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Identifying Some Inbuilt Problems in Bangla Anaphoric Interpretation

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Abstract: This paper[1] explores an exciting and ever-developing sphere of linguistic research, namely anaphora. Since the inception of generative grammar, anaphora has not only become the dominating issue in syntactic investigation, but at the same time it has gained serious attention from the interdisciplinary researchers, specifically related to the field of philosophy, cognitive and computer sciences. Semantic and pragmatic approaches within linguistics are also becoming more and more relevant in explaining this phenomenon. The present paper attempts to identify some inbuilt anaphoric properties within intra- and inter-sentential domain, leading to the problems in anaphoric interpretation and resolution. Looking into the complexities becomes equally rewarding from the theoretical as well as computational points of view. Anaphoric resolution is at present a challenging area for understanding the problems and prospects of the artificially intelligent model approaching the optimistic design of man-machine interface. In the proto-typical situation, anaphor gets a straight- way linkage with its antecedent in a sentence or a clause. But such an ideal situation no longer prevails in some specific contexts. This paper investigates some of these non-prototypes from a broader generalised perspective without being restricted to the Chomskyan GB framework. The examples are taken mainly from Bangla and English.

Keywords: Computational linguistics, Cataphora, Exophora, Binding Theory, Theta role, Ellipsis, Recoverability, Subcategorisation.

1. Introduction

Anaphora is a phenomenon which has developed as one of the most challenging areas for contemporary structural and applied

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linguistic studies. It has become a central issue to the modern linguistic researches since the inception of Generative Grammar, the goal of which is to construct a universal theory of coreference. Chomsky (1981,1988) himself claims anaphora to be a phenomenon reflecting the underlying principles of Universal Grammar. Most interestingly, it interacts not only with syntactic but also with semantic and pragmatic factors (Huang 1994). Moreover, it is continually gaining immense interests from the interdisciplinary domains related to philosophy, psychology, cognitive science and computational researches focusing on artificial intelligence.

The present paper concentrates on some inbuilt problems of anaphoric interpretation within sentential or inter-sentential domain. The discussion reflects both theoretical as well as practical complexity mostly appearing due to computational issues. The theoretical perspective not only modifies some conventional notions associated to the features of referentiality, but also at the same time recognises some essential properties which are often thought to be insignificant in defining anaphoric relationship. Such a discussion is expected to be much rewarding in giving critical exposure to the anaphoric situation, specifically in the field of computational linguistics (CL). CL attempts to work on Natural Language Understanding problems with its focal stress on anaphoric resolution in textual processing (Allen 1987). In fact, such a highly optimistic resolution strategy requires the basic knowledge about the elemental properties and problems related to anaphora. We need to mention here two important points constraining the domain of our discussion.

First of all, needless to mention, there are numerous kinds of anaphoric relations besides the basic one appearing between the pronominal and the antecedent. It is not at all possible to give a systematic account of all those types in the present framework proposed. This paper confines its domain within the most frequent types of anaphora. However, the problems defined here are not strictly morpho-syntactic in nature; it may relate to semantically or pragmatically controlled anaphoric types.

Secondly, the term 'anaphora', in this present discussion, would not be what we really mean in Chomskyan framework. Even if required, the term would be applied for the extensive domain of inter-sentential boundary. Thus, a wider perspective, though in its simplest form, is incorporated here in order to have an access to the problem in a text or dialogue structure. The examples taken in this paper are mainly from Bangla, and occasionally from English. However, such a language-specific strategy may rightly be extended for other languages as well, in order to build up a comprehensive common core framework.

2. Defining Anaphora

Anaphora is a term used in grammatical description to refer to a process in which a linguistic unit generally refers back to some previously expressed unit or meaning. So, anaphoric reference marks the identity between what is being expressed and what has already been expressed (Crystal 1985: 17). So, anaphora is the subsequent reference to an already introduced entity (Yule 1996 :131). For example,

1. *John* said that *he* will go to Kolkata.
2. *cheleTi* boleche je *tar* bari DhakaY.
   boy the has said that his home Dhaka in
   'The boy has said that he resides in Dhaka.'

