On the Clause-Controlled PRO in English[*]

In-Sik Jeong
(Seoul Digital University)

Jeong, In-Sik. 2008. On the Clause-Controlled PRO in English. *The Linguistic Association of Korea Journal,* *16*(3), 119-142. This article explores the type of overt arguments that can act as a controller, on the basis of grammatical or semantic functions of a nonfinite clause, and shows that not only an NP but also a clause serves as a controller of PRO. Interestingly enough, PRO, which is controlled by a clause, does not occur in an infinitival clause and a gerundival clause but just in a participial clause, more specifically in a result participial clause. This study also addresses the directionality of referential dependence between PRO and its controller. When its interpretation is dependent on NPs, PRO usually precedes or follows its controller. It allows a bidirectional control. When it is dependent on a clause as its interpretational referent, however, PRO must be preceded by its clause controller. It allows only a unidirectional left-to-right control. The opposite is disallowed.

Key Words: PRO, result, argument, controller, directionality of control, non-finite clause

1. Introduction

Since its introduction in Chomsky (1981), PRO has attracted a lot of attention as a non-overt argument. Linguists have observed that it is controlled by an overt argument, concerning its interpretation.[1] Its

1) The term *control* often implies that there may be a c-command relation between PRO and its controller. In this article, however, it refers simply to a relation of referential dependence between PRO and its controller, borrowing Bresnan (1982).

controllers, however, have been dealt with in detail mainly on the basis of overt argument NPs until now, as shown in (1):

(1) a. John$_i$ tried PRO$_i$ to solve the problem.
     b. [The officer]$_i$ ordered [the men]$_j$ PRO$_{*i/j}$ to fire the guns.
     c. John$_i$ asked how PRO$_{i/j}$ to behave himself$_i$/oneself$_j$.

In (1a) the non-overt element PRO is referentially dependent upon the subject NP *John* for its interpretation. In (1b) PRO is not subject to control by the subject NP *the officer* but by another NP *the men*. In the case of (1c), the subject of the infinitive may be interpreted as equivalent to the subject of the matrix *John* as in (1a) or the arbitrary pronoun *one*. The sentences in (1) show that the non-overt subject PRO of the infinitival clause is controlled by the subject or object NP of the upper clause, or the arbitrary pronoun. However, the subject and the object of a clause are not always realized only in the form of NPs. Sentences can take a form of a clause for their subject or object, as in (2):

(2) a. [$_{CP}$ [$_{IP}$ That the diplomat is not reliable]] bothers me very much.
     b. I don't think [$_{CP}$ that [$_{IP}$ this medicine will work well]].

In (2a) the subject is realized by the clause *that the diplomat is not reliable*. In (2b) the object position of the verb *think* is filled with the clause *that this medicine will work well*.

As shown in the sentences in (1), whose subject or object is represented by the NP, the non-overt element PRO is taken to refer to a subject or an object for its interpretation. The sentences in (2), in contrast, show that a clause may function as a subject or an object of a sentence. We could infer from this respect that PRO may refer not only to an argument NP but also to an argument clause depending on the context. However, the latter argument has attracted little attention as its controller, to the best of my knowledge. I attempt to explore in this article if such a clause as an IP or a CP in English can serve as a controller of the non-overt argument PRO. I also examine conditions of

its occurrence as a controller of PRO.

This article focuses on the relation between PRO and its controller on the basis of a variety of sentential structures rather than of a particular theory.

The rest of this article is organized as follows. Section 2 deals with the type of overt arguments that can act as a controller, on the basis of grammatical or semantic functions of a nonfinite clause, and shows that not only an NP but also a clause such as IP or CP serves as a controller of PRO. Interestingly enough, PRO, which is controlled by a clause, does not occur in an infinitival clause and a gerundival clause but just in a participial clause[2], more specifically in a result participial clause[3]. Section 3 addresses the directionality of referential dependence

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2) In this article, the *-ing* clause is classified, for expository convenience, into two types. One is called a gerundival clause, which functions as a nominal clause. The other is called a participial clause, which functions as an adverbial clause.

3) When we want to express the result of an action or situation, we can use a result clause which is introduced by conjunctions such as *so, so... that,* or *such ... that.*

   (i) The lecture was boring and irrelevant, *so* some of the students began to fall asleep.

   (ii) Peter was having problems with mathematics, *so* he went to see his tutor to ask for advice.

   (iii) There were *so* many books on the subject *that* Cindy didn't know where to begin.

