Structural Ambiguity Interpretation: A Case Study of Arab Learners of English

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Abstract - The aim of this paper is to investigate how Arabic native speakers (non-native speakers of English) interpret English ambiguous sentences. It has been recognized that Arabic native speakers encounter problems with English sentences which involve structural ambiguity. Sixty subjects participated in the experiment. All were university students specialized in English. The subjects were given ambiguous sentences contain prepositional phrases, relative clauses, etc. For instance, prepositional phrases like 'the girl hit the boy with the book' in which the prepositional phrase (PP) can be attached either to the verb phrase (VP) or to the preceding noun phrase (NP). It has been recognized that the students face difficulty in interpreting ambiguous structure and generally take the general meaning which can be understood from the sequence of words.

Keywords : Ambiguity, Arabic, translation, structural ambiguity, lexical ambiguity.

I. Introduction

Ambiguity is, strictly speaking, used to describe a word, phrase, or sentence when it has more than one interpretation. Generally, two types of ambiguity are distinguished, lexical and structural ambiguity. Lexical ambiguity, which is so common, indicates that the word itself has more than one meaning. The word 'hard', for example, can mean 'not soft' or 'difficult'. Structural ambiguity, on the other hand, occurs when a phrase or a sentence has more than one underlying structure, such as the phrases 'English history teacher', 'short men and women', 'The girl hit the boy with a book', etc. These ambiguities are said to be structural because each such phrase can be represented in two structurally different ways, e.g., '[English history] teacher' and 'English [history teacher]'. Indeed, the existence of such ambiguities provides strong evidence for a level of underlying syntactic structure. Consider the structurally ambiguous sentence 'The chicken is ready to eat' which could be used to describe either a hungry chicken or a broiled chicken. It is arguable that the operative reading depends on whether or not the implicit subject of the infinitive clause 'to eat' is tied anaphorically to the subject 'the chicken' of the main clause (see Quirk, et al., 1985 and Radford, 2008, among others).

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In certain cases it is not clear whether we have a case of structural ambiguity. For example 'Jane likes her new dress and so does Emily'. This can be used to say either 'Jane likes Jane's new dress and Emily likes Emily's new dress' or 'Jane likes Jane's new dress and Emily likes Jane's new dress'. In the above case, ambiguity is not clear or even one might say that there is no ambiguity at all and the clause 'so does Emily' can be read unequivocally as saying in the context that Emily does the same thing that Jane does, and although there are two alternatives to explain the clause 'so does Emily', these alternatives are not fixed semantically. Hence the ambiguity is merely apparent and better described as semantic underdetermination.

Although ambiguity is fundamentally a property of linguistic expressions, people are also said to be ambiguous on occasion in how they use language. This can occur if, even when their words are unambiguous, their words do not make what they mean uniquely determinable. Strictly speaking, however, ambiguity is a semantic phenomenon, involving linguistic meaning rather than speaker meaning (see Sturt et al., 2003 among others). Generally when one uses ambiguous words or sentences, one does not consciously entertain their unintended meanings, although there is psycholinguistic evidence that when one hears ambiguous words one momentarily accesses and then rules out their irrelevant senses. When people use ambiguous language, generally its ambiguity is not intended.

One of the most significant problems in processing natural language is the problem of ambiguity. Most ambiguities escape our notice because we are very good at resolving them using context and our knowledge of the world. Many works (as we will see below) have been carried out either to check how people paraphrase ambiguous sentences or to find out the reasons behind the way we understand these sentences. However, most of the previous works emphasis one type of ambiguous sentences, for instance, sentences with prepositional phrases, with wh-clauses, etc.

Our work here is distinguished from the previous works in that it deals with different types of ambiguous sentences (7 types according to the source of ambiguity). Moreover, it tackles the interpretation of ambiguous sentences by non-native speakers.