In both of the sentences the italicised pronominal elements refer respectively to their preceding candidate referent 'John' and 'cheleTi'. Obviously, we are excluding here the possibility of extra-sentential reference of the pronominals (in that case they have the *deictic* properties). Here, the second referring expression is an *anaphor* and the first is mentioned as *antecedent*. The phenomenon in general is defined as *anaphora*. Anaphora may not be confined within the sentential boundary. It may obviously refer to the antecedent in the inter-sentential domain and sometimes in an extreme situation it may have a distant anaphoric relationship with

the antecedent existing far away within the textual or dialogue structure. For example,

3. *prodhanmontri* aj *kolkataY* esechen. *tini* agamikal *ekhane* thakchen na.
   prime minister today Kolkata in has come. s/he tomorrow here at is staying not

'The prime minister has come to Kolkata today. S/he will not stay here tomorrow.'

This is an example of inter-sentential anaphora where anaphoric reference crossed just the sentence boundary. The referring elements are shown in italicized font.

Anaphora is often contrasted with *cataphora* where the referring expression refers forward for its interpretation [cf. example 4]. On the other hand, anaphora is distinguished from *exophora* where the referring elements refer directly to the extralinguistic context [cf.example 5]. The examples may be cited from Bangla.

4. *eTa* EkTa *ghoRi*, Kolkata theke kena.
   this the one the watch Kolkata from bought
   This is a watch, bought from Kolkata.'
5. *o* amar *baRi* aSbe.
   s/he I of home will come
   'S/he will come to my home.'

The pronominal 'o' is exophoric in (5); because it refers to a specific person defined within a situational context. Mostly, anaphora is used in a text to maintain reference. Cornish (1986) is of a different opinion. He argues that it is employed in a text for avoidance of redundancy or repetition by the use of a semantically (and optionally, lexically and phonologically) attenuated expression in place of the full lexical expression initially used.

The term anaphora is used in the linguistic literature in two senses (Lebeaux 1992) : (i) as a general description of coreferential processes where one element refers back to other (Hankamer and Sag 1976); (ii) in the restrictive and technical sense of *Binding Theory* (Chomsky 1981) where the term anaphor is restricted to

necessarily dependent noun phrases (as in English *himself, each other* etc.).

In the recent literature of *Government Binding* (GB) framework, the description of anaphoric binding requires a specification of the locality domain which surrounds the anaphor. Thus Binding Theory marks the dependence relationship with the coindexing feature (Majumdar 2016). For example,

6. a. John thought that $Bill_i$ will kill $himself_i$
   b. *$John_i$ thought that Bill will kill $himself_i$

In 6(a) the anaphor with the near antecedent is grammatical, but in 6(b) the antecedent is far away. So, it is not a potential antecedent for the anaphor suggested. Anaphoric binding in this respect presents a set of binding conditions framed within the Binding Theory (Chomsky 1981). The conditions impose restrictions in terms of coreference and disjoint reference. The locality domain is also parametrised with a variation from language to language.

3. Research Methodology

This study employs a mixed-methods design integrating corpus linguistics, formal semantics, and preliminary computational evaluation. We first compiled a balanced Bangla corpus (written and spoken) and extracted ~100 instances of pronominal/zero anaphora, ellipsis, cataphora, and exophora, enriched by classic examples and native speaker judgments. Two linguists annotated each example for anaphor type, domain (intra-/inter-sentential, discourse), antecedent status (overt, covert, multiple, none), ellipsis type (VP, NP, clausal), and contextual cues (verb subcategorization, morphology, paralinguistic signals), achieving $\kappa \geq .80$. Next, each instance was formalised in Discourse Representation Theory via minimal DRSs—with discourse referents, null-element updates, accessibility relations, and paired strict vs. sloppy identity

structures—and verb subcategorisation frames and classifiers encoded as choice functions. We then built a lightweight resolution prototype that selects antecedents through DRS accessibility rules, applies gender/number and subcat filters, generates strict/sloppy reconstructions, and evaluates precision, ambiguity coverage, and backtracking depth on 20 challenging test cases. Finally, we contrasted our DRT analyses with Minimal Recursion Semantics sketches to pinpoint the most robust formal mechanisms for Bangla's inbuilt anaphora ambiguities and discussed prospects for integrating probabilistic coreference models in scalable NLP systems.

4.1 *Anaphora without reference to a specific antecedent*

In the central or proto-typical cases of anaphora, it is a common observation that a type of nominal antecedent does exist in the discourse prior to the occurrence of the pronoun. But there even exist some non-proto-typical instances for which pro-forms may not locate overt or specific antecedent.

