

Research Article

# On the Central and Marginal Debate of Embedded Implicatures: Evidence from Chinese

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## Abstract

Over the past two decades, embedded implicatures—a core construct in the interface of semantics and pragmatics—have attracted extensive attention among pragmaticists, semanticists and philosophers of language, spawning a wealth of theoretical debates and empirical investigations. An embedded implicature denotes a pragmatic inference that arises not at the propositional level of an utterance, but within a subordinate linguistic structure (e.g., a clause, phrase, or quantifier phrase). A highly controversial issue at the heart of these discussions pertains to whether embedded implicatures are central or marginal. In this paper, we addressed this pivotal question through a rigorous questionnaire-based approach conducted within a Chinese linguistic context, with the aim of providing empirical evidence rooted in non-English discourse data. The results consistently demonstrate that the phenomenon of embedded implicature is central rather than marginal. In the pilot test, the average proportion of embedded Q1 [quantity]-implicature, embedded I[nformativeness]-implicature and embedded M[anner]-implicature is 67%, 67% and 80% respectively, which is apparently predominant; the average proportion of embedded Q2 [quality]-implicature is 49%, which is close to a predominant level. In the formal test, the average proportion of embedded Q1-implicature, embedded I-implicature, embedded M-implicature and embedded Q2-implicature is 77%, 72%, 68% and 78%. Collectively, these cross-test data provide compelling confirmation of Neo-Gricean theoretical postulates, with Levinson's model receiving particularly robust empirical reinforcement, thereby shedding new light on the cross-linguistic validity of implicature theories.

## Keywords

Embedded Implicature, Central vs. Marginal Debate, Questionnaire, Neo-Gricean Pragmatics

## 1. Introduction

The phenomenon of embedded implicature has drawn increasing attention from different lines of inquiry, dating back to Grice [32] and Cohen [18]. In relation to the meaning divergences between natural language (e.g. logical words) and formal language (e.g. logical operators), Grice [32] held that there was no discrepancy in meaning between natural language and its corresponding formal language. He stressed that the seemingly existing divergences in meaning between

natural language and formal language could arise from the fact that natural language was capable of producing a variety of meanings. These ideas were structured as theory of conversational implicature [33]. More specifically, Grice proposed that the hearer would first combine the literal meaning of the whole sentence before he or she would examine whether the literal meaning obeyed or flouted the cooperative principle and its four maxims, thus determining

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what the speaker intended to convey. However, Cohen [18] argued that Grice's model of 'literal meaning first' could not be applied to a number of complex sentences, such as the *if* conditional construction [19]. Thereafter, philosophers of language, semanticists and pragmaticists such as Wilson [69], Gazdar [24], Landman [39], Green [31], Levinson [40], Carston [5, 6], Chierchia [11] and Recanati [47, 49] went a step further to solve the problem posed by Cohen [18], gradually developing the phenomenon into the embedded implicature.

In the last twenty years, extensive theoretical and experimental research on embedded implicatures has been conducted, with one controversy addressing whether such implicatures are central or marginal [40, 25, 26, 36]. In this context, the paper employs a questionnaire survey method to address the issues of embedded implicatures in Chinese, with particular focus on determining whether the phenomenon of embedded implicature is central or marginal. Specifically, the investigation will systematically examine whether the phenomenon of embedded Q[quantity]<sub>1</sub>-implicature, embedded I[nformativeness]-implicature, embedded M[anner]-implicature, and embedded Q[uality]<sub>2</sub>-implicature is central or marginal in Chinese (hereafter embedded Q<sub>1</sub>, embedded I, embedded M and embedded Q<sub>2</sub> implicature). By contributing empirical data from Chinese, this paper aims to give a response to the ongoing debates, thereby offering cross-linguistic insights into further research on embedded implicatures.

## 2. Research on Embedded Implicatures

Embedded implicatures have been primarily explored from theoretical and experimental perspectives, with the latter advancing rapidly in recent years.

### 2.1. Theoretical Perspective

The theoretical study of embedded implicatures can be classified into two camps: a pragmatic approach and a grammatical approach. In addition, several scholars hold the view that the two approaches are complementary, known as the complementary approach, in which the interaction between embedded implicature and presupposition has recently emerged as a cutting-edge topic.

#### 2.1.1. Pragmatic Approach

This approach proposes to analyze embedded implicatures from a pragmatic perspective, laying emphasis on cooperation, rationality, intention, context, and so on. In more specific terms, it consists of the analyses framed in Gricean pragmaticists, truth-conditional pragmaticists and relevance theorists.

##### (i). Analysis of Gricean Pragmaticists

Gricean pragmatics takes 'Gricean in the broad sense' as

the starting point, which means that the occurrence of a conversational implicature involves intention-recognition and cooperative principle but does not require an order of semantics-pragmatics (or what is said vs. what is implicated)<sup>1</sup>. The most noteworthy analysis is Geurts [25, 26]. Geurts categorized the context from which an embedded implicature is derived into contrastive and non-contrastive ones. With regard to an embedded implicature engendered by a contrastive context, an upper-bounded construal may occur at any embedded position; there is pragmatic intrusion into semantics; some words need to be stressed or at least context is acquiescently contrastive; and this sort of embedded implicature can be solved by pragmatic narrowing. However, regarding an embedded implicature generated in a non-contrastive context, there is no pragmatic intrusion into semantics; and it can be interpreted as Q<sub>scalar</sub> implicature [60].