II. REVIEW OF LITERATURE

Natural languages are vastly ambiguous, and our apparently effortless ability to account for this phenomenon is one of the central problems of modern cognitive science (Sturta, et. al., 2003). However, each language has its peculiarity to express ambiguity. It seems that it is not necessary for the native speakers to be aware of all the possible interpretations associated with the sentence. (Gibson and Pearlmutter, 1998) point out that sentence comprehension involves integration of multiple different cues to interpretation, including morphological, syntactic, semantic, discourse-level and probabilistic ones. If it is not easy for the native speakers to account for all the possible readings of certain sentences, the situation will be more complicated for the non-native speakers. It should be pointed out that some studies (Clahsen and Felser, 2006) indicate that learners' ability to use sentence-internal semantic cues to interpretation may be similar to native speakers'. They add that non-native speakers might be able to compensate for their grammatical processing problems by making efficient use of non-grammatical cues to interpretation. Guo et al. (2008) points out that L2 learners apply non-grammatical cues (i.e. semantic cues) more than native speakers do. A survey of different types of structural ambiguity shows that there are many sources of ambiguity. For instance, structural ambiguity could result from ellipsis, usage of adverbial clauses, prepositional phrases, etc. All the types which we will review below were included in our test for our subjects (Arabic native speakers) to find out how do they interpret them.

In the case of ellipsis, the problem is that sometimes we cannot decide whether the remaining NP is a subject or an object, for instance, a sentence like 'She loves me more than you' is ambiguous and has two interpretations which can be paraphrased as 'She loves me more than she loves you', in which 'you' is an object, and 'She loves me more than you love me', in which 'you' is a subject (Radford, 2008: 13). He adds

"it is important to emphasize that this grammatical knowledge of how to form and interpret expressions in your native language is tacit (i.e. subconscious) rather than explicit (i.e. conscious): so, it's no good asking a native speaker of English a question such as 'How do you form negative sentences in English?' since human beings have no conscious awareness of the processes involved in speaking and understanding their native language. To introduce a technical term devised by Chomsky, we can say that native speakers have grammatical competence in their native" (ibid.).

The usage of adverbial clauses in complex sentences could cause ambiguity. The adverbial could be attached to the main verb or the embedded verb. For instance, 'I told him to leave before you came'. The adverbial clause 'before you came' can be attached to the main verb 'told' to have the meaning that the time of telling was 'before you came' or it can be attached to the embedded verb leave to have the meaning that leaving 'should be before you came'. Generally, it has been found out that adverbs are preferentially attached to the lower verb (Kimball, 1973 and Altmann, et al. 1998). For example, in the following sentence, the preference is for the adverb 'miserably' to modify 'failed' rather than 'said': 'John said that he failed miserably'.

Another source of syntactic ambiguity is where whole phrases, typically prepositional phrases (PPs) can attach themselves, normally in a constituent-final position, to constituents of almost any syntactic category - sentences, verb phrases, noun phrases, etc. For instance, 'She hit the boy with the book'. 'with the book' can be attached to the NP (the boy) to mean 'the boy who has a book' or it can be attached to the verb 'hit' to mean that 'the book' is the instrument by which the boy was hit. The two interpretations can be represented respectively in (a & b).

a) NP VP [NP PP]
b) NP [VP [NP] [PP]]

This type of ambiguity has received much attention in the literature. Rayner, et al. (1983) examine sentences such as the above and find that there is initial preference for the verb phrase attachment. That is, the subjects attach the prepositional phrase with the verb rather than the NP ('the boy'). Since that time, a number of studies have pointed out that the interpretation of sentences which include PP can be modified by some factors such as the type of verb involved (Konieczny, Hemforth, Scheepers, & Strube, 1997; Spivey-Knowlton & Sedivy, 1995) and the argument status of the prepositional phrase (Schuetze & Gibson, 1999) or the choice of preposition (Katsika, 2009).