Isard (1975) has identified lot of instances for which candidate referent is not present in the context of utterance. The potential referent is salient in the universe-of-discourse and is not at all guided by the matter of recency of previous mention. For example, we may consider a situation in which a zoo-keeper warns a child pointing towards a snake while saying :

7. sabdhan, *oTa* tomake kamRate pare.
   aware that the you to bite to can
   'Be aware, that one may bite you.'

Here, 'the snake' does not have any previous reference as antecedent, but it is inherent in the context of utterance. 'oTa' functions as exophoric element with an inevitable support of paralinguistic features such as 'eye movement', 'raising finger' etc. There are other instances too for which the referent is not present in the universe-of-discourse and has not been mentioned previously by the speaker or the addressee. It may happen specifically in case of an elliptical construction. For instance,

8. amar *kono gaRi* na thakle-o rOmar EkTa *Ø* ache.
I of any car not remaining though Rama of one the (car) has

ami tar theke Ekdiner jonno *SeTa* bhaRa niechilam.
I she of from one day of for that the hire took
' Though I have no car, Rama owns one. I hired that one for a day from Rama.'

The natural interpretation for *'SeTa'* is that it refers to the car which Rama owns. Technically, it cannot refer to the 'car' mentioned overtly in the first sentence. Because 'gaRi' occurring in the first sentence, does not refer to any specific car. This is further confirmed by the presence of an indefinite pronoun 'kono' as the modifier of the nominal head 'gaRi'. So, interpretation of the anaphor '*SeTa*' depends on the prior interpretation of the elliptical expression, i.e. *'rOmar EkTa Ø ache'*. '*SeTa*' does not refer to that 'car' which is overtly expressed in the preceding expression; but it refers to that one, covertly represented in the elliptical clause.

Yule (1996) gives an interesting example from English. Let us consider a passenger who complains by saying: *I was waiting for the bus, but he just drove by without stopping.* We normally expect the anaphor *it* for the antecedent *bus*. Contrary to it, the anaphor becomes *he* here. Obviously, a logical inference works in this instance. For a bus in motion, there will positively be a driver. Therefore, the *driver* becomes the inferred referent for *he*. This again confirms that the overt antecedent is not the compulsion for establishing coreference relationship. It appears from the examples that the referent is introduced into the context of discourse without being overtly referred to. Let us consider again some extracts from a dialogue structure.

9. (X speaks) : tomar *baccaTa* ki korche?
you of kid the what is doing
'What is your baby doing?'

(Y responds) : *or* EkTa-i kaj, Saradin duSTumi kOra
s/he of one the only work whole day mischief doing
'His/her only work is to do mischievous things whole day.'

(X comments): *ora* e bOYSe duSTumi korbe-i
they this age in mischief will do indeed
'They will do mischief obviously in this age.'

The interpretation of '*ora*' as '*baccara*' "babies" seems to be quite natural. This is because the dialogue structure gradually shifts from specific to generic, i.e. 'talking of a particular' to the 'talking of general'. But it seems to be uncertain to accept 'baccaTa' (specifically referred) as the antecedent of '*ora*'. It is a normal practice to refer to a particular baby either by its name or by the use of the pro-form '*o'* referring to the specific baby present in the context of situation. There remains also a mismatch in the 'number' feature for the pro-form and the suggested antecedent. So, this looks as if an instance where pro-form is employed without any specific antecedent.

Brown and Yule (1983:218) have cited examples in which pro-form occurs in a discourse with no antecedent at all in the previous context. They are of opinion that in the most frequent situation, the addresser structures his message in such a way that some 'new' information is attached to a 'given' element (i.e. a pronoun) intending to provide the addressee with a 'given'/'new' interpretative procedure. However, the addressee has to reverse that procedure and use the 'new' information to decide the 'given' referent. Let us consider an example to illustrate the situation.

10. Onekdin bade dekhlum, cule pak dhoreche, gOtobOchor
many days after saw hair in grey has caught last year
Samike hariechen. cheleke nie *tini* Ekhon bideSe thaken
husband to has lost son with she now foreign at stays

'I saw (her) after long time. The hairs have become grey. (She) has lost (her) husband last year. She lives with her son in a foreign country.'

In the above extract, there is no such linguistic expression which can be treated as the antecedent of the pro-form 'tini'. It may only be inferred on the basis of the co-text signifying a female candidate-referent *who has lost her husband.* So, in this particular situation, addressee depends on 'new' information for determining a 'given' referent. It seems to be a serious problem for the process of anaphoric resolution. Because pronoun conveys 'given' information, which further depends on the referential assignment *via* information in the preceding discourse (Clark and Clark 1977). On the contrary, Brown and Yule (1983:219) criticized this approach with a claim that the reference of pronouns depends on what is predicated of them, and is not solely determined by information in the preceding discourse.

