# Centering and Pronominal Reference: In Dialogue, In Spanish

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## Abstract

This paper describes an application of Centering Theory (Grosz et al. 1995) to dialogue in Spanish. Centering is a theory of local focus and local discourse coherence. It also relates focus in discourse to choice of referring expression. In this paper, I discuss the analysis of nine task-oriented conversations. The main aim of the paper is to establish links between transition type and choice of pronoun, studying correlations between those two, and examining what other factors might be at play when a general tendency (e.g., of CONTINUE transitions to result in pro-drop) is not followed. I explore whether some of those factors could be related to characteristics of dialogue, such as signaling turn-taking.

## Introduction

Different theories attempt to account for how anaphoric terms can be linked to their referents, often with the goal of providing anaphora resolution in computational systems. Centering Theory (Grosz et al. 1995), a theory of focus of attention in discourse, has also been applied to the problem of anaphora resolution (Brennan et al. 1987). Usually the perspective is that of a language understanding system, which needs to keep track of referents and pronouns in discourse. In this paper, I proceed from a different point of view, trying to establish not what antecedent a pronoun has, but instead what type of anaphoric term is used in a particular context. Given the transitions proposed by Centering, I examine the anaphoric term (pronoun, clitic, stressed pronoun, noun phrase, etc.) chosen for the backward-looking center of an utterance.

To examine these issues, I studied a corpus of dialogues in Spanish. The paper first presents a brief introduction of Centering, and then the application of the theory to a relatively new area, dialogue, and to a new language, Spanish (Sections 2 and 3). In Section 4, I present the results of the corpus study.

## 1 Centering

Centering (Grosz et al. 1995) is a theory of focus in discourse, and its relation to choice of referring expressions. It provides rules and constraints to explain how entities become focused as the discourse proceeds, and how transitions from one focus to the next make the discourse coherent. For each utterance in the discourse, Centering establishes a ranked list of entities mentioned or evoked[1], the *forward-looking list* (Cf). The first member in the Cf list is the *preferred center* (Cp). Additionally, one of the members of the Cf list is a *backward-looking center* (Cb), the highest-ranked entity from the previous utterance that is realized in the current utterance.

In Example (1), part of a conversation, the speaker proceeds from having *he* as a focus of attention in (1a), to *we all* in (1b), and back again to *he* in (1c). The changes are indicated by using explicit subjects in both (1b) and (1c), *todos* and *él*, respectively. The centers for each utterance in (1) are provided in (2)[2].

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[1] I discuss what "evoked" means in Section 2.

[2] Abbreviations used in the examples: 1/2/3 - first/second/third person; CL - clitic; DAT - dative; NOM - nominative; SG - singular; PL - plural; IMP - imperative; INF - infinitive; FUT - future. Only those examples that illustrate a grammatical point are rendered in a word-by-word gloss. The rest are simply

(1) CREA, uam480.per001

a. Entonces si le surge un problema,
   then if he-CL-DAT arise-3SG a problem
   'So if he has any problem come up,'

b. pues todos le vamos a echar una mano,
   then all he-CL-DAT go-1PL to give
    a hand
   'we'll all give him a hand,'

c. pero él es la persona responsable.
   but he-NOM is the person responsible
   'but he's the one in charge.'

(2) a. Cf: HE, PROBLEM; Cb: HE; Cp: HE
    b. Cf: WE ALL, HE; Cb: HE; Cp: WE ALL
    c. Cf: HE; Cb: HE; Cp: HE

In addition to the three types of centers, Centering proposes different types of transitions, based on the relationship between the backward-looking centers of any given pair of utterances, and the relationship of the Cb and Cp of each utterance in the pair. Transitions, shown in Table 1, capture the introduction and continuation of new topics. $Cb(U_i)$ and $Cp(U_i)$ refer to the centers in the current utterance. $Cb(U_{i-1})$ refers to the backward-looking center of the previous utterance. Thus, a CONTINUE occurs when the Cb and Cp of the current utterance are the same and, in addition, the Cb of the current utterance is the same as the Cb of the previous utterance. Transitions are ranked according to the demands they pose on the reader. The ranking is: CONTINUE > RETAIN > SMOOTH SHIFT > ROUGH SHIFT. In (1) above, the transition from (1a) to (1b) is a SMOOTH SHIFT, whereas the transition from (1b) to (1c) is a CONTINUE.

|  | $Cb(U_i)=Cb(U_{i-1})$ or $Cb(U_{i-1})=0$ | $Cb(U_i) \neq Cb(U_{i-1})$ |
|---|---|---|
| $Cb(U_i)=Cp(U_i)$ | CONTINUE | SMOOTH SHIFT |
| $Cb(U_i) \neq Cp(U_i)$ | RETAIN | ROUGH SHIFT |

Table 1. Transition types.

translated.