Simons [51, 52] also makes an analysis based on speaker intention and cooperative principle. As she sees it, the hearer realizes that certain sentence on the whole violates Grice's cooperative principle, and also recognizes that this meaning is not what the speaker intends to convey; the hearer further observes that it is certain clause that leads to the violation of Grice's cooperative principle, from which the hearer infers that if he or she does not interpret the clause as its literal meaning, the violation problem could be easily solved. Similar to Simons, Popa-Wyatt [45] formulates that embedded implicatures are in essence conversational implicatures and can be resolved with a minor revision of classical Gricean pragmatics [1, 59].

##### (ii). Analysis of Truth-conditional Pragmaticists

The truth-conditional pragmatics represented by Recanati [47-50] also gives an explanation to the phenomenon of embedded implicature. He makes a distinction between primary pragmatic process and secondary pragmatic process. The latter is post-propositional and global as it is based upon a complete utterance or speech act. The former is a pragmatic process that is employed to determine what is said, including saturation and modulation. A major type of modulation is free enrichment, which can contextually produce an interpretation that is more specific than the literal meaning [67].

##### (iii). Analysis of Relevance Theorists

In relevance theory, it is argued that the inference of a conversational implicature should be context dependent, hence we have the contextual inference theory [54, 55]. Relevance theorists maintain that a conversational implicature can be sub-sententially generated. Wilson [69] writes that certain words like *and* may be truth-conditional when they appear within embedded contexts. Carston [6]

1 'Gricean in the narrow sense' completely follows the semantics-pragmatics (or what is said vs. what is implicated) order.

takes embedded informativeness implicatures as explicatures which are engendered by specific contexts. Additionally, Carston [7] proposes that as Grice [33] suggests that ‘a conversational implicature does not necessarily give priority to a complete utterance or speech act’, we should turn our attention from the occurrence scope of a conversational implicature to Grice’s concept of ‘saying’ or division of labor between ‘what is said’ and ‘what is implicated’.

### 2.1.2. Grammatical Approach

This approach is also called the conventional theory by Geurts [26], as it contends that an embedded implicature (primarily embedded  $Q_{\text{scalar}}$  implicature) is in the strict sense not pragmatic inference but part of the lexico-grammatical content of an utterance which may be hardly distinguished from conventional truth-conditional meaning. This framework consists of two perspectives: lexicalist conventionalism and syntax-based conventionalism.

#### (i). Lexicalist Conventionalism

It is exemplified by Levinson’s default inference theory, which suggests that an embedded implicature conveys the kind of default meaning that is pre-calculated by a conscious inference of language user. In general, if there is a linguistic expression that can trigger a conversational implicature, an embedded implicature will be generated automatically; meanwhile, the scalar implicature that is engendered by means of default may be cancelled because of a discrepancy with semantic content or context [40, 36, 37, 68]. On the one hand, the scalar implicature in this theory is strong implicature, for which it is also referred to as strong defaultism; on the other hand, there is a less focused weak defaultism which delimits embedded  $Q_{\text{scalar}}$  implicature in such a way that most people would give in circumstances in which the context is unbiased one way or the other [26].

#### (ii). Syntax-based Conventionalism

It is represented by Chierchia’s structural inference theory, which proposes that scalar implicatures are computed locally rather than over the entire utterance. In detailed terms, an embedded implicature is calculated phrase by phrase (starting from a deepest level of an embedded clause) together with truth condition, which is projected onto the syntactic tree of the whole utterance in a bottom-up manner, and which is then merged into semantics [11, 13]. In this way, a scalar implicature has become one component of compositional semantics and the calculation of the phenomenon of scalar implicature is fused into the grammatical system. To be more precise, structural inference theorists put forward that language system is equipped overtly or covertly with an exhaustivity operator that is semantically like *O* (only). This operator can be freely inserted into any node in the sentence and also can occur frequently. Furthermore, Chierchia et al. [15] posits that

Gricean scalar implicature would be maintained in an upward entailment environment and suspended or blocked in a downward entailment environment [23, 66].

### 2.1.3. Complementary Approach

Apart from the two approaches mentioned above, some scholars have proposed a complementary approach to embedded implicatures. For instance, Recanati [49] postulates that while the grammatical approach has placed embedded implicature within a grammatical computation system that is almost independent of context and the pragmatic approach has placed it in a pragmatic system that relies on context, there is no evidence that the two approaches cannot function simultaneously [47, 50]. A related development lies in combining the views of syntax-based conventionalism with pragmatic presupposition. Specifically, Spector & Sudo [53] posit a hybrid approach which relies on a grammatical theory at the assertion level and a pragmatic principle at the presupposition level. However, Marty & Romoli [41] argue that this approach is unable to account for presupposed free choice [44, 64]. Moreover, Xue [65] develops an innovative constructional utterance meaning framework and offers a new account of embedded implicature.

## 2.2. Experimental Perspective

The experimental aspect primarily involves experimental pragmatics, encompassing not only the verification of theoretical perspectives but also studies from developmental pragmatics, as well as investigations into scalar diversity and reasoning in large language models (LLMs).

### 2.2.1. Experiments on Pragmatic Approach

Relevant experimental studies cover Gricean pragmatics, a comparison of relevance theory with default inference theory, and the role of typicality effects.