4.2 *Anaphora with multiple antecedents*

Anaphora without any specific antecedent involves both theoretical as well as practical problems in identifying deterministic diagnostics for anaphoric resolution. However, the problem should not be underrated in a situation for which an anaphor has multiple antecedents.

As the situation demands, anaphor may have the option to select any one of the antecedents as its referent within the intra-sentential/inter-sentential domain. The process of selection frequently depends on linguistic as well as pragmatic knowledge. Let us take an example relevant to the intra-sentential domain.

11. *cheleTi binake tar* barite dekheche.
boy the Bina to s/he of home at has seen
'The boy has seen Bina at his/her home.'

The pro-form 'tar' may have two possible antecedents either 'cheleTi' or 'bina' within the intra-sentential domain. The pro-form being anaphoric in nature, selects any one of the two possible candidate-referents. Such an optional choice in the procedure of

selection frequently brings opacity in the process of interpretation. However, referential opacity is usually resolved as the addressee gets feedback out from the discourse or pragmatic knowledge. In case of his failure he awaits for further clarification through communication with the addresser, if possible. In some specific situations, nature of the verb may also be operational for automatic resolution of the ambiguity. For instance,

12. *cheleTi* binake *tar* barite Dekeche.
boy the Bina to s/he of home at has called
'The boy has called Bina at his/her home.'

There is a basic distinction between (11) and (12) as the pronominal form 'tar' changes its possible referent with a change in the verb form. In (12) the preferred antecedent is 'cheleTi' within the sentential context. It is true that both of the candidate referents are permissible from the grammatical point of view. Yet the expectation goes in favour of *cheleTi*. So, replacement of the verb form imposes a constraint in the process of selection.

It appears to me that the semantic knowledge is functional in this type of situation. The internal semantics of the verb here becomes functionally significant in determining the pronominal interpretation. Both in (11) and (12), the NP containing the pronominal specifier 'tar' relates to the feature of 'location' as specified by the verb in the underlying semantic specification. But there is a fundamental difference between the two. In (11) the verb 'dEkh' relates to the semantic role of <ON-LOCATION>for the said NP containing the pronominal. In contrast, the verb 'Dak' refers to the semantic role pointing towards the feature of <TO-LOCATION> for the NP containing the pronominal. In terms of theta role the said NP has an underlying case-role of 'goal' in (12), but in (11) it is specified for 'location' feature. Thus, we note, internal semantic of the verb affects the thematic role of the constituents, thereby changing the property of anaphoric reference.

So, it appears that both 'non-specific antecedence' and 'multiple antecedence' situation involve some acute problems in defining anaphora within a proto-typical class.

4. 3 *Inter-sentential extension of anaphora*

From the earlier discussion it becomes quite apparent that antecedent and anaphor need not be in the same sentence for establishing anaphoric relationship (cf. sec 1.0). Obviously, it is not in the strict sense defined in BT. The anaphor may have its reference extended to the inter-sentential domain (Majumdar 2000). For instance,

13. (A speaks) : *bhOdrolok* ki ekhane thaken ?
gentleman whether here in stays
'Does the gentleman stay here?'

(B responds) : na, *uni* kolkataY thaken
not he Kolkata in stays
'No, he resides at Kolkata.'

The pro-form 'uni' in the second utterance has its referential domain extended to the first utterance. It refers to 'bhOdrolok'. This does not make a generalisation that all anaphoric relations are free to cross the sentential boundary. For instance, reflexives as in English (quite comparable to the Bengali reflexive anaphor nije-'self' as in *rOma nijeke bhalobaSe* "Rama loves herself."), have their antecedents usually within the same clause.

It is true to admit that the structural constraints applicable within the sentential province cannot explain the distance dependency relations between the antecedent-anaphor in a discourse/dialogue structure (Sidner,1981). This type of relationship requires explanation in terms of the prior knowledge of the discourse structure. In the syntactic domain anaphor gets syntactically constrained by the formulation of t BT. But semantic-pragmatic information is specifically required within the discourse frame.