With these constructs as a starting point, the main goal of the paper is to show how the choice of anaphoric terms in spoken Spanish can be explained according to the transition type between one utterance and the next. For this purpose, I have carried out a corpus analysis of task-oriented dialogues in Spanish. The speakers communicate in order to complete a task, in this case, finding a date when they can both meet. Before analyzing spoken Spanish, I will describe the application of Centering Theory to dialogue, and to Spanish.

## 2  Centering in Dialogue

Centering has been applied mostly to monologic discourse. A few studies show how it can be extended to explain the coherence of dialogue. Brennan (1998) studied a corpus of spontaneous dialogues, and observed problems in segmentation and speaker change. Byron and Stent (1998) suggest the following as the main issues regarding the adaptation of Centering to two-party dialogue (multi-party dialogue is yet to be addressed):

1. Utterance segmentation. Utterance boundaries determine which entities are available for the following utterance's Cf list. A related issue is how to segment complex sentences.
2. Speech phenomena. We also need to consider the utterance status of segments before and after pauses and hesitations, and how to account for side sequences or self-repairs (as studied in Conversation Analysis).
3. First and second person pronouns. In dialogue, participants often refer to themselves and to each other through a pronoun in subject position. Since in the ranking of the Cf list, subjects take precedence (at least in English), these subjects will be ranked higher in the Cf list. However, it is not clear whether they are the centers of the utterance.
4. Linearity. Centering depends on the previous utterance to determine the entities and the focus of the current utterance. Since current and previous might have been uttered by different speakers, we should consider whether to use "previous by same speaker" rather than simply "previous".

The model for dialogue adopted here is Byron and Stent's (1998) *Model 1*, that is, a model where both first and second person pronouns are included in the Cf list. In addition, utterances are

consecutive: in the search for $Cb_n$, only $Cf_{n-1}$ is searched, whether it was produced by the same speaker or not. Byron and Stent (1998) found that this model performed better than models that discarded first and second person pronouns, and models that considered previous or current speaker's previous utterance[3].

The decision to use Model 1 settles issues (3) and (4) above, and seems justified given the data. I found that reference to first and second person was important in the conversations, and often 'I' is mentioned in contrast to 'you' (singular) and to 'both of us', because the speakers discuss what dates one of them is available, versus what dates the other speaker has free, and which dates suit both of them as a unit.

Another general issue in Centering is what to include in the Cf list, and how to interpret the need that entities in that list be realized in the current utterance. The definition of 'realize' depends, according to Walker et al. (1998: 4), on the semantic theory one chooses. This is of particular importance in dialogue because it relies more than monologue on the context outside the text proper. Particularly difficult were decisions having to do with dates and times, and how those are related to each other. In general, I considered only "include" relations (Hurewitz 1998), such that a date was deemed to be part of the previous utterance's focus if it was part of a date range mentioned there. However, when the date was not within the time frame established, it is plausible to think that the hearer had to construct a new model for it. In Example (3), speaker famm[4]

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[3] Their performance measures were based on (i) number of zero Cbs, (ii) whether the Cb that Centering found corresponded with a loose notion of sentence topic, and (iii) number of cheap vs. expensive transitions. Cheap and expensive refer to inference load on the hearer (Strube and Hahn 1999), based on whether $Cp_{n-1}$, the expected $Cb_n$, is actually realized as $Cb_n$.