#### (i). Experiments on Gricean Pragmatics

These experimental paradigms collectively challenge conventionalism. Geurts & Pouscoulous [27] takes advantage of experimental methods, e.g. the inference and verification tasks, to explore the phenomenon of embedded implicature, demonstrating that such implicatures exclusively emerge under the scope of propositional attitude verbs like *think*, rather than in structurally analogous linguistic environments. Building upon this discovery, Geurts & van Tiel [28] re-emphasize that an upper-bounding interpretation of embedded implicatures is a non-universal phenomenon, observable only under specific pragmatic constraints. Crucially, both studies are devoted to rebutting conventionalism as a whole. Beyond these central studies, Ippolito [38] takes the quantifier *some* that is embedded within the propositional attitude verb *believe* for example to

verify the *strongest meaning hypothesis*<sup>2</sup>, but fails to detect embedded implicatures.

## (ii). Experiments on Contextual Inference vs. Default Inference Theory

Relevance theory and default inference theory are conventionally framed as competing analytical frameworks within non-embedded experimental paradigms, with most agreeing with the former [3, 42, 43, 4]. This preference persists even in analyses of implicatures generated within embedded experimental environments. A notable demonstration comes from Reboul's [46] study, which employed Koenig's puzzle as a method to contrast the global processing model advocated by relevance theory with the local processing mechanism posited by default inference theory, specifically examining implicatures embedded within comparative constructions. The experimental findings consistently corroborated the predictions of relevance theory.

## (iii). Experiments on the Role of Typicality Effects

Typicality is proposed by van Tiel [61] to dissolve the disputes among Geurts & Poussoulous [27], Clifton & Dube [17] and Chemla & Spector [10]. Geurts & Poussoulous [27] makes it clear that the number of embedded implicatures is small. Nevertheless, Clifton & Dube [17] and Chemla & Spector [10] hold different views. Van Tiel [61] discovers that the results of Clifton & Dube [17] and Chemla & Spector [10] are affected by typicality. Normally, typicality refers to a representative of a type. Van Tiel borrows it to mean that some discussions of embedded implicatures are more in line with the truth-condition of propositions, and further points out that what Clifton & Dube [17] and Chemla & Spector [10] measure is actually the typicality rather than the frequency of embedded implicatures [62, 20, 21, 63].

## 2.2.2. Experiments on Grammatical Approach

Relevant studies primarily include experiments on mainstream vs. minimal conventionalism, lexicalist and syntax-based conventionalism.

### (i). Experiments on Mainstream vs. Minimal Conventionalism

Mainstream conventionalism takes strong interpretation as a priority, arguing that the strong interpretation of a conversational implicature is preferred unless it occurs in a context that is weaker than a global interpretation (e.g. downward entailment environment). In contrast, minimal conventionalism merely takes into account the possibility of a strong interpretation. Clifton & Dube [17] uses the choice

task to examine the divergences between mainstream and minimal conventionalism. It turns out that subjects prefer a strong interpretation. Hence, mainstream conventionalism is confirmed [30].

### (ii). Experiments on Lexicalist and Syntax-based Conventionalism

The experimental hypothesis of lexicalist conventionalism is that an embedded implicature is not different from lexical content by nature. For instance, Storto & Tanenhaus [56] exploits visual-world eye-tracking task to investigate the disjunction in English, concluding that the fact coincides with the assumption of lexicalist conventionalism.

Experiments on syntax-based conventionalism concentrate on two aspects: reaction-time and linguistic environment. As for the former, Chemla, Cummins & Singh [9] takes quantifier *some* which is embedded under disjunction *or* for example and uses self-paced reading task as a method to examine the following hypothesis: Suppose an embedded implicature can be generated locally, then subjects' reading time in the scope of quantifier shall be longer than that in other scopes. The result shows that subjects are determined to spend more time in local conditions. In view of this, they are convinced that their experiment provides support for syntax-based conventionalism [22]. Next, many experiments are related to the linguistic context in which embedded implicatures are realized. An illustrative example comes from Bezuidenhout, Morris & Widmann [2] which has considered that embedded  $Q_{\text{-scalar}}$  implicatures would be dismissed in downward entailment environments, as evidenced through a multi-method paradigm integrating self-paced reading, eye-tracking and inference tasks.

## 2.2.3. Experiments on Complementary Approach

A large proportion of experimental results correspond with the viewpoints of complementary approach. To name two, Chemla [8] applies inference tasks to both the grammatical and pragmatic approaches, finding that grammatical approach lacks explanatory power for negative universal inference and pragmatic approach cannot interpret free choice properly. Therefore, they draw the conclusion that the two approaches should complement each other. Gotzner & Benz [29] has established through a best response paradigm that when *some* is embedded under *all*, the conversational implicature is interpreted locally, which is consistent with the grammatical approach, but when *some* is embedded under *some*, the conversational implicature is interpreted globally, which aligns with the pragmatic approach.

## 2.2.4. Experiments from Developmental Pragmatics

Experimental studies from this perspective involve two issues: (i) Do children have the ability to compute embedded implicatures? (ii) If the answer to (i) is 'yes', then under what circumstances are children able (or unable) to compute

<sup>2</sup> The main idea is as follows: There is a preference for the strongest possible interpretation among the possible readings of a sentence, and that this might account for why having the exhaustive operator *O* in the scope of a downward entailment operator is a dispreferred option since it gives rise to an interpretation weaker than the one obtained without *O* [38].

embedded implicatures? Crucially, Gualmini et al.'s [35] application of truth-value judgment task to question (i) provides a positive answer. Similarly, Chierchia et al. [14, 16] adopt truth-value judgment, inference and felicity judgment tasks to address question (ii), confirming that embedded implicatures tend to be cancelled in a downward entailment environment and appeared in an upward entailment environment and a non-monotonic environment.