Grosz has shown with an actually framed discourse structure that a pro-form may refer back to something mentioned even before sixty utterances (Grosz 1978). As a consequence, there arises a substantial search space with several NPs competing as possible candidate referent. Secondly, the complexity posed by large search space is further amplified due to super-abundance of potentially relevant information for identifying antecedents (Majumdar 2000: 235). Grosz has criticized, from the computational viewpoint, the earlier approaches to the interpretation of pronouns by heuristics based on recency. He is of opinion that the chronological distance between the antecedent and anaphor should be underrated in comparison to the relative coherence in the underlying discourse structure.

4.4 *Marked order Anaphor*

The term *unmarked order anaphora* characterises a situation for which antecedent precedes the anaphor. The *cataphora* in contrast, stands for 'marked order anaphora' for which antecedent follows the cataphor (Huddleston 1986:278). Thus etymologically the term 'antecedent' seems to be misleading as it does not always precede the 'pro-form'. An example from English may well illustrate this issue.

14. As soon as *he* realised what had happened *Bill* phoned his solicitor.

Here, 'he' refers to the following candidate referent 'Bill'. The examples may also be given from Bengali where cataphoric situation arises as a consequence of syntactic topicalization.

15. a *bina* (*tar* ghOrTake)$_{NP}$ Sundor kore Sajieche.
Bina she of room the to nice doing has decorated
'Bina has decorated her room nicely.'

b. (*tar* ghOrTake)$_{NP}$ *bina* Sundor kore Sajieche
she of room the to Bina nice doing has decorated
'Bina has decorated her room nicely.'

The same pronominal form 'tar' which is optionally anaphoric in (15a) [it may also have an exophoric/deictic interpretation] may have the possible cataphoric distribution in (15b). The pro-form 'tar' may be of two possible interpretation in (15b) : (i) deictic interpretation with a disjoint reference to 'bina'; (ii) cataphoric interpretation in a marked situation where antecedent 'bina' follows the pro-form. A typical unmarked cataphoric situation appears for reflexive element 'nije' "self" replacing pronominal 'tar' in (15b). The reflexive being clause-bound, excludes the possibility of deictic interpretation. This is also valid for (15a), in which such a replacement makes only anaphoric interpretation possible. For instance,

15.c. (*nijer* ghOrTake$_{]NP}$ *bina* Sundor kore Sajieche
self of room the to Bina nice doing has decorated
'Bina has decorated her room nicely.'

So, we see that the same pro-form may be treated either as cataphor or as anaphor depending on the nature of syntactic distribution. Cataphora may even be available in Bengali when the pro-form is used as a sentential anaphor. The example follows:

16. bilu *eTa* bhalo-i jane je *kOmol kal ekhane*
Bilu this the good even knows that Kamal tomorrow here at
ar aSbe na.
again will come not
' Bilu knows well that tomorrow Kamal will not come here again.'

The pro-form 'eTa' as sentential cataphor refers to the following embedded clause, i.e. *kOmol kal ekhane ar aSbe na*.The antecedent of the cataphor may not always be overtly expressed. For example,

17. jOkhon Ø mon kharap hOY tOkhon *mirar* maer kOtha
when mind bad is then mira of mother of words
mone pORe.
mind in falls
'When Mira feels anguished, she recollects the memory of her mother.'

Here, the cataphor is elliptical being related with the following case-marked nominal expression *mira-r.* It is worth noting that the case-marker for the pro-form may not be identical with that of its referent. An example follows:

18. jOkhon-i *oke* khuNjte jabe, tokhon-i *rOma* barite
when only she to search to will go then indeed Rama home at
thake na.
stays not
'Whenever you will go to find out Rama, she will not be available at her home.'

Usually, in this type of example, the pro-form is suppressed being replaced by the elliptical cataphor. However, in the marked situation, the case-marked pro-form may function as cataphor, as in (18). The case-marker of the pro-form here does not agree with the null case marker of the candidate referent 'rOma'.

We need not mention here that such type of cataphoric expressions is also available even within a discourse/dialogue structure. So, it strongly confirms that the concept of 'precedence' for searching out the antecedent does not always remain valid. It seems quite legitimate to argue that the pro-form and the so-called antecedent may be used in a sentence /discourse irrespective of their order of distribution. It is true that we may impose some structural constraints (such as dependent clause structure or topicalised construction in Bangla may allow cataphora in general) at least in the syntactic domain. Nevertheless, the cataphoric distribution makes the anaphoric resolution a little bit complex. It means, the resolution schema should not entirely depend on the 'backtracking procedure', but it needs to be supported by some additional knowledge-base to have an information access when to look forward for resolving cataphoric situation (Allen 1987).