Jurafsky (1996), for instance, discusses how the type of the verb affects prepositional phrase attachment preferences. The PP in a sentence like 'They discuss the dogs on the beach' can attach either to the noun phrase or the verb phrase. The situation is different if the verb discuss is replaced by the verb 'keep' as in 'they keep the dogs on the beach'. In this case the sentence has one and only one interpretation. Quirk, et al.(1985:518) points out that the occurrence of PP final position in sentences like 'Did you drive the car near the police station?' causes more than one interpretations. For instance, the PP 'near the police station' could be interpreted as either 'directional' (towards the police station) or 'positional' (which describes the car).

Pan and Felser (2011) investigate the resolution of prepositional phrase (PP) ambiguities in sentences such as 'The policeman watched the spy with binoculars'. The PP 'with binoculars' can either be interpreted as modifying the verb (watched) to be 'The policeman [VP watched [NP the spy] [PP with

binoculars]]' or the post verbal noun phrase (the spy) as in 'The policeman [VP watched [NP the spy [PP with binoculars]]]'. The study shows that when sentences such as the one above presented in isolation, native speakers of English tend to prefer the VP modification over the NP modification reading. That is, grammatical constraints (Crocker, 1996; Phillips, 1996) and other factors may affect the attachment preference of PP. For instance, the PP in a sentence like 'Bill glanced at the customer with strong suspicion' is attached to the verb, whereas the PP in 'Bill glanced at the customer with ripped jeans' is attached to the preceding NP.

Wh-relative clause has its role in structural ambiguity. The main structure is usually assumed to be NP-PP-RC (relative clause), where NP dominates PP, and RC. The RC could be immediately dominated either by the first NP, or by the second NP (which is embedded inside the PP). In some sentences, it is not clear where to attach the relative clause. According to Cuetos and Mitchell (1988), English native speakers prefer to attach the relative clause to the closest NP although the relative clause could modify either of the two noun phrases. For instance, 'The driver of the manager who lived there died.' The relative clause 'who lived there' is attached to the manager rather than the driver. That is, 'it is the manager who lived there' not the driver. That is, the structure in (c) is more frequent than the structure in (d).

c)   [NP … [PP [NP … RC]]]

d)   [NP… [PP NP] RC],

Some other scholars (Gilboy, et al., 1995 and Traxler et al., 1998) state that WH- preference appears to vary according to various factors, such as the type of the preposition used in the complex noun phrase.

Whenever there is more than one possibility for how a sentence can be read, difficulty arises. Much of this is because we don't know how a person sorts out the differences between ambiguous statements. Consider the following:

e)   'I saw the river walking over the bridge today.'

f)   'I saw my friend walking over the bridge today.'

In the first sentence, it's obvious to us that the speaker is walking over the bridge, and saw the river as he passed over it. In the second sentence, it's probable that both the speaker and his friend were walking across the bridge and they saw each other in passing. But it's also possible that the speaker was riding in a car across the bridge and saw his friend walking across. Or perhaps the friend was in a car while the speaker was walking. All three are valid conclusions one could draw from reading the second sentence. If they wanted to know exactly what happened and remove all ambiguity, the reader of the sentence would ask the speaker to clarify exactly who was walking where. But there is no ambiguity in the first sentence at all. The reading that

'the river is walking over the bridge' is of course eliminated since rivers cannot walk. The sentence is truly unambiguous. However, in the second sentence, both characters are equally likely to be walking, so there is valid ambiguity there.

Mitchell et al. (1995) investigate how his participants understand ambiguous sentences. They support the claim that there is a purely configurational, non-lexical component to disambiguation preferences. They apply sentence completion experiment like 'The satirist ridiculed the lawyer of the firm who…' and the participants had to complete the sentences. He finds out that in addition to low attachment preference, the subjects tend to attach the relative clause to a particular configurational position, rather than to use the relative clause to modify a particular lexical item.