### 2.2.5. Experiments on Scalar Diversity and LLMs

During recent years, these two topics have attracted increasing attention in experimental pragmatics. Scalar diversity describes the phenomenon that varied types of scalar expressions trigger scalar implicatures with statistically distinct frequencies. Two questions are most worthy of discussion: (i) the cause of scalar diversity and (ii) which scalar item is more likely to generate embedded implicature [57, 58]. When it refers to LLMs, what many experimental pragmaticists concern is whether it has intentionality and whether it can truly understand various types of conversational implicature. The field has increasingly focused on embedded implicatures [34].

### 2.3. Summary

Theoretical inquiry into embedded implicatures presents the following critical aspects. To begin with, Gricean pragmaticists have sought to account for embedded implicatures within the original framework, arguing against the claim that such a phenomenon is widespread. Secondly, the default inference theory can be applied to a much wider range of implicatures compared with the structural inference theory, i.e., generalized conversational implicatures, but lacks due attention to context. Thirdly, the exhaustivity operator *O* in the structural inference theory can occur at the maximal and local levels, leading to the Gricean implicatures and embedded implicatures. Nevertheless, it is criticized for merely being able to be applied to scalar implicature [12]. Next, truth-conditional pragmatics and relevance theory both propose that there is pragmatic intrusion into semantics and furthermore they expand the type of embedded implicature to particularized conversational implicature [51, 52], but the question of 'what the pragmatic intrusion under consideration is' remains to be answered. Moreover, the complementary approach seems plausible, but the problem will not be solved unless a clear division of labour between the grammatical and pragmatic approaches is made. In particular, a presuppositional approach to embedded implicatures concentrates within syntax-based conventionalism, which however is constrained by its exclusive focus on embedded scalar implicatures.

Key points observed in experiments on embedded implicatures are as follows. Initially, the focus is on verifications of syntax-based conventionalism, Geurts' Gricean pragmatics, and a comparison between default and

contextual inferences. In essence, these findings, like theoretical studies, reveal the disputes between semantic and pragmatic interpretation of the phenomenon of embedded implicature. Subsequently, experimental studies on lexicalist conventionalism lag far behind theoretical discussions, indicating its limited attention in experimental pragmatics. Equally important, experiments on mainstream vs. minimal conventionalism, the role of typicality effects, scalar diversity and LLMs, and experiments from development pragmatic perspective are cutting-edge, which also enriches the research topics of embedded implicatures. Moreover, no experiment on Recanati's free enrichment is conducted. This may be attributed to its philosophical orientation.

As a conclusion, an important issue that lies between theoretical and experimental studies is whether the phenomenon of embedded implicature is central or marginal. Grounded in Chinese data, this paper will systematically address the question.

## 3. Method

Inspired by the inference task and classification of embedded implicatures [27, 40], we attempt to conduct a questionnaire survey of this phenomenon, centering on four categories, i.e., embedded *Q*<sub>1</sub>-implicatures, embedded *I*-implicatures, embedded *M*-implicatures and embedded *Q*<sub>2</sub>-implicatures. Particularly, the design, subjects, assessments and analysis are illustrated as follows.

### 3.1. Design

The investigation was conducted via a digitally distributed questionnaire platform called *wenjuanxing*. A pilot questionnaire is developed, followed by a final one. The former is composed of a title, opening sentences, illustrative sentences and thirty-two questions. Most of the examples are selected or adapted from Center for Chinese Linguistics Peking University (CCL) or BLCU Corpus Center (BCC), with several of them based upon intuitions. Barring 4 filler items, the final questionnaire is similar to the pilot one. The selection of filler questions follows two principles. First, they should be non-embedded sentences. Second, they should engender implicatures. An illustrative example from the final questionnaire is presented below.

Each of the following questions contains two sentences. Please judge whether the second sentence can be inferred from the first. If it is the case, please choose 'Yes'. If not, please choose 'No'.

“我觉得一些课太难了”能推出

Wo juede yixie ke tainan le neng tuichu

1PS think some course difficult CRS can launch

“我觉得一些但不是所有课太难了”

Wo juede yixie dan bushi suoyou ke tainan le

1PS think some but NEG all course difficult CRS

是否

shi fou

yes no

'I think some courses are difficult' can launch 'I think some but not all courses are difficult'.

Yes No

### 3.2. Subjects

All students participating in the pilot and final surveys are native Chinese speakers. A total of 40 students have completed the pilot questionnaire, and 205 have completed the final one. They are from Beihang University, Minzu University of China, University of Science and Technology Beijing, Nanyang Normal University and Southwest Petroleum University.

### 3.3. Assessments

Tests show that the Cronbach Alpha coefficients for the pilot and final assessments are 0.8 and 0.894 separately, revealing high internal consistency. Table 1 presents the statistics.

**Table 1.** Reliability of the Pilot and Final Tests.

| Cronbach's Alpha | N of Items | Cronbach's Alpha | N of Items |
|------------------|------------|------------------|------------|
| .800             | 32         | .894             | 36         |

The Kaiser-Meyer-Olkin values for the pilot and final questionnaires are found to be 0.293 and 0.812 respectively. Although the preliminary value lacks statistical robustness due to a small sample size, the subsequent figure demonstrates strong construct validity. As is shown in Table 2.

