

Pronoun Interpretation in the Second Language: Effects of Computational Complexity

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Abstract

Interpreting pronouns has been reported to be difficult by second or foreign language learners. As a matter of fact, most of them face difficulties to understand English as their foreign language, which is different from their own language. Especially, when they refer to referential antecedents than to quantified antecedents. The current research hypothesizes that second language learners will face difficulties in interpreting pronouns due to computational complexity. In light of that, two groups were assigned as a sample of experimental and control groups. They consist of 50 students and each groups contained 25 students in the intermediate level. The members of the experimental group have different learning backgrounds. One of the aims of this study is to shed the light on the learning fact concerning pronouns and the students' mastery of pronouns.

Keywords: Pronouns, Second Language, Foreign Language, Computational Complexity.

تفسير الضمير في اللغة الثانية: آثار التعقيد الحسابي

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المديرة العامة للتربية في نينوى

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المستخلص

توجد صعوبة في تفسير الضمائر من قبل متعلمي اللغة الثانية أو الأجانب. في واقع الأمر، يواجه معظمهم صعوبات في فهم اللغة الإنجليزية كلغة أجنبية تختلف عن لغتهم الأم. على وجه الخصوص، عندما يشيرون إلى السوابق المرجعية بدلاً من السوابق الكمية للضمائر. يفترض البحث الحالي أن متعلمي اللغة الثانية سيواجهون صعوبات في تفسير الضمائر بسبب التعقيد الحسابي. في ضوء ذلك تم تخصيص مجموعتان كعينة من المجموعات التجريبية والضابطة. تتكون من 50 طالباً وكل مجموعة تضم 25 طالباً في المستوى المتوسط. اعضاء مجموعتي العينة لديهم خلفيات تعليمية مختلفة. يتمثل أحد أهداف هذه الدراسة في إلقاء الضوء على حقيقة التعلم المتعلقة بالضمائر وكذلك قدرة الطلاب على ضبط استخدام الضمائر.

الكلمات المفتاحية: الضمائر، اللغة الثانية، اللغة الأجنبية، الصعوبة الحاسوبية.

1. Introduction

The manner in which the learner interprets pronouns has been largely investigated in many subfields of linguistics such as computational linguistics and psycholinguistics. Most of these studies have focused on determining the strategies in which learners employ to identify pronominal referents. In most cases, it has

been found that the interpreting pronouns has been considered an attention-driven process which is guided by the relationship between referring expressions and the salience/accessibility of their antecedents (Brennan, Friedman, & Pollard, 1987; Givón, 1983; Grosz, Joshi, & Weinstein, 1995).

The difficulty of this process has been observed by researchers who have defined the problem of comprehending anaphoric expressions as one of determining the antecedent of an anaphoric expression, that is, determining to which word or phrase an anaphoric expression refers or "points". Recent studies in both artificial intelligence and linguistics have demonstrated the need for a theory of the comprehension of anaphoric expressions, a theory that accounts for the role of syntactic and semantic effects, as well as inferential knowledge in explaining how anaphors are understood. However, it must first be known what an antecedent is. The traditional definition encounters difficulty right from the start; it is founded on the notion that one word in a sentence refers or points back to another word or phrase in the (same or another) sentence. But words don't refer back to other words (Morgan 1978); people use words to refer to entities in the world. In particular they use pronouns to refer to entities which have already been mentioned in a discourse. Referring to anaphoric antecedents falls into four broad categories:

1. General heuristics for finding antecedents (Winograd, 1972)
2. Syntactic and semantic constraints on anaphora (Katz & Fodor, 1963; Woods et al., 1976; Chomsky, 1976; Lasnik, 1976; Reinhart, 1976; Walker, 1976)
3. Use of inference to find antecedents (Charniak, 1972; Rieger, 1974; Hobbs, 1976)
4. Analysis of relations among objects in a discourse context (Grosz 1977; Webber 1978).

General heuristics, as a means of choosing antecedents, predict reliably in a large number of typical examples. However, no simple characterization fits the wide variety of cases where they fail (see Winograd, 1972 and Hobbs, 1977); furthermore, the heuristic approach is not theoretically grounded and cannot offer a unified approach to the phenomena.