[4] Speakers are referred to using their initials, plus an 'f' or 'm' in front, to identify their gender. These conventions are also used to name dialogues (e.g., in Table 2). 'famm_06_12' refers to speaker famm's turn 12 in conversation number 6. In the transcripts, slashes indicate backchannels (/uh huh/), and angle brackets false starts (<de> de).

proposes the week of the fourth, after having discussed the previous week. However, speaker mjnm returns to the previous week, and mentions Friday, October 1st, i.e. a date not in the week of the fourth. I believe this is a new entity, and cannot be related to the immediately preceding utterance. As it happens, this results in a zero Cb.

(3) famm_06_12: … quieres tratar la semana de cuatro?
'... do you want to try for the week of the 4th?'
mjnm_06_13: qué te parece el viernes primero de octubre, luego de las once de la mañana?
'what do you think of Friday October 1st, after 11am?'

There are still two dialogue-related issues I have not discussed, namely (1) and (2) above. As for utterance segmentation, I separated compound sentences in their component coordinate clauses, following Kameyama (1998). For subordinates, I separated finite subordinate clauses that have a clear final intonation (4), but not non-finite clauses (5) or those where there is continuing intonation.

(4) a. realmente tengo una reunión <de> desde las diez hasta las doce.
'I actually have a meeting <from> from 10 till 12.'

b. por tanto no creo que sea muy conveniente ese día.
'So I don't think that day is very convenient.'

(5) por favor no te olvides de traer todos los legajos. <para poder este> para tener toda la información a mano.
'please don't forget to bring all the papers. <to be able to uh> to have all the information handy.'

The issue of speech disfluencies is left open at this point. For the present analysis, I have discarded backchannels, repairs, and utterances with no entities in them. On the other hand, I did include side sequences and clarifications. These often result in zero Cbs, at either the beginning or the end boundary of the clarification.

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Intonation is represented by orthographic signs (. , ?).

## 3  Centering in Spanish

Centering is proposed as a cross-linguistic universal that relates participants' focus of attention and choice of referring expression. The transitions, constraints and rules are believed to be common to all languages, because they reflect human processing constraints[5]. The only adjustment necessary from language to language is the ordering of the Cf list, what Cote (1998) calls the *Cf template* for a language.

In English, the Cf template is considered to correspond closely to grammatical function and to linear order. Thus, subjects are ranked higher than objects, and these higher than adverbials. Walker, Iida and Cote (1994) proposed a different ranking for Japanese, which includes topic markers and markers of empathy in verbs, ranked higher than subjects or objects. Di Eugenio (1998) also ranks empathy the highest in her template for Italian, following Turan's (1995) for Turkish.

Spanish is a pro-drop language; subjects do not need to be realized as pronouns if they are known in context. Additionally, it has direct and indirect object clitics (unstressed pronouns). Corresponding stressed object pronouns are possible for animate entities only.

Animacy is a relevant feature in Spanish, in my view. Clitics and reflexive pronouns that refer to participants in the discourse have two characteristics that would make them candidates for a higher ranking: (i) they convey empathy and (ii) they are often placed before the verb, linearly before non-animate direct objects. In (2b), the most salient entities are 'you' and 'me' (captured in the clitic *me*); 'the time' should rank lower in the list.

(6) a. /mm/ de todas formas <el> el martes estaré listo.
   /mm/ of all ways <the> the Tuesday be-FUT-1SG ready
   'Anyway I'll be ready on Tuesday.'

   b. fíjame tú la hora
   set-IMP-2SG-me-CL you the time
   'You set the time (for me)'

I also ranked experiencers in psychological and perception verbs higher in the scale, following previous research (Turan 1995; Brennan 1998). These are the experiencers in verbs such as 'interest', 'seem' and 'feel'. The experiencer in such verbs is often expressed through a pre-verbal clitic pronoun in Spanish (*me parece*, 'it seems to me'). Ranking animacy higher unifies empathy in psychological and perception verbs, and it also captures the fact that pronouns that refer to participants are placed first in the discourse, thus resulting in linear ordering of the Cf list.

A proposal for a Cf template for Spanish is presented in (7). This is a working version, and it still needs to address other issues: subject-verb inversion (in presentational and other constructions), possessives[6], etc.

(7) Cf template for Spanish
    empathy/animacy > subject > animate indirect object > direct object > other

One case that I found especially difficult was the frequent occurrence of *para mí* ('for me') as a benefactive. The speakers often say 'X date is not good for me' or 'For me that's not good'. Following the template above, we could include it as an animate indirect object. However, the emphasis seemed to be different according to whether *para mí* appeared at the beginning or the end of the clause, possibly making this a case for considering word order as well as grammatical function.