**Table 2.** Validity of the Pilot and Final Tests.

|                                                  |      |
|--------------------------------------------------|------|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | .293 |
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | .812 |

### 3.4. Analysis

The tools used to analyze the data of the pilot and final surveys are *Wenjuanxing* and IBM SPSS Statistics 21. *Wenjuanxing* can assist us to input the result of each item into IBM SPSS Statistics 21, taking advantage of which we are able to calculate the reliability and validity of the questionnaires. *Wenjuanxing* is also employed to count the frequency and percentage of the answer to each item.

## 4. Results

On the whole, the results of the pilot test on embedded implicatures in Chinese demonstrate that this phenomenon is central, and the results of the final test also indicate that it is largely central in Chinese. This section concisely presents pilot testing data, with the primary focus on final test findings.

### 4.1. Results of the Pilot Test

The pilot survey involving 40 students reveals that the average frequency and percentage of embedded implicatures as a whole in Chinese is 26 and 66% separately. The frequency and percentage distributions of embedded Q<sub>1</sub>-implicatures, embedded I-implicatures, embedded M-implicatures and embedded Q<sub>2</sub>-implicatures are summarized in Table 3.

**Table 3.** Distribution of Embedded Implicatures in Pilot Test.

| embedded implicatures                 | frequency |    | percentage |     |
|---------------------------------------|-----------|----|------------|-----|
|                                       | yes       | no | yes        | no  |
| embedded Q <sub>1</sub> -implicatures | 27        | 13 | 67%        | 33% |
| embedded I-implicatures               | 27        | 13 | 67%        | 33% |
| embedded M-implicatures               | 19        | 21 | 49%        | 51% |
| embedded Q <sub>2</sub> -implicatures | 32        | 8  | 80%        | 20% |
| average                               | 26        | 14 | 66%        | 34% |

### 4.2. Results of the Final Test

The results of a final questionnaire survey conducted with 205 students demonstrate that the phenomenon of embedded implicature is central in Chinese, with average frequency and percentage reaching 151 and 74%. The data are summarized in Table 4. We will systematically present the data of each type in the following subsections.

**Table 4.** Distribution of Embedded Implicatures in Final Test.

| embedded implicatures                 | frequency |    | percentage |     |
|---------------------------------------|-----------|----|------------|-----|
|                                       | yes       | no | yes        | no  |
| embedded Q <sub>1</sub> -implicatures | 157       | 48 | 77%        | 23% |
| embedded I-implicatures               | 148       | 57 | 72%        | 28% |
| embedded M-implicatures               | 140       | 65 | 68%        | 32% |
| embedded Q <sub>2</sub> -implicatures | 160       | 45 | 78%        | 22% |

| embedded implicatures | frequency |    | percentage |     |
|-----------------------|-----------|----|------------|-----|
|                       | yes       | no | yes        | no  |
| average               | 151       | 54 | 74%        | 26% |

#### 4.2.1. Distribution of Embedded Q<sub>1</sub>-Implicatures

Items 1-9 (except for the filler item 5) pertain to embedded Q<sub>1</sub>-implicatures. Collectively, each subtype demonstrates centrality, evidenced by an average frequency (157) and percentage (77%). This convergence establishes embedded Q<sub>1</sub>-implicatures as a central linguistic phenomenon within Chinese. See Table 5.

**Table 5.** Distribution of Embedded Q<sub>1</sub>-implicatures in Final Test.

| embedded Q <sub>1</sub> -implicatures | frequency |    | percentage |        |
|---------------------------------------|-----------|----|------------|--------|
|                                       | yes       | no | yes        | no     |
| item 1                                | 185       | 20 | 90.24%     | 9.76%  |
| item 2                                | 132       | 73 | 64.39%     | 35.61% |
| item 3                                | 165       | 40 | 80.49%     | 19.51% |
| item 4                                | 181       | 24 | 88.29%     | 11.71% |
| item 6                                | 109       | 96 | 53.17%     | 46.83% |
| item 7                                | 154       | 51 | 75.12%     | 24.88% |
| item 8                                | 161       | 44 | 78.54%     | 21.46% |
| item 9                                | 167       | 38 | 81.46%     | 18.54% |
| average                               | 157       | 48 | 77%        | 23%    |

Item 1 is an embedded Q<sub>1</sub>-implicature that arises from the use of scalar term *yixie* [some], which is placed under *renwei* [think]. Few of the 205 subjects (i.e., 20) selected the answer 'No'. Proportionally, they merely account for 9.76% of the total answers. Clearly, embedded Q<sub>1</sub>-implicatures that are created by scalar terms and embedded within the scope of propositional attitude verbs are central. Item 2 is an embedded Q<sub>1</sub>-implicature stemming from the use of scalar term *jiushi fenzhong* [90 minutes] which is introduced by *ruguo* [if]. 132 subjects (64.39%) of the 205 subjects chose the answer 'Yes', revealing the centrality of embedded implicatures under investigation. Item 3 is an embedded Q<sub>1</sub>-implicature due to the use of scalar term *bufen* [part] which is placed under *huo* [or]. 165 subjects (80.49%) answered 'Yes'. This indicates that Q<sub>1</sub>-implicatures of this kind are central in Chinese. Item 4 is also an embedded Q<sub>1</sub>-implicature that resulted from the use of scalar term *yixie* [some] but embedded under *zhidao* [know]. Only 24 (11.71%) of the 205 subjects gave the answer 'No'. This