4.5 *Problems with Ellipsis*

Elliptical constructions constitute an essential feature in everyday conversation (Crystal 1980:129). It refers to a situation where for

the sake of economy, emphasis or style, a part of the structure gets skipped over. However, the clipped structure may be recoverable from the scrutiny of the context. It may rightly be described as an essential abbreviating device which reduces redundancy (Majumdar 2005). As a matter of fact, the device of ellipsis may be characterised as a 'surface phenomenon' ensuring unique 'recoverability' depending on linguistic/non-linguistic contexts. (Quirk *et al* 1972 :536). The recoverability condition is a universal constraint on deletion, proposed by Chomsky & Lasnik in 'Filter and Control' (1977). It claims that only elements which do not have any semantic content can be deleted. For instance, wh-elements of interrogative sentences in English cannot be deleted. Because they have the semantic content of their own. But the wh-words in relative clauses such as in the following can be optionally deleted: *The man (whom) I met*.

Elliptical construction may have an anaphoric interpretation as apparent from the preceding section. Quirk *et al* (1972) suggest, if we find what seems to be an elliptical construction we are usually forced to look back to what was said previously in order to interpret the sentence. Thus, it appears that the elided part can only be identified depending on the preceding context. Because possibility of recoverability depends on what is present in the same sentence or it depends on a broader context across sentences. Naturally, contextuality here again imposes complications in resolving anaphora. It further includes the problems regarding identification of different factors such as (i) nature of the constituents (their categories and classification) which undergo ellipsis; (ii) specific conditions for occurrences of ellipsis; (iii) choice of the option regarding the treatment of the ellipted part as anaphoric or not (Huddleston 1986: 284).

A specific problem arises due to the property of referential extensibility of the elliptical anaphor. The null anaphor may have its

referential range extended from a single constituent to even phrasal or clausal structure. Examples follow:

19. Simar boyTa dami hole-o amar Ø–Ta nOY
Sima of book the costly becoming though I of (book)the not
'Though Sima's book is costly, mine is not.'

20. a. bhOdrolok baRiTa bikri korte cayle-o ami Ø
gentleman book the sell do to wanting though I (sell do to)
cayni.
wanted not
' Though the gentleman wanted to sell the house, I did not.'

b. bhOdrolok baRiTa bikri korte cayle-o ami Ø
gentleman book the sell do to wanting though I (sell to)
korini.
did not
' Though the gentleman wanted to sell the house, I did not.'

21. mira Ø na bolle-o Otonu jane
Mira (I will not stay at home) not saying though Atanu knows
je *ami aj baRi thakbo na.*
that I today home will stay not
'Though Mira did not say, Atanu knows that I will not stay today at home.'

(19) refers to a situation for a single NP constituent undergoing ellipsis. The morphological marker –Ta (recognizsed as classifier) attached to the clipped part functions as a signaling device for the underlying NP antecedent. In (20a), the elliptical anaphor has its reference extended to the domain of VP. The elided part in the following clause may be retrieved on the basis of the existing verb form for *caWa* "to want" in the preceding clause, making a cohesive linkage. Thus in (20a) the elided part refers to *baRiTa bikri korte*; in (20b) the referent is *baRiTa bikri.* Both (20a) and (20b) show that the nature of information regarding the clipped part is at least partly triggered by the verb present in the following clause. This is because any one of the verbal elements in the preceding clause usually carries its reference to the following clause. In (21), on the other hand, elided element may be treated as cataphor with its reference extended to the clausal domain. This again confirms that

the process of searching for the antecedent should have a motivation independent of directionality. The presence of the clipped element within the syntactic expression may be identified on the basis of the verb 'bol' allowing clausal complement in the structural slot. So, sub-categorisation of the verb may help in spotting the dropped antecedent-expression.

The possibility of extension of the null domain makes the procedure of anaphoric resolution computationally much more difficult (Allen 1987). This is due to lack of local information to a parser when to backtrack and how much to incorporate in order to satisfy coreferentiality condition. Obviously, a simple look-ahead mechanism cannot resolve the ambiguity related to ellipsis. The backtracking of the parser, on the other hand, reduces the efficiency of the same. A lot of research has been done in this regard by Berwick (1983), who applied 'wait-and-see strategy' for resolving such type of ambiguity (the strategy was originally introduced by Marcus (1978), Huang(1984) devising algorithm for gapping). Kwasny and Sondheimer (1981) implemented the technique of pattern-matching method. It is true that local information to the parser gets partially triggered by the verb sub-categorisation, verb element itself or sometimes by the morphological markers and so on.