Negation can be a source of ambiguity. Generally, ambiguity arises as a result of what is called in grammar the scope of negation (Bresnan, 2003:30-31). For instance, in a sentence like 'all of you won't pass', either we negate the verb 'pass' to mean 'no passing'. In this case, the sentence has the interpretation 'no one will pass (all of you will fail)'. Or we negate 'all' to arrive at the interpretation that 'not all of you will pass (some will pass and some will fail). (see Quirk, et.al., 1985). Radford (2008: 171) points to this type of ambiguity and states that a sentence like 'everyone hasn't finished the assignment yet' is ambiguous according to scope of negation. If the scope of 'not' is not the subject 'everyone' the sentence has the reading 'everyone is in the position of not having finished the assignment yet', and if the scope of 'not' is 'everyone', the sentence will have the reading 'not everyone is yet in the position of having finished the assignment'.

Ambiguity resolution involves syntactic and non-syntactic factors, such as lexical, semantic plausibility and even non linguistic factors. According to the Tuning Hypothesis, these non-syntactic factors play a role in later processes (Frazier, 1987). Lexical semantic and all other factors must be taken into consideration to complete the process of ambiguity resolution.

III.   Subjects and Methodology

Sixty Arabic native speakers participated in the experiment. All were university students majoring in English. They were given 18 ambiguous sentences. Sentences include different sources of ambiguity such as, prepositional phrases, adverbial clauses, ellipsis, etc. The subjects were asked to translate the sentences. Unlike most of previous studies, the authors prefer to use translation to find out how the subjects interpret the English ambiguous sentences for two reasons, the first is to avoid any problem which could result from how to express the meaning in English. The second, each reading of the English ambiguous sentences has a

different translation in Arabic. Accordingly, we know exactly how the Arabic native speakers interpret English ambiguous sentences. For instance, the English sentence 'she hit the boy with the book' has two different translations in Arabic:

g)   Albintu Dharabit alwalada bilkitaab

'The girl hit the boy by the book.'

h)   Albintu Dharabit alwalada allathii yahmil lkitaab.

'The girl hit the boy who has the book.'

Accordingly, the first translation in (g) means that the book is the instrument used by the girl. The usage of the prefix {bi-} in Arabic means that the book is the instrument by which the boy was hit. That is, the PP is connected with the verb. Whereas, the second interpretation in (h) indicates that the prepositional phrase describes the NP (the boy). So, each of the possible readings of the sentence has a different translation. The sentences in which the Arabic translation could be ambiguous were avoided.

The sentences can be classified as follows:

a) *Sentences with coordinated clauses or noun phrases.*
1.   He said lies and hurt his friends.
2.   Bill and Mary got married.
3.   Don't eat fish and meat.

b) *Sentences with adverbial phrases or clauses.*
4.   I told him to run again.
5.   He said I met her last week.
6.   He said he saw her when she left.

c) *Sentences with prepositional phrases in which the PP could be connected to the noun or the verb.*
7.   He saw the man with the binoculars.
8.   The girl hit the boy with the book.
9.   I want the music book on the table.

d) *Sentences with non-finite clause in which the subject of the non-finite clause is not clear.*
10. He killed the cat crossing the street.
11. The horse is ready to ride.

e) *Negative sentences.*
12. All of you won't pass.
13. I didn't close the door because he left.

f) *Sentences with relative clauses.*
14. The driver of my sister who lived there died.
15. The mother of my friend who bought the house left.
16. The box of toys which I bought is expensive.

g) *Sentences with ellipsis in the second clause.*
17. She loves her dog more than her husband.
18. I know a richer man than John.

IV.   Results and Discussion

In the first group of sentences, ambiguity results from whether we look at the coordinated clauses or NPs as one entity or two entities with ellipsis. For instance, the sentence 'he told lies and hurt his friends' could mean that 'he told lies and as a result of his lies he hurt his friends', That is he did one thing. The second interpretation is that he did two things, 'he told lies' and 'he hurt his friends'. All our subjects (60 participants) understood the sentence according to the second interpretation in which he did two things. The first interpretation is not available for our subjects.

The second sentence in the first group means either 'Bill and Mary married each other' or 'Bill married another girl (not Mary) and Mary married someone else.' All the subjects took the first interpretation and understand the sentence as 'Bill and Mary married each other.' Ellipsis has no room in the interpretation of the sentences.