Semantic selectional restrictions, based on the Katz-Fodor theory of semantic markers, and used by many computational linguists, can reduce the space of possible antecedents, but they cannot be used to eliminate all possibilities.

Syntactic restrictions, on logical form (Chomsky, 1976) and on constituent structure (Lasnik, 1976; Reinhart, 1976), stipulate conditions in which a pronoun and a noun phrase must have disjoint reference.

Artificial intelligence on inference led to methods for forward and backward chaining of inferences to bind the pronoun, represented as a free variable, with some piece of knowledge; with this approach, the pronoun's interpretation was the value bound to the free variable. This approach revealed that inferences about

world knowledge are often needed to interpret pronouns. However, these methods failed to control the inference process sufficiently.

Discourse approaches to anaphora include a technique similar to the inference method; one identifies sentence pairs and determines their semantic relationship as one of elaboration, similarity, contrast, parallel structure; the pronouns are interpreted by variable binding between items of the sentence pairs (Hobbs 1979).

Pronouns (*him, her, etc.*) behave differently from anaphors like reflexives (*himself, herself, etc.*). In the typical case, the antecedent of an anaphor cannot occur in the same position as the antecedent of a pronoun.¹ In particular, anaphors require their antecedents to be close (or *local*) whereas pronouns disallow this. Consider the English examples in (1) and (2):

(1) Mary_i thought (that Susan_j liked herself_{j/*i})

(2) Mary_i says (that Susan_j likes her_{i/k/*j})

In (1), the reflexive *herself* can only refer to the local antecedent, *Susan*, and not to the non-local antecedent, *Mary*. In (2), on the other hand, *Susan* is impossible as an antecedent for the pronoun, whereas *Mary* (or anyone else of female gender mentioned in the previous discourse) is a possible antecedent.

To express these relationships, Chomsky (1981) formulated Principles A and B of the Binding Theory, presented, in simplified form, below, where *local* means roughly “in the same clause”:

(3) Principle A: a reflexive must take a local antecedent.

(4) Principle B: a pronoun may not take a local antecedent.

In other words, Principle B renders local antecedents ‘inaccessible’ to pronouns.

Moreover, computational linguistics is the scientific and engineering discipline concerned with understanding written and spoken language from a computational perspective, and building artifacts that usefully process and produce language, either in bulk or in a dialogue setting. In this regard, computational complexity and natural language heralds an entirely new way of looking at grammatical systems. It applies the recently developed computer science tool of complexity theory to the study of natural language. A unified and coherent account emerges of how complexity theory can probe the information-processing structure of grammars, discovering why a grammar is easy or difficult to process and suggesting where to look for additional grammatical constraints. For the linguist or cognitive scientist, the book presents a nontechnical introduction to complexity theory and discusses its strengths, its weaknesses, and how it can be used to study grammars. For the computer scientist, it offers a more sophisticated and efficient computational analysis of linguistic theories. Given the variety of new techniques rising from complexity theory, the authors foresee a developing cooperation among linguists, cognitive scientists, and computer scientists toward understanding the nature of human language. The book also describes a set of case studies that use complexity

theory to analyze grammatical problems. And it examines several grammatical systems currently of interest to computational linguists - including spelling-change/dictionary lookup and morphological analysis, agreement processes in natural language, and lexical-functional grammar - demonstrating how complexity analysis can illuminate and improve each one.

In summary, computational complexity may constitute a considerable problem for Iraqi student at the intermediate third level. This study deals with computational complexity in the interpretation of pronouns of third year intermediate level.

1.1 Statement of the Problem

The major problem can be mentioned in the following lines. Most of the students face difficulties in interpreting, recognizing or producing pronouns. Also, students suffer from overlap among the different types of pronouns. They tend to use the pronouns in an Arabic use. Moreover, the recognition of pronouns' antecedents creates a big problem for students.