## 4 Centering and Reference in Spoken Spanish

This section presents the results of the corpus analysis, an analysis of nine two-party conversations from the Interactive Systems Lab scheduling corpus[7]. These are conversations between two speakers, with the goal of finding a suitable time to meet. They are grouped by gender of participants, three conversations being between

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[5] Walker (1998) discusses Centering as a model of human memory.

[6] See Di Eugenio (1998) for a discussion of possessives.

[7] The conversations were recorded by ISL at Carnegie Mellon University. Thanks to ISL and Alex Waibel, its director, for permission to use the data.

|  | Utterances | Cb=0 | Continue | Retain | Smooth shift | Rough shift |
|---|---|---|---|---|---|---|
| FMGL_FMCS_01 | 52 | 15 | 26 | 2 | 7 | 1 |
| FNBA_FCBA_04 | 33 | 10 | 16 | 3 | 2 | 1 |
| FVGC_FSNM_09 | 18 | 8 | 6 | 1 | 1 | 1 |
| MARC_MPHB_02 | 27 | 9 | 9 | 5 | 2 | 1 |
| MJBP_MMBU_04 | 29 | 4 | 13 | 3 | 5 | 3 |
| MRBZ_MCRA_03 | 34 | 9 | 19 | 2 | 1 | 2 |
| FCBA_MEBA_08 | 24 | 5 | 12 | 4 | 2 | 0 |
| FMEM_MEOC_02 | 24 | 9 | 6 | 6 | 0 | 2 |
| MJNM_FAMM_06 | 30 | 12 | 14 | 1 | 2 | 0 |
| Total | 271 | 81 | 121 | 27 | 22 | 11 |
| % of total transitions (excluding 0, $n$=181) |  |  | 66.85% | 14.92% | 12.15% | 6.08% |

Table 2. Transition types per conversation.

|  | Continue | | Retain | | Smooth shift | | Rough shift | |
|---|---|---|---|---|---|---|---|---|
| *Pro*, participant | 90 | 74.38 | 9 | 33.33 | 16 | 72.73 | 2 | 18.18 |
| Stressed pronoun, participant | 7 | 5.79 | 0 | - | 2 | 9.09 | 2 | 18.18 |
| Demonstrative pronoun | 2 | 1.65 | 1 | 3.70 | 1 | 4.55 | 3 | 27.27 |
| Stressed IO (*para mí*) | 5 | 4.13 | 1 | 3.70 | 0 | - | 0 | - |
| Unstressed IO (clitic, *me*) | 8 | 6.61 | 5 | 18.52 | 1 | 4.55 | 1 | 9.09 |
| *Pro*, non-participant | 5 | 4.13 | 1 | 3.70 | 1 | 4.55 | 2 | 18.18 |
| NP, non-participant | 3 | 2.48 | 3 | 11.11 | 0 | - | 1 | 9.09 |
| Adverbial | 1 | 0.83 | 7 | 25.93 | 1 | 4.55 | 0 | - |
| Total | 121 | | 27 | | 22 | | 11 | |

Table 3. Choice of referring expression according to transition.

two females, three between two males, and three mixed. Conversations were divided into utterances, and centers coded for each. The conversations had in total 2,858 words and 271 utterances. They were divided in utterances, according to the methodology explained in Section 2, and centers were coded for each utterance. Overall numbers of utterances and transitions are presented in Table 2.

In general for the entire corpus, and in particular for each conversation, CONTINUE is the preferred transition by far (66.85% of all non-zero transitions in the corpus). RETAIN and SMOOTH SHIFT are similar in overall percentage (14.92% and 12.15%, respectively).

Finally, ROUGH SHIFT is the least frequent of all transitions, occurring 6.08% of the time.

A number of backward-looking centers were empty, which resulted in 81 zero transitions. A backward-looking center is empty when none of the entities in the previous utterance, $U_{n-1}$, is repeated in the current utterance, $U_n$. In (8) the entities of (8a) are not repeated in (8b), because the speaker proceeds from the mention of 'I' and 'you' to 'us'. This was considered to be a new entity in the discourse. Given that Cb for (8b) is empty, the transition is zero. Instances of empty Cb were very common towards the end of the conversations, which consist mainly of good-byes and repetitions of the dates agreed upon. From a structural point of view, a series of empty Cbs

could then indicate that the conversation is nearing its end.