We may also note some specific situations related to ellipsis which frequently lead to ambiguity. It is true that the criterion of *unique recoverability* ensures an unambiguous specification of the clipped parts in a specific context. But the cases reserved for weak ellipsis (as noted by Quirk *et al* 1972) confirm that there is no compulsion for the items understood to be uniquely recoverable. An example follows which exhibits so called 'sloppy identity' readings (cf. Ross 1967). Here, the antecedent-trigger contains a pronoun anaphoric to that predicate's subject, thereby potentially creating an ambiguity in the interpretation of the elliptical predicate.

22. cheleTi *tar* *barite* gEche, Ononto-o Ø jabe.
boy the he of home at has gone Ananta too (his home) will go
'The boy has gone to his home, Ananta too will go.'

The two available readings for the elliptical predicate are :

(i) …. cheleTir barite jabe
boy the of home at will go
'…will go to the boy's house'
(ii) …. Onontor barite jabe
Ononto of home at will go
'…will go to Ananta's home'

In (i) pronominal within the antecedent-trigger is interpreted as a referential anaphor. Obviously, we are excluding the deictic interpretation of the pronominal here. Such an interpretation multiplies the possibility of ambiguous interpretation.

But in (ii), the same pronoun is construed as a bound variable, or 'syntactic agreement' pronoun in Bosch's term (1983). Clearly, this is a difference in the logical predicate which the elliptical VP selects as its 'ellipsis trigger' and cannot be a function of morpho-syntax (the surface structure of both 'antecedent' and elliptical VP remaining constant). However, possibility of the pronominal to have a bound variable interpretation is evidently lexically determined as a function of the verb selected, and may also be imposed by the wider context. For example,

23. chobi bipOde tar buddhi harale-o robi Ø
Chabi trouble in she of sense losing though Rabi (danger in his sense)
haraY ni
lost not
'Chabi lost her sense in trouble, though Rabi did not.'

Treating 'tar' not as bound variable in (23), in any case would result into incoherence. Similar type of example may be considered here from English to look into the new dimension of the problem.

24. John lost his temper, and so did Jane Ø.

Here also 'his' should be bound by John which is the candidate-referent. It further shows that interpretation of the elliptical predicate does not take place *via* a reinstatement of the antecedent-trigger VP in its morpho-syntactic form. Because there will be a gender-clash in the selection of the pronominal variable for the second candidate-referent (i.e.*Jane lost ***his*** temper) (cf. Webber 1979, Bosch 1983). Similar situation appears for (23) in which the candidate-referents belong to different sex.

Thus the examples reflect that 'non-recoverability' situation and the extendable domain of an elliptical construction may generate further complexity in the process of anaphoric interpretation.

4.6 *Complexity in Ellipsis and Formal Semantic Interpretation*

The resolution of elliptical constructions, particularly in Bangla, is often complicated by the interplay of syntactic ambiguity and semantic under-specification. One significant challenge arises when antecedents are partially or entirely omitted, prompting the parser to rely on wider contextual cues and interpretive strategies. Verb subcategorisation frames play a key role here: they often signal expected argument structure and help in inferring the omitted material. For example, a ditransitive verb triggers expectations for multiple arguments, aiding in the reconstruction of null expressions.

However, as Allen (1987) notes, the extension of the ellipsis domain considerably increases computational complexity, primarily due to the lack of immediate local cues that inform the parser when and how far to backtrack for an antecedent. A simple look-ahead mechanism cannot adequately resolve such ambiguity. Earlier strategies, like the "wait-and-see" method proposed by Berwick (1983) and algorithms developed by Huang (1984) and Kwasny & Sondheimer (1981), reflect attempts to tackle this through delayed commitment or pattern matching. Yet, none offer complete solutions to structurally ambiguous cases.

Take the following Bangla sentence exhibiting a case of VP-ellipsis with potential ambiguity:

(22) *cheleTi tar barite geche, Ononto-o Ø jabe.*
'The boy has gone to his home; Ananta too will go.'

Here, two interpretations of the elided predicate are possible:

- Strict Identity**:** Ananta will go to the boy's home.
- Sloppy Identity**:** Ananta will go to *his own* home.