reveals that Q<sub>1</sub>-implicatures occurring under scalar term in clauses and embedded within the scope of factive verbs are central. Item 6 is an embedded Q<sub>1</sub>-implicature because of the use of scalar terms *jiu* [nine] and *shi* [ten] embedded within the scope of *bi* [better than]. 109 of the 205 subjects provided the answer 'Yes'. This shows that this particular type of embedded Q<sub>1</sub>-implicatures is central. Item 7 is an embedded Q<sub>1</sub>-implicature that comes from the use of the scalar term *youxie* [some] located within *yinwei* [because]. 154 (75.12%) of the 205 subjects answered 'Yes', manifesting that it is central. Item 8 is an embedded Q<sub>1</sub>-implicature which is produced by the use of scalar term *duanque* [scare] subordinated to *bushi.....ershi.....* [not...but...]. 161 (78.54%) of the 205 subjects gave the answer 'Yes', indicating the central position of embedded Q<sub>1</sub>-implicatures engendered by the use of scalar term in clauses that are put under negations. Item 9 is an embedded Q<sub>1</sub>-implicature achieved through using the scalar term *yixie* [some] embedded under *suoyou* [all]. 38 of the 205 subjects (18.54%) provided the answer 'No', suggesting that this type of embedded Q<sub>1</sub>-implicature is central in Chinese.

#### 4.2.2. Distribution of Embedded I-Implicatures

With the exception of item 15, items 10-18 are associated with embedded I-implicatures. Although the average frequency (148) and percentage (72%) are slightly lower than those observed in embedded Q<sub>1</sub>-implicatures, the phenomenon of embedded I-implicature retains central. Please refer to Table 6 for more information.

**Table 6.** Distribution of Embedded I-Implicatures in Final Test.

| embedded I-implicatures | frequency |    | percentage |        |
|-------------------------|-----------|----|------------|--------|
|                         | yes       | no | yes        | no     |
| item 10                 | 162       | 43 | 79.02%     | 20.98% |
| item 11                 | 139       | 66 | 67.8%      | 32.2%  |
| item 12                 | 145       | 60 | 70.73%     | 29.27% |
| item 13                 | 161       | 44 | 78.54%     | 21.46% |
| item 14                 | 126       | 79 | 61.46%     | 38.54% |
| item 16                 | 166       | 39 | 80.98%     | 19.02% |
| item 17                 | 151       | 54 | 73.66%     | 26.34% |
| item 18                 | 135       | 70 | 65.85%     | 34.15% |
| average                 | 148       | 57 | 72%        | 28%    |

Item 10 is an I-implicature stemming from the use of *hejiulianhong* [...drinks alcohol and face turn red] which is embedded within the scope of *bi* [better than]. 162 (79.02%) of the 205 subjects responded positively, demonstrating that

this type of I-implicature is central in Chinese. Item 11 is an embedded I-implicature that arises from the use of *miehuoqi* [extinguisher] which is embedded under the logical operator *suoyou* [all]. 139 of the 205 (67.8%) chose the answer ‘Yes’, showing that it is central. Item 12 is an embedded I-implicature that is produced as a result of the use of *lvbai lvzhan* [ever tried, ever failed] which is placed under *shijishang* [actually]. 145 (70%) of the 205 subjects gave a favorable answer. This points to its centrality in Chinese. Item 13 is an embedded I-implicature generated by using *zuijia* [drunk-driving] embedded within the scope of *yinwei* [because]. Only 44 (21.46%) of the 205 subjects answered ‘No’, showing its centrality. Item 14 is an embedded I-implicature resulting from the use of *hushi* [nurse] embedded under *huaiyi* [suspect]. 126 of the 205 subjects (61.46%) held a positive attitude. This indicates that this kind of I-implicature is central. Item 16 is an embedded I-implicature stemming from the use of *jiehunshenghaizi* [getting married and having a baby] and *shenghaizi jiehun*

[having a baby and getting married] which are embedded under *bi* [better than]. Only 39 (19.02%) of the 205 subjects chose the answer ‘No’, indicating that it is central. Item 17 is an embedded I-implicature arising from the use of *qiong* [poor] which is embedded under *bushi.....ershi.....[not...but...]*. 151 (73.66%) of the 205 subjects gave a favorable answer, making it clear that this type of I-implicature is central. Item 18 is an embedded I-implicature owing to the use of *hongcheng* [red orange] and *chenghong* [orange red]. 135 of the 205 subjects (70%) answered ‘Yes’, thus pointing to its centrality in Chinese.

#### 4.2.3. Distribution of Embedded M-Implicatures

Excluding item 23, items 19-27 are related to embedded M-implicatures. Compared with embedded I-implicatures, the average frequency (140) and percentage (68%) of this type are minimally reduced, but remains central. Further details are provided in Table 7.