The source of ambiguity in the third sentence is similar to the first two sentences. The sentence means either 'not to eat fish and meat at the same time' or 'eating fish is forbidden, moreover, eating meat is forbidden.' Most of our subjects (54 or 90%) followed the first interpretation in which 'eating fish and meat with each other is forbidden'. The rest (6 subjects or 10%) gave ambiguous Arabic sentences. It seems that our participants translate the English 'and' into Arabic 'wa' which has the same syntactic and semantic behavior as 'and'. However, the Arabic word which means at the same time is 'ma9' (with) which was used by most of the subjects.

Accordingly, in their interpretations, our subjects took 'and' as a coordinator to connect what is before to what is after. Ellipsis was ignored by our subjects. So, when we say 'Bill and Mary got married', they coordinated the two NPs without thinking of the possibility of ellipsis and the sentence could mean 'Bill got married and Mary got married'.

The source of ambiguity in the second group is the usage of the adverb which could be attached to the main verb or the embedded verb. For instance, the first sentence of this group 'I told him to run again' means either 'I told him again' or 'to run again'. All the subjects (60 subjects) preferred the second reading in which 'again' is attached to the verb 'run'. None of the subjects attached 'again' to the verb 'told'. 'last week' in the second sentence of this group could be interpreted either the time of saying or the time of meeting. 58 subjects took 'last week' as the time of meeting whereas two subjects understood 'last week' to be the time of saying. The adverbial clause 'when she left' in (6) can be taken to describe 'the time of saying' or 'the time of seeing'. All the subjects interpreted the adverbial clause as 'the time of seeing'. As can be noted, our subjects preferred to attach the final adverb to the closest verb or the embedded verb. Our results here go on line with many previous studies (Kimball, 1973 and Altmann, et al. 1998) which indicate that the subjects prefer to attach the adverbial clause to the lower verb.

The presence of the prepositional phrase in a final position is the source of ambiguity in the third group. The reading of the sentence depends on where we attach the prepositional phrase. For instance, in the first sentence 'he saw the man with the binoculars', the prepositional phrase 'with the binoculars' can be attached to the NP 'the man' to mean 'the man who has binoculars', and it can be attached to the verb 'saw' to mean the way by which 'he saw the man'. Fifty one subjects attached the prepositional phrase to the verb. Two subjects attached the prepositional phrase to the NP 'the man'. The other subjects (7) gave literal translation to the preposition 'with'. They translated it erroneously into the Arabic preposition 'ma9', so their sentences are not clear. All the subjects attached the prepositional phrase 'with the book' in (8) to the verb 'hit'. That is, they interpreted the book as the instrument by which the girl hit the boy. In the third sentence (9), 46 subjects attached the prepositional phrase 'on the table' to the verb 'want'. The rest (16 subjects) attached it to the NP 'the book'. So, to attach the prepositional phrase to the main verb is the preferable reading for our subjects. The results of our subjects (non-native speakers of English) match previous studies (Pan and Felser, 2011 among others) in which it is preferable to attach the prepositional phrase to the verb. Other factors which could affect the attachment of the PP like the type of the verb are ignored in our study.

The occurrence of the non-finite clause without a subject is the source of ambiguity in the fourth group. In the first sentence (10), 6 subjects selected the main subject (he) to be the subject of the non-finite clause 'crossing the street'. In this case, the sentence has the following reading 'he killed the cat while he was crossing the street'. Fifty four subjects preferred the 'cat' to be the subject of the non-finite clause 'while the cat was crossing the street' or 'the cat which was crossing the street'.

The non-finite clause in the second sentence (11) is a to-infinitive clause. The subject of this clause could be 'the horse' or 'someone'. All the subjects preferred the 'someone' to be the subject of this clause. Accordingly, the reading of the sentence goes like this 'the horse is ready for someone to ride'.

Accordingly, the first NP was preferred by our subjects to be the subject of the non-finite clause.