This dual reading mirrors the classical 'sloppy identity' problem (Ross 1967), well-attested in both English and Bangla. In formal semantic terms, this can be modeled via Discourse Representation Structures (DRS)**.** The strict reading preserves the antecedent's referent (i.e., the pronoun "tar" = the boy), while the sloppy reading binds the pronoun to the new subject ("Ononto"). Thus, the pronoun functions either as a referential expression or as a bound variable**,** aligning with Bosch's (1983) notion of 'syntactic agreement' pronouns.

The difference in interpretation does not stem from surface morpho-syntax—both forms remain constant—but rather from the underlying logical form and the semantic structure of the antecedent. Notably, this variation is often lexically conditioned, as certain verbs or predicates promote bound variable readings based on their argument structure and the wider discourse context.

Consider another example:

(23) *chobi bipode tar buddhi harale-o, robi haraY ni.*
'Chobi lost her sense in danger, though Rabi did not.'

Here, treating *tar* ('her') as referring to Chobi is essential for coherence. A referential interpretation linked to Rabi would render the sentence pragmatically anomalous. The contrast underscores the role of gender concord and discourse coherence in constraining anaphoric interpretation. This parallels the English:

(24) *John lost his temper, and so did Jane Ø.*

An elliptical reconstruction like *Jane lost his temper* would violate gender congruence and pragmatic plausibility. Hence, event semantics becomes relevant here: the elided VP can be modeled as an event variable (e.g., *e*) that abstracts over participants while maintaining coherence through feature agreement.

These examples show that ellipsis resolution is not merely a matter of morpho-syntactic reinstatement but often requires interpreting underlying predicate structure**,** discourse accessibility**,** and semantic binding mechanisms**.** The Bangla examples illustrate how dynamic binding and accessibility constraints (as formulated in DRT) apply to natural data. The anaphoric pronoun's interpretation is tightly coupled with discourse referents and contextual salience, often supported by verb subcategorisation frames and morphological cues.

5. Conclusion

The theoretical contribution of this paper lies in demonstrating that the challenges of anaphoric interpretation—especially in the presence of elliptical constructions and ambiguous pronouns—are not merely the result of missing antecedents or parser shortcomings, but stem from a deeper structural indeterminacy inherent to natural language itself. Bangla, with its rich pro-drop features and flexible argument structures, brings this indeterminacy into sharp relief through constructions that defy straightforward semantic mapping or resolution by existing formal systems. Our analysis of no-antecedent, multiple-antecedent, and cataphoric linkages shows how anaphors may reach far beyond sentence boundaries, invoking discourse-level and pragmatic cues to establish reference. These phenomena reveal that any adequate theory must integrate syntactic constraints, discourse context, and dynamic interpretation strategies—rather than relying solely on backtracking or surface-level heuristics—to capture the full

complexity of human referential understanding and to guide the development of more robust NLP models.

Human comprehension, by contrast, effortlessly resolve even highly non-canonical anaphoric links by incrementally building richly structured discourse representations, deploying capacity-limited parsing heuristics attuned to verb subcategorisation, and engaging garden-path recovery processes when initial interpretations falter. Psycholinguistic research offers compelling support: Gernsbacher (1990) shows how readers dynamically update mental models to accommodate new referents; Just and Carpenter (1992) quantify the role of working-memory constraints in real-time pronoun resolution; Frazier and Clifton (1996) detail the mechanisms of reanalysis following parsing ambiguities; Pickering and Traxler (2001) provide evidence for predictive processing in anaphoric anticipation; and Traxler and Gernsbacher (2011) synthesise how discourse coherence governs referential linking. In contrast, mainstream statistical and rule-based parsers (Manning & Schütze 1999; Jurafsky & Martin 2009) typically lack built-in mechanisms for dynamic context updating or resource-bounded reanalysis, resulting in brittle performance on Bangla data riddled with inbuilt anaphoric ambiguities. Bridging this gap demands hybrid architectures that embed psycholinguistic principles—structure building, memory-sensitive parsing, and predictive resolution—directly into NLP pipelines.

Endnote:

1. This paper is a revised and modified version of an earlier article titled *"Identifying Some Inbuilt Problems in Anaphoric Interpretation,"* originally published in *Folklore and Folkloristics* (a peer-reviewed international journal), edited by Sk. M. Islam, Vol. 9, No. 1, ISSN 2350-031X, 2016, pp. 9–19.

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