiency and cognitive maturity across the sample.

3.2 Instrument

The experimental materials will consist of sentences constructed to represent high and low contextual constraints, derived from a self-created corpus. Classifiers for these sentences will be selected from Modern Chinese (Wang et al., 2017), ensuring appropriate pairing with images [10]. The images used in the experiment will be sourced from the Appendix of Zhou & Chen (2017), a study specially focused on object picture naming tasks in Mandarin Chinese [13].

Participants will be presented with pairs of sentences, one exhibiting high contextual constraint and the other low. Each sentence will conclude with a noun preceded by a classifier. Participants will be tasked with selecting, from two provided images, the one they believe represents the noun following the classifier. The timing for this selection process will commence immediately after the sentence and images are presented and conclude upon the participant's selection.

3.3 Data Collection

Data collection and experimental administration will be conducted using the Testable platform. This platform facilitates efficient task administration and captures participants' response times and selections. The procedure for data collection has been demonstrated in the Appendix.

3.4 Data Analysis

Data will be analyzed using Analysis of Covariance (ANCOVA) with SPSS 29.0 software, incorporating 'context' and 'Chinese quantifiers' as the independent variables, and 'response time' as the dependent variable. This methodology will allow for an assessment of the differences in reaction times between high and low constraint conditions, controlling for potential covariates.

Prior to participation, all participants will be required to sign an informed consent form. This procedure ensures that participants are fully informed about the study's nature, their rights as participants, and the confidentiality of their data.

In order to control for variables and ensure the rigor of the experiment, participants will be tested via a computer set up in a room that is quiet enough, so as to avoid the potential influence of noise.

4 Anticipated Results

It is anticipated that participants will demonstrate shorter reaction times in making correct choices for sentences with high context compared to their reaction times for any response in sentences with low context. This expectation is based on the assumption that high-context sentences provide more cues and contextual information, which facilitate quicker comprehension and decision-making. Consequently, participants are

likely to identify the appropriate noun more rapidly in high-context sentences than in low-context ones, where less contextual information is available.

5 Timeline

Experimentation Phase: This phase is expected to last for one month. During this period, the primary focus will be on conducting the experiment, which includes participant recruitment, data collection, and initial data analysis. The experiment will be carried out in a controlled environment, and all necessary preparations, such as setting up the experimental setup and pilot testing, will be completed prior to the commencement of this phase.

Thesis Writing Phase: Following the completion of the experimental phase, the next month will be dedicated to writing the thesis. This phase involves a detailed analysis of the collected data, interpretation of the results, and the integration of these findings into the broader context of existing research. The writing phase will also include the preparation of the manuscript for submission, encompassing drafting, revising, and finalizing the thesis.

6 Conclusion

In conclusion, this experiment is designed to compare the response speeds of participants under different contextual conditions, specifically in sentences with high and low context containing Chinese classifiers. The method involves participants listening to sentences structured similarly, ending in a noun preceded by a classifier, and predicting which of two presented images represents the noun. It is anticipated that faster accurate responses in high-context sentences, offering a novel contribution to the limited research on Chinese quantifiers. One of the limitations of this study is the small sample size, which may limit the generalizability of the research findings.

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