There have been proposals that L2 learners are not able to access full representations when parsing (the Shallow Structure Hypothesis) (Clahsen and Felser, 2006); there have been proposals that L2 learners may have difficulties integrating syntactic knowledge with discourse requirements (the Interface Hypothesis) (Sorace and Filiaci, 2006; Belletti et al., 2007); there have been proposals that morphological problems exhibited by L2 learners reflect difficulties in accessing forms that are in fact present in the interlanguage lexicon, possibly under production pressure when speaking (the Missing Surface Inflection Hypothesis) (Haznedar and Schwartz, 1997; Prévost and White, 2000; see also Lardiere, 2000).

In this study, two terms are represented as measurement of pronouns interpretation namely, recognition and production. Following that, the problem of the study can be summarized in the following questions:

1. Are male and female intermediate Iraqi students able to recognize pronouns in terms of computational complexity?.
2. Are male and female intermediate Iraqi students able to produce pronouns in terms of computational complexity?.
3. Are there any differences between males and females in the recognition and production of pronouns?

1.2 Hypotheses of the Study

It is hypothesized that computational complexity of interpreting pronouns is one of the major reasons that made the students fail to use or recognize pronouns. Therefore, the current study hypothesizes that:

1. Male and female intermediate Iraqi students are expected to find difficulties in recognizing pronouns.
2. Male and female intermediate Iraqi students are expected to find difficulties in producing pronouns.

1.3 Aims of the study

This study aims at investigating the ability of Iraqi learners of English in respect of using the appropriate pronouns at the recognition and production levels under the effect of computational complexity. It also aims to find the problematic pronouns according to the Iraqi students at intermediate levels.

1.4 Procedures

The procedures followed in this study can be summarized in the following lines:

- 1- A theoretical framework of pronouns is dealt with.
- 2- Constructing two tests to investigate learners' ability of recognition and production of pronouns.
- 3- Analysis of the collected data.

1.5.1 The Definition of Pronouns

It will be given some definitions of pronouns. The definition of pronoun according to Payne (2011) in his book "Understanding English Grammar A Linguistic Introduction", he states that pronouns are words that can be shorted to be noun phrase. In addition, Quirk et al. (1985) said on their book "Pronouns share several characteristics, most of which are absent from nouns."

According to some definitions above, it can be concluded that pronouns are words that can replace or refer to a noun.

1.5.2 Types of Pronouns

Pronouns have different types that can people use in daily activity. There are "I", "them", "us" etc. There are six categories according to Quirk et al. (1985), they are:

a. Central pronoun. (a) Personal: subject; I, you, we, they, she, he, it. Object: me, you, us, them, her, him, it. (b) Reflexive: myself, themselves, herself, himself, ourselves, itself. (c) Possessive adjective; my, your, their, our, her, his. Possessive pronoun: mine, yours, ours, theirs, hers, his.

b. Reciprocal pronoun; each other, one another.

c. Relative pronoun; who, where, when, which, what, that.

d. Interrogative pronoun; who, what, when, which, where.

e. Demonstrative pronoun; this, these, that, those.

f. Indefinite pronoun. (a) positive; universal: all, both, each and every. Assertive: some, one, half, several, enough, other and another. Non-assertive: any and either.

(b) Negative: no and neither

g. The Personal pronoun: the meaning of personal pronoun: Marcel Danesi states that "personal pronouns are classified according to the person(s); the person speaking (first person); the person spoken to (second person); anyone or anything else (third person)." Quirk et al. (1985) distinguish personal pronouns in the following table:

Table (1): Types of Pronouns (Adopted from Quirk et al., 1985)

Subject		Object	Possessive adjective	Possessive pronoun	Reflexive
Singular	I	Me You Her Him It	My Your Her His Its	Mine Yours Hers His	Myself Yourself Herself Himself Itself
	You She He It				
Plural	We	Us Them You	Our Their Your	Ours Theirs Yours	Ourselves Themselves Yourselves
	They You				

Moreover, there are three parts in personal pronoun:

1. First person pronouns are used to refer to the person who is speaking (I/me) or a group of people including the person who is speaking (we/us)
2. Second person pronouns refer to the person or the group of people to whom we are speaking (you)
3. Third person pronouns are used to refer to specific persons or things previously mentioned. For a male (he/him), a female (she/her), an animal or inanimate object (it), people, animals or things in the plural (they/them). Personal pronouns change their form for person (first, second, third), for case (subject, object, possessive), number (singular, plural), and gender (masculine, feminine, neuter) except for reflexive pronoun making the same kind of changes.