Table 7. Distribution of Embedded M-Implicatures in Final Test.

| embedded M-implicatures | frequency |    | percentage |        |
|-------------------------|-----------|----|------------|--------|
|                         | yes       | no | yes        | no     |
| item 19                 | 146       | 59 | 71.22%     | 28.78% |
| item 20                 | 135       | 70 | 65.85%     | 34.15% |
| item 21                 | 145       | 60 | 70.73%     | 29.27% |
| item 22                 | 145       | 60 | 70.73%     | 29.27% |
| item 24                 | 128       | 77 | 62.44%     | 37.56% |
| item 25                 | 143       | 62 | 69.76%     | 30.24% |
| item 26                 | 133       | 72 | 64.88%     | 35.12% |
| item 27                 | 142       | 63 | 69.27%     | 30.73% |
| average                 | 140       | 65 | 68%        | 32%    |

Item 19 is an embedded M-implicature due to the use of *bushi buke xiangxiang* [not unthinkable] which is embedded within the scope of *chengren* [admit]. 146 (71.22%) of the 205 subjects answered ‘Yes’, pointing to the central place of this implicature in Chinese. Item 20 is an embedded M-implicature which arises from the use of *hennanguohennanguo* [very very sad] embedded within the scope of *suoyou* [all]. 135 of the 205 subjects gave a positive answer. This demonstrates that the implicature is central. Item 21 is an embedded M-implicature that is produced by *duodeduo* [much much more] placed under *bi* [than]. 60 (29.27%) of the 205 subjects gave a negative answer, showing that this M-implicature is central. Item 22 is an

embedded M-implicature that is engendered by the use of *henkaixinhenkaixin* [very very happy] which is placed under *yinwei* [because]. 145 (70.73%) of the 205 subjects chose the answer ‘Yes’. This manifests that M-implicatures of this type are central. Item 24 is an embedded M-implicature which is resulted from the use of *gengduogengduo* [more and more] embedded within the scope of *xiwang* [hope]. More than a half (128) of the 205 subjects preferred the answer ‘Yes’, indicating that the embedded M-implicatures are central. Item 25 is an embedded M-implicature that arises from the use of *henleihelei* [very very tired] which is embedded within the scope of *ruguo* [if]. 62 of the 205 subjects (30.24%) answered ‘No’, leading to the central status of the

embedded M-implicatures under discussion. Item 26 is an embedded M-implicature stemming from the use of *buxiang gongzuo* [unwilling to work] that is placed under *bushi* [not]. 133 of the 205 subjects (64.88%) provided the answer ‘Yes’, bringing up the central status of this sort of embedded M-implicature. Item 27 is an embedded M-implicature that is created by the use of *henzhongyaohenzhongyao* [very very important] embedded within the scope of *huozhe* [or]. 142 (69.27%) of the 205 subjects chose the answer ‘Yes’, demonstrating that this kind of embedded M-implicature occupies a central place of attention for Chinese speakers.

#### 4.2.4. Distribution of Embedded Q<sub>2</sub>-Implicatures

Apart from item 33, items 28-36 are linked to embedded Q<sub>2</sub>-implicatures. Statistics show that the average frequency (160) and percentage (78%) of this type are higher than embedded M-implicatures, which is apparently central. Detailed information is summarized in Table 8.

**Table 8.** Distribution of Embedded Q<sub>2</sub>-Implicatures in Final Test.

| embedded Q <sub>2</sub> -implicatures | frequency |    | percentage |        |
|---------------------------------------|-----------|----|------------|--------|
|                                       | yes       | no | yes        | no     |
| item 28                               | 161       | 44 | 78.54%     | 21.46% |
| item 29                               | 162       | 43 | 79.02%     | 20.98% |
| item 30                               | 176       | 29 | 85.85%     | 14.15% |
| item 31                               | 144       | 61 | 70.24%     | 29.76% |
| item 32                               | 153       | 52 | 74.63%     | 25.37% |
| item 34                               | 174       | 31 | 84.88%     | 15.12% |
| item 35                               | 157       | 48 | 76.59%     | 23.41% |
| item 36                               | 155       | 50 | 75.61%     | 24.39% |
| average                               | 160       | 45 | 78%        | 22%    |

Item 28 is an embedded Q<sub>2</sub>-implicature owing to the use of *lan taohua* [rotten peachblossom] and *zheng taohua* [real peachblossom] which are embedded within the scope of *bushi.....ershi.....* [not...but...]. Only 44 of the 205 subjects (21.46%) chose the answer ‘No’. This indicates that the Q<sub>2</sub>-implicatures under study are central. Item 29 is an embedded Q<sub>2</sub>-implicature engendered by the use of *gezi* [pigeon] which is embedded under *bi* [better than]. 162 (79.02%) of the 205 subjects gave a favorable answer, suggesting that such Q<sub>2</sub>-implicatures are central. Item 30 is an embedded Q<sub>2</sub>-implicature that is generated by the use of *santiandayu liangtianshaiwang* [go fishing for three days and dry the nets for two] embedded within the scope of *ruguo* [if]. A large number (176) and proportion (85.85%) of the 205 subjects gave a positive answer, marking the central

status of the Q<sub>2</sub>-implicatures under investigation. Item 31 is an embedded Q<sub>2</sub>-implicature stemming from the use of *muqin shi taiyang* [mother is the sun] that is embedded under *shuo* [say]. 144 (70.24%) of the 205 subjects preferred the answer ‘Yes’, indicating that this category of Q<sub>2</sub>-implicature is central. Item 32 is an embedded Q<sub>2</sub>-implicature produced by the use of *reqingsihuo huoliwuxian* [enthusiasm is like fire and vitality is infinite] embedded within the scope of *xiang* [want]. More than half of the 205 subjects (153 by frequency and 74.63% by percentage) chose the answer ‘Yes’. This manifests that Q<sub>2</sub>-implicatures of this type are central. Item 34 is an embedded Q<sub>2</sub>-implicature created by the use of *yichenburan* [be spotlessly clean] which is embedded within the scope of *suoyou* [all]. 174 of the 205 subjects (84.88%) held a positive view, indicating that this kind of embedded Q<sub>2</sub>-implicature is central. Item 35 is an embedded Q<sub>2</sub>-implicature engendered by the use of *lishi* [history] that is embedded within the scope of *huo* [or]. 157 of the 205 subjects (76.59%) preferred a positive answer, pointing to its centrality in Chinese. Item 36 is an embedded Q<sub>2</sub>-implicature resulting from the use of *pozaimiejie* [be hanging over one’s head] that is placed under *youyu* [because]. 155 (75.61%) of the 205 subjects answered ‘Yes’, showing that Q<sub>2</sub>-implicatures embedded within the scope of because-clauses are central.