In the fifth group, negation is the source of ambiguity. That is, what do we negate in the sentence. For instance, in the first sentence (12), the scope of negation could be 'pass', that is, we negate 'passing'. Accordingly, the sentence means 'no body will pass'. The scope of negation could be 'all'; in this case, the sentence could be interpreted as 'not all of you will pass (some of you). All of our subjects preferred the first reading in which 'passing' is negated (no passing). Again, the negative particle in the second sentence (13) could be interpreted to negate the verb 'close' or to

negate the reason 'because he left'. In this case, the sentence is interpreted as follows: 'the reason for not closing the door is not because he left but because…' That is there is another reason for not closing the door. All the subject selected the first reading which is 'not closing the door' and the reason for that is 'his leaving'. For our subjects, the preferable reading is to take 'not' as a negative particle for the verb which directly follows it.

The sentences in (group 6) include relative clauses. This relative clause could be attached to one of the NPs in the sentence. One of these NPs is masculine the other one is feminine since in Arabic there is a difference between masculine and feminine relative words (i.e.'allathi' masculan and 'allati' feminan). The relative clause 'who lived there' in (14) can be attached to 'the driver' or to 'my sister'. All the subjects attached the relative clause to 'the driver'. None of our subjects attached the relative clause to the NP 'my sister'. In the second sentence (15), 'who bought the house' could be attached to the 'mother' or to the 'friend'. Most of our subjects (53) attached it to 'the mother' whereas seven subjects attached it to 'my friend'.

The subjects preferred to attach the relative clause to the first NP rather than the closest one. It seems that there is a strong association between relative clauses and prepositional phrases. In both cases, the subjects preferred not to attach them to the closest NP. Our results contradict with what is mentioned by some scholars (Cuetos and Mitchell, 1988). They state that their subjects prefer the attachment of the RC to the lower NP, where as our subjects prefer to attach the RC to the higher NP. It seems that the subjects are affected by Arabic. The usage of prepositional phrase as NP is absent in Arabic. For instance, 'the driver of my sister' is equivalent to 'sa'q ukhti' (diver sister) and in such case the 'the driver' is the topic and the predicate talks about or describe it.

The last group of sentences (group 7) exhibits ellipsis in the second clause which results in leaving an NP which could be interpreted as an object or subject. For example, in the sentence (17), 'she likes her dog more than her friend.' 'Her friend' could be a subject for the elliptic clause to have the following interpretation: 'she likes her dog more than her friend [likes her dog]'. A gain, 'her friend' could be the object, 'she likes her dog more than [she likes] her friend. The second example of ellipsis is the sentence 'Bill knows a richer man than John' which has two meanings, that 'Bill knows a man who is richer than John' and that 'Bill knows a man who is richer than any man John knows'. In both sentences, our subjects interpreted the NPs (her friend in the first and John in the second as objects). They were not aware of the possibility of the interpretation of these NPs as subjects. That is, the first sentence was understood by our subjects as 'she likes her dog more than [she likes] her friend' whereas the

second sentence is understood to mean 'Bill knows a man who is richer than John'.

V. CONCLUSION

The above discussion shows that our participants who are not native speakers of English exhibited difficulty in processing all the given types of ambiguous sentences. Unlike previous studies, we applied sentence translation approach to find out the preferable reading of ambiguous sentences. The use of Arabic translation of the ambiguous English sentences allows us to know exactly how our participants understand these sentences. Except in the case of relative clauses, high attachment was preferred by our subjects unlike some previous studies about native speakers, our results are consistent with most of the previous studies about ambiguous sentences and the preferable reading. Prepositional phrases were attached to the verb rather than the lower NP. It seems that in their interpretations, our subjects paraphrased the sentences according to the string of words which is taken as the main clue. This is why in the case of negation the scope of negation is the verb. The same thing is applied when the sentences exhibit ellipsis in the second clause; they took the remaining NP as an object. Adverbial clauses were preferable to be attached to the embedded verb.

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