1.5.3 Factors Affecting Pronoun Interpretation

According to attention-driven approach towards pronoun resolution, it has been argued that both referential choices and anaphora resolution are closely related with and explained by accessibility of the referent (Ariel, 1994; Givón, 1983; Grosz et al., 1995). An under-specified form such as pronoun is used when the speaker believes the referent is highly accessible. Otherwise, a more specified form such as proper name would be used. Therefore, a new topic is often introduced by proper names while an existing topic is usually maintained by pronouns. As a result, the hearer would expect a new topic to be introduced with a more specified form and an existing topic to be maintained with a less specified form.

Although researchers generally agree that accessibility is the primary determinant for anaphora resolution, they are still exploring whether and how specific factors influence the accessibility of referents. Some of the factors which have been found to affect the choice of pronoun resolution are grammatical roles (Gordon, Grosz, & Gilliom, 1993; Järvi-kivi, van Gompel, Hyönä, & Bertram, 2005), thematic roles (McDonald & MacWhinney, 1995; Stevenson, Crawley, & Kleinman, 1994),

syntactical parallelism (Arnold, 1998; Kehler, 2002), verb semantics (Cheng & Almor, 2015; Hartshorne & Snedeker, 2013), discourse relations (Arnold, 2001; Kehler et al., 2008), and discourse unit (De La Fuente, 2015; Hemforth et al., 2010; Miltsakaki, 2002). The following sections outline how some factors might have an effect on the processes of anaphora resolution.

Pronominalization in particular serves to focus attention on what is being talked about; inappropriate use or failure to use pronouns causes communication to be less fluent. For instance, it takes longer for hearers to process a pronominalized noun phrase that is *no*-in focus than one that is, while it takes longer to process a non-pronominalized noun phrase that is in focus than one that is not.

1.5.4 Personal Pronoun Problems

According to Swan (1995), Personal pronoun is kind of determiner which is used when it is not necessary to use or repeat more exact noun phrase. Personal pronouns have the important role. Misusing one of them can cause the wrong meaning in one paragraph or even in the whole of it. It is because the personal pronouns always refer to a noun, so they related to each other.

In English there are many types of personal pronouns and they also have different position and function, as the first person in English used as; (a) subject: I, you, (b) object: me, them, (c) possessive adjective: my, their, (d) possessive pronoun: mine, yours, (e) reflexive pronoun: myself, yourself which are different in students' first language and it makes students confuse to use personal pronouns.

In the researcher's experience, when the students have already understood personal pronouns, they are still confused when they will use subject or object pronoun, because of that there are many grammatical errors that are made by the students. Most of the learners have some difficult in using the right Personal pronoun. Here are some problems that learners face:

1. A pronoun with two possible antecedents

Example : whenever John is able to help his brother financially. Or : John's brother is happy to receive financially help from John.

2. An unnecessary personal personal pronoun after a noun subject

Example : My friends, they told me the whole story. Corrected to : My friends told me the whole story.

3. Vague *it*. The personal pronoun *it is* used without a definite antecedent.

Example: Because Jane had once had a bad accident while driving, she was afraid to try it again.

Corrected to: She was afraid to try to drive again.

In certain colloquial idioms, a definite antecedent is not required for the personal pronoun *it*.

Example. I hope you will like here.

The strain of final examinations is to great, I can't take it.



4. *Too many it's near each other personal. It appears in close proximity with impersonal or anticipatory it.*

Example: We like *it* very much in this hotel. It is wonderful to relax in its. Comfortable atmosphere. *It* is possible we'll stay in *it* again on our next vacation.

5. *Loose use of it or they as subject*

It or *They* is sometimes used as the subject of a verb, while the agent that should actually be the subjects is put in prepositional phrase.