## 5. Discussion

This section provides an analytical discussion of the results from the previous section. Our examination will commence with a concise overview of the pilot test findings, followed by a comprehensive analysis of the final test results that constitute the principal focus of the discussion.

### 5.1. On Results of the Pilot Tests

Succinctly stated, a pilot study of embedded Q<sub>1</sub>-implicatures, embedded I-implicatures, embedded M-implicatures and embedded Q<sub>2</sub>-implicatures indicates that the phenomenon of embedded implicatures is not marginal in Chinese. In other words, our observation shows limited alignment with the marginal view of Gricean pragmaticists [25, 26, 51, 52]. Conversely, it lends support to the central view held by the lexicalist and syntax-based conventionalists, such as Levinson [40], Chierchia [11, 13] and Huang [36, 37], who suggest that all types of implicatures can be embedded. The results of the final test provide a further insight into the phenomenon.

### 5.2. On Results of the Final Test

Primarily, the results of the final test are heavily biased to the view of grammatical approach, specifically lexicalist conventionalism. Lexicalist conventionalists, such as Levinson [40] and Huang [36, 37] propose that all kinds of

implicatures should be embedded. The average positive respondent frequency for embedded Q<sub>1</sub>-implicatures is 157, making up 77% of the total responses. The corresponding figures for embedded I-implicatures are 148 and 72%, for embedded M-implicatures are 140 and 68%, and for embedded Q<sub>2</sub>-implicatures are 160 and 78%. On average, the positive respondent frequency for embedded implicatures is 151, amounting to 74% of the total responses. These data provide evidence for what lexicalists have claimed. Syntax-based conventionalism represented by Chierchia [11, 13] points out that all scalar implicatures (apart from those that occur under downward entailment environment) can be embedded, which is also confirmed by the results relevant to embedded Q<sub>1</sub>-implicatures.

Secondarily, the findings of the final test are to a large extent in disfavor of the view of Gricean pragmaticists, such as Geurts [25, 26], who argues that fewer embedded implicatures can occur under contrastive contexts. It is noteworthy that our data demonstrate partial overlap with the experimental results of Geurts & Pouscoulous [27]. While their proposal that scalar implicatures can merely be embedded within the scope of the logical operator *think* fails empirical validation, the fact that 185 of the 205 subjects who make up 90.24% of the totality give a positive answer confirms *renwei* [think] as the logical operator that is most likely to trigger embedded implicatures.

Subsequently, our empirical findings substantiate the presence of scalar diversity [57, 58] to a measurable extent. On the one hand, the phenomenon of embedded implicature is central, as on average only 54 and 26% of the 205 participants gave negative answers in terms of frequency and percentage. On the other hand, the frequency and percentage of implicatures embedded within different logical operators show variations. Among them, embedded Q<sub>2</sub>-implicatures exhibit the highest frequency and percentage, while embedded M-implicatures display the lowest. Embedded Q<sub>1</sub>-implicatures and embedded I-implicatures fall in between. Specifically, the logical operators that are most likely to engender embedded Q<sub>1</sub>-implicatures, embedded I-implicatures, embedded M-implicatures and embedded Q<sub>2</sub>-implicatures are *renwei* [think], *bi* [better than], *chengren* [admit] and *ruguo* [if] respectively.

Furthermore, we do not argue that the results are (in) consistent with other analyses such as truth-conditional pragmatics [47, 49], relevance theory [6, 7] and complementary approach [47, 50], because they are less concerned about the central or marginal status of embedded implicatures but focus on how to explain them.

## 6. Conclusion

We conducted a questionnaire survey of the phenomenon of embedded implicature in Chinese to address the issue regarding the central or marginal status of embedded implicatures. Evidence indicates that embedded implicatures

including embedded Q<sub>1</sub>-implicatures, embedded I-implicatures, embedded M-implicatures and embedded Q<sub>2</sub>-implicatures are central. Accordingly, the results lend support to grammatical approach, especially the lexicalist conventionalism represented by Levinson and Huang, who argue that Q<sub>1</sub>-implicature, I-implicature, M-implicature and Q<sub>2</sub>-implicature all can be embedded. In contrast, the findings fail to corroborate the idea of Gricean pragmaticists, such as Geurts who holds that the phenomenon of embedded implicature (especially embedded Q<sub>-scalar</sub> implicature) is marginal. Grounded in the Chinese linguistic context, subsequent theoretical and experimental inquiry into embedded implicatures may center on the following questions: 1) what roles do grammar and pragmatics play? 2) what are the functions of context and convention? 3) what are the differences between default and presuppositional perspectives? 4) How do LLMs understand embedded implicatures?

## Abbreviations

|                |                |
|----------------|----------------|
| Q <sub>1</sub> | Quantity       |
| I              | Informativenss |
| M              | Manner         |
| Q <sub>2</sub> | Quality        |

## Author Contributions

Lirong Bai is the sole author. The author read and approved the final manuscript.

## Conflicts of Interest

The author declares no conflicts of interest.

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