(8) a. fmgl_01_10: sí. okay. /eh/ te llamo por teléfono antes cuando yo salga de mi oficina. /mm/?
    'yes. okay. /uh/ I'll call you on the phone before, when I leave my office /mm/?'
    Cf: FMGL [*pro*], FMCS [te], PHONE [por teléfono], FMGL [yo], OFFICE [mi oficina]

   b. así <[n]> combinamos bien
    'That way <[n]> we can coordinate'
    Cf: US [*pro*]; Cb: 0; Transition: ZERO

The focus of this paper is the relation of transition type to type of pronoun chosen for the backward-looking center. For each transition pair, I looked at the linguistic realization in the backward-looking center in the second utterance of the pair. That realization was then characterized according to the categories presented in Table 3. The first column for each transition presents raw frequencies, and the second column the percentage of that transition type that was realized in each of the categories. (Although the focus is on choice of pronoun, all the realizations of the Cb were coded.)

The first two categories include reference to participants as subjects, divided in stressed pronoun or *pro*. In (9), the speaker refers to herself with a stressed pronoun in the first sentence of the turn, but continues the reference with a zero pronoun (9b).

(9) a. a ver *yo* estoy de viaje del treinta y uno hasta el miércoles junio dos, el dos de junio,
    'Let's see *I* am away from the 31st until Wednesday the 2nd, June 2nd.'

   b. o sea que [*pro*] no voy a poder
    so [*pro*] no go-1SG to be-able-to-INF
    'So (I) won't be able to make it.'

Participants can also refer to themselves through indirect objects realized as clitics, as in (10) and (11), or with stressed pronouns preceded by a preposition: *para mí* ('for me'), *a mí* ('to me'), *a ti* ('to you'), as in (12).

Pronouns can also be in first person singular (13).

(10) *me* parece lo mejor dejarlo para la otra semana,
    *me* seem-3SG the best leave-INF-it-CL for the other week
    'I think it's better to leave it till the next week,'

(11) /eh/ a qué hora *te* viene mejor?
    /uh/ at what time *you* come-3SG better?
    'What time is it better for you?'

(12) *para mí* esto está ideal Cati.
    *for me* that be-3SG ideal Cati.
    'For me that's ideal, Cati.'

(13) <pero> pero no *nos* alcanza el tiempo porque /eh/ tenemos hasta las cinco de la tarde.
    <but> but not *us* reach-3SG the time because /uh/ have-1PL until the five of the afternoon.
    'But that's not enough time, because we (only) have until 5pm.'

The next few categories include entities other than the participants, circumstances such as dates and places. These can also be realized as zero pronouns, as in (14), where *el jueves* (Thursday), the subject of *parece*, is implicit.

(14) a. ...me viene mejor el jueves, <pero> por ejemplo empezar a las dos de la tarde.
    me come-3SG better the Thursday <but> for instance start-INF at the two of the afternoon.
    'Thursday is better for me, <but> for instance to start at 2pm.'

   b. qué te parece [*pro*=el jueves]?
    what you seem-3SG
    'What do you think (of Thursday)?'

In Spanish, it is not common to refer to a non-animate entity with a stressed personal pronoun (*ello*, 'it'). In the corpus, the pronoun of choice for these entities is a demonstrative (15). Finally, reference can also be made through NPs (16), or PPs (17).

(15) y así podemos hacer *eso*, y ya.
    and so can-1PL do-INF *that*, and already.
    'And then we can do *that*, and that's it.'

(16) bueno. *el dieciséis* está bien.
okay. *the sixteen* is good.
'Okay. *The 16th* is fine.'