Example: In the news paper, it says that the concert was canceled. Corrected to: The newspaper says that the concert was canceled.

Example: At the university, they require an examination for all entering freshman.

Corrected to: The university requires an examination for all entering freshman.

6. *Shift Pronoun Number*

Example: The *student* must be made to understand how each lesson can be of value to *them*

Corrected to: The *student* change to be students or *them* changes to be *him*

7. *Shift pronoun*

Third person is not used in one part of a sentence if it is shifted back to the personal *you*.

Example: A good song lends comfort to people, so that you feel less alone.

Corrected to: A good song lends comfort to you...Or. so that feel less alone.

8. *Choice of case*

Over corrected it happens when there are two choices between subject (she) and object (her) case forms of pronoun. Many students, tend to use objective forms when Standard English uses subject ones (him and, me are friends), they automatically "overcorrect" in certain situations.

Example: They appointed *she* and *i* to a subcommittee

1.6 Previous Studies

Although pronoun interpretation by native speakers has been extensively researched, not much is known about nonnative reference processing. Most previous studies on L2 learners' acquisition of reference have mainly focused on the learners' topic maintenance and continuity. Studies on how L2 learners make use of various cues to resolve anaphors have been limited (Shin, 2007). It is assumed that the task of resolving pronouns is relatively challenging to L2 learners since it involves complex process of understanding the interaction between syntax, semantic and discourse structure of their foreign tongue (cf. Sorace's (2011) Interface Hypothesis). Consequently, the ability to identify and use relevant syntax, semantic and discourse information is crucial for appropriate pronoun resolution. Since studies that examine this ability of L2 learners have been of insignificant amount, there is an utmost necessity to further investigate the issue.

2. Methodology



In this part it is dealt with the procedures held in this research. Two tests were conducted: a multiple choice test and a placing test (to place pronouns between brackets in their suitable position). The former was used to measure students' recognition of pronouns, while the second is used to measure their ability to use them.

2.1 Characteristics of a Good Test:

The main characteristics of a good test are validity, reliability and practicality (A I Juboury, 2000:21-22).

2.2 Sample Selection

The samples of the study were randomly selected from the students of the third stage intermediate schools. Two schools were chosen for the tests. The sample of the first school consisted of 50 students, 25 males and 25 females, while the sample of the second school consisted of 50 students, 25 males and 25 females. Third year students are supposed to be acquainted with pronouns.

2.3 Administration of the Tests

There were two types of tests in the present study. The students who took the tests consisted of nearly 80 % of the total number of the students in the two schools. Nearly all the students who took the test have Arabic as their first language. The first test was conducted at their schools, while the second was conducted by using Google forms. It should be mentioned that the students were informed that the test results will be analyzed for research purposes. This was done to motivate them to answer freely and effectively.

2.4. Time of the Tests

The two tests were administrated in April, 2021. Each test took about an hour this period was considered sufficient since all the students submitted their papers within the time limits. The time span between the two tests was about a week.

2.5 Variables of the Tests

2.5.1 Gender

Gender has been the most variable that linguists focused on. One of the earliest theories concerning the gender is that of Lakoff (1975:53-56) in which he concentrated on the females' language with that of males'.

2.5.2 Schools

Schools represent the variable of the educational background, which is regarded as an important factor that affects the students' command of pronouns.

3 Data Analysis and Results

The collected data have been analyzed and statistically manipulated by using statistical programs. Accordingly, results are shown in the following tables:

Table (2): Results of the Recognition Test



Item No.	Items	School 1		School 2	
		MALE	FEMALE	MALE	FEMALE
1	How many times has Bill told a lie to (his / him) father?	40 %	45 %	45 %	50 %
2	Where did Sally go with (she / her) friends yesterday?	50 %	50 %	40 %	45 %
3	The cat was taking care of (its / his) young.	30 %	40 %	30 %	35 %
4	Many students wonder where (they / them) will end up after college.	44 %	50 %	35 %	30 %
5	Look at the mother and father bird building (their / its) nest in the tree.	34 %	30 %	25 %	30 %
6	My name is Sonia. ___ love my family.(I/ you)	50 %	70 %	60 %	65 %
7	I met Sonia yesterday. ___ made me laugh .(I/ she)	60 %	65 %	55 %	60 %
8	At the left, you can see Simon. ___ is my brother. .(I/ he)	54 %	60 %	60 %	55 %
9	Birds flap ___ wings. (we / their)	35 %	30 %	25 %	30 %
10	My grandparents live in Mumbai. ___ visit us often. .(they/ you)	23 %	35 %	20 %	25 %
11	Look outside. ___ is my car parked there. (these/ this)	44 %	50 %	35 %	40 %
12	Why have you not sent	55 %	55 %	35 %	40 %

	the report? ___ was your responsibility.(these/ this)				
13	Our friend, ___ we invited for the party, arrived early. (whom/ whose)	57 %	30 %	30 %	35 %
14	We fixed the car----- (ourselves/ themselves)	23 %	30 %	35 %	30 %
15	Her new house cost over half a million pounds. _____ a lot of money. (that/ this)	22 %	30 %	30 %	30 %
16	Susa met Ali and liked -- ---(him / her)	70 %	60 %	50 %	60 %
17	The idea of refurbishing was ----- (theirs/ their)	40 %	45 %	50 %	55 %
18	The cat that was sick yesterday was ----(her/ hers)	25 %	30 %	45 %	40 %
19	The car on the driveway is -----(ours / him)	60 %	30 %	30 %	35 %
20	They visited ----- yesterday. (we/ us)	20 %	40 %	30 %	35 %

The total percentage of the males' recognition of the pronouns is 41.8% while females' is 43.75 % of the first school. The percentages of the second school collected 41 % for the males and 38.5 % for the females.

This indicates that male and female Iraqi intermediate students have difficulties in recognizing English pronouns since the total percentage is lower than 50 %. Based on these results, the first hypothesis which reads: 'Male and female intermediate Iraqi students are expected to find difficulties in recognizing pronouns' is accepted.

Table (3): Results of the Production Test

Item No.	ITEMS	SCHOOL 1		SCHOOL 2	
		MALE	FEMALE	MALE	FEMALE
1	I	70 %	75 %	60 %	55 %

2	YOU	60 %	65 %	60 %	60 %
3	she	60 %	55 %	50 %	60 %
4	they	60 %	65 %	60 %	70 %
5	he	65 %	60 %	55 %	60 %
6	Ours	30 %	35 %	25 %	30 %
7	Theirs	35 %	35 %	40 %	35 %
8	Its	25 %	25 %	30 %	25 %
9	hers	25 %	30 %	40 %	30 %
10	mine	50 %	45 %	40 %	45 %
11	Myself	30 %	35 %	30 %	25 %
12	himself	40 %	45 %	40 %	45 %
13	Itself	30 %	30 %	25 %	30 %
14	Themselves	35 %	40 %	35 %	35 %
15	Ourselves	30 %	35 %	40 %	35 %
16	Him	50 %	40 %	45 %	50 %
17	Me	30 %	30 %	45 %	40 %
18	Us	25 %	25 %	15 %	25 %
19	It	30 %	25 %	25 %	30 %
20	Them	50 %	45 %	50 %	55 %

In the first school the males' percentage is 42% while the females' is 40.5%. In the second school the total percentage of males is also 42% while the females 41.5%.

This indicates that male and female Iraqi intermediate students have difficulties in producing English pronouns since the total percentage is lower than 50 %. Based on these results, the second hypothesis which reads: 'Male and female intermediate Iraqi students are expected to find difficulties in producing pronouns' is accepted.

In summary, results of the two tests have shown that male and female students of both schools have had difficulties in recognizing and producing English pronouns under the effect of computational complexity.

2.6 Conclusions

This study has come up with the conclusions that are based on the analysis of the collected data of the two tests.

1. Many students suffer from difficulties in controlling pronouns either because their lack of knowledge or because of computational complexity and interfere of their first language.
2. Different educational backgrounds affect their misuse of pronouns.
3. Antecedents of pronouns are regarded as a complicated issue for them.

4. there is no sufficient awareness about pronouns.

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