(17) qué tal *pause* está tu horario *en esta siguiente semana, del ocho al doce.*
how *pause* is-3SG your schedule *in this following week, from the eight to the twelve.*
'How's... your schedule *in this coming week, from the 8th to the 12th.*'

As for the relation of transition and anaphoric term, and as was expected, CONTINUE transitions are frequently realized through pro-drop. I divided the use of pro-drop according to whether the dropped pronoun referred to a participant in the conversation or to some other entity (dates and places). In 74.38% of all CONTINUE, the Cb referred to a participant, and did so without an explicit pronoun. A few Cbs, 4.13% of CONTINUE, referred to another entity in the discourse. The rest of the categories are small in number, perhaps with the exception of a stressed pronoun to refer to a participant (5.79%). The use of a stressed pronoun in some of these cases might have a role in turn-taking (see below).

In the RETAIN transitions, again the most frequent realization was a *pro*, but two other categories are interesting. First of all, dative clitics (*me, te*, 'me', 'you') appear often. These appear sometimes in the first utterance of a new turn. In (18b) below, speaker fmcs addresses speaker fmgl for the second time. In (18c), the other speaker takes the turn, addressing fmcs, but making reference to herself ('you didn't tell *me* what Monday…'). Since the reference to fmgl is the only connection between the two turns, that is the Cb for (18c).

(18) a. fmcs_01_05:        ... qué te parece?
'...what do you think?'

b. fíjate tu horario, a ver qué tal te viene.
'Check your schedule, and see whether that's good for you.'

c. fmgl_01_06:        bueno. <primer> en primer lugar, no me dijiste qué lunes o martes o miércoles.
'Okay. First of all, you didn't tell me what Monday, or Tuesday, or Wednesday.'

SMOOTH SHIFT transitions very frequently result in a *pro* for the Cb of the utterance. Because of the situated nature of the conversations, it is not necessary to use a stressed pronoun to clarify referents, even when a shift in focus of attention takes place.

It is interesting to note that some of the stressed pronouns that referred to participants occurred right after a change of turn. There were in total four of these (one in CONTINUE, one in SMOOTH SHIFT and two in ROUGH SHIFT). For instance, in (19), a CONTINUE, speaker fcba signals turn-yielding by asking a question of the other speaker. Speaker fnba then starts a turn by making reference to herself with a stressed subject pronoun, *yo*.

(19) fcba_04_01: ... puedes reunirte conmigo en mayo?
'... can you meet with me in May?'

fnba_04_02: a ver yo estoy de viaje del treinta y uno hasta el miércoles junio dos, el dos de junio,...
'Let's see, I'm away from the 31st to Wednesday June 2, June 2nd,...'

This phenomenon opens up the possibility of establishing points of contact between Centering and Conversation Analysis (e.g., Sacks et al. 1974). There might also be a connection between transition type and turn-taking. Example (20) shows the last two utterances of a long turn in which the speaker presents his available dates, all resulting in CONTINUE transitions. The very last utterance in the turn introduces the other speaker with an imperative[8], but the speaker retains a reference to himself in the clitic *me*. This is the first RETAIN in the sequence, preparing for the turn change.

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[8] Subjects of imperatives (i.e., the addressee) are considered entities in the discourse.

(20) viernes puedo todo el día.
    'Friday I can all day.'

    entonces mientras para no hacértelo más
    difícil, dime si puedes uno de estos días.
    'So in the meantime so that this doesn't get
    more difficult, let me know if you can one
    of these days.'

Other phenomena that cannot be discussed here include null objects and their relationship to evoked entities, and the status of clausal subjects. I would also like to explore the relationship of stressed indirect objects (*para mí*) to their unstressed counterparts (clitics). The stressed versions are usually grammatically optional, and they can appear towards the beginning or the end of the clause.

## Conclusion

This paper has presented an application of Centering Theory to dialogue in Spanish. A corpus analysis of nine task-oriented conversations shows certain correlations between transition type and choice of referring expression. I have also discussed some of the difficulties of applying Centering to dialogue, and how to establish the Cf template for Spanish. Future directions of this work include analysis of other corpora, especially written data, in order to provide a general characterization of certain phenomena in Spanish such as zero pronoun, clitic doubling, and choice of definite/indefinite article. Another extension will compare these results to both spoken and written English.

Further research is also needed to establish the adequacy of the proposed Cf template for Spanish. A measure would be its success in resolving anaphora.

The final aim of the study is to formalize the relationship between anaphoric terms and transitions, so that the formalization can be used in a computational application.

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