   (iv) There was *such* a lot of material to cover *that* Ivan found it difficult to keep up with his studies.

There may be many other ways of talking about the result of an action or situation. In some situations we may prefer to use *and as a result* or *with the result that.*

   (i) The lecture was boring and irrelevant, *and as a result* some of the students began to fall asleep.

   (ii) The lecture was boring and irrelevant, *with the result that* some of the students began to fall asleep.

As a result can also be used at the beginning of a new sentence.

   (i) The lecture was boring and irrelevant. *As a result,* some of the students began to fall asleep.

   (ii) The government increased the duty on wine. *As a result,* there was a fall in demand.

We can use words or phrases such as *Therefore, Thus, In consequence, Consequently, For this/that reason, etc.*

   Causal relations can be expressed by the *-ing* clause of result which is a

between PRO and its controller. When its interpretation is dependent on NPs, PRO usually comes after its controller or before it. It allows a bidirectional control. When it is dependent on a clause as its interpretational referent, however, PRO must be preceded by its clause controller. It allows a unidirectional left-to-right control. The opposite is disallowed. Section 4 is the conclusion.

2. Pro and Its Controller

In English, nonfinite clauses[4] include infinitival, gerundival, participial clauses, etc. As will be shown below, they may function as nominal, adjectival or adverbial clauses, and usually take a non-overt argument for their subject. Chomsky (1981) and Abney (1987) state that NPs and clauses belong to arguments. It follows that PRO, which is controlled by an overt argument in a sentence, can be subject to control not only by NPs but also by clauses. On this assumption, in this section, I will chiefly deal with the occurrence and interpretation of PRO and other relations between PRO and its controller, according to grammatical or semantic functions of a nonfinite clause.

2.1. PRO as Non-overt NP in Nonfinite Clauses

2.1.1. Nominal Clauses

Let us first discuss the relation between PRO and its NP controller on a nominal nonfinite clause which functions as a subject, a complement or an object. In doing so, we need to examine some

matter of main concern in this article, as in the following:
- The government increased the duty on wine, *resulting in* a fall in demand.
4) With respect to nonfinite clauses, we leave out of this article verbless small clauses like those in (i) and (ii):
(i) John$_i$ arrived [PRO$_i$ angry].
(ii) While [PRO in Rome], you will be sure to see the Colosseum.

In (i) the small clause [PRO angry] falls under the AP and does not have an overt argument but PRO as its subject. In (ii) the small clause *John* [PRO in Rome] falls under the PP and takes PRO as its subject.

examples whose subject nonfinite clauses come from infinitival clauses as in (3):

(3) a. PRO$_i$ To behave himself$_i$ in public would help Bill$_i$. (Manzini 1983: 424)

b. PRO$_{*i/j}$ To behave oneself$_i$ in public would help Bill$_i$. (Manzini 1983: 424)

c. Mary$_i$ knows that PRO$_{i/*j}$ to behave herself$_i$ in public would help him$_j$. (Manzini 1983: 424)

d. PRO$_{i/*j}$ To behave himself$_i$ would be his$_i$ pleasure.

e. PRO$_i$ To be allowed to leave was never promised to Mary$_i$. (Bresnan 1982: 404)

f. It was never promised to Mary$_i$ PRO$_i$ to be allowed to leave.

In (3a) PRO, from which the reflexive *himself* picks up its reference, is controlled by the object *Bill* of the verb *help*. In (3b) PRO is not controlled by anything in the sentence. It has an arbitrary reference, as seen in the fact that it must bind the anaphor *oneself*. In (3c), where the nonfinite clause is the subject of the embedded clause, PRO is controlled by *Mary,* the subject NP of the higher clause. It can be accounted for by the fact that the anaphor *herself* is bound by PRO. In (3d) PRO is taken to be controlled by the possessive *his* of the NP *his pleasure*, because PRO must bind the anaphor *himself.* In (3e) PRO is understood as referring to *Mary*, the object NP of the preposition. In (3f), a paraphrase of (3e) by the so-called extraposition, the NP *Mary* also contributes to the interpretation of PRO. This shows that PRO, a subject of nominal infinitival clauses, may precede or follow its controller regardless of c-command, when it is controlled by NPs.

Let us consider some examples whose subject nonfinite clauses come from gerundival clauses as in (4):

(4) a. PRO$_i$ Becoming an expert in a foreign language is difficult.

b. PRO$_{i/j}$ Reading this newspaper makes me$_i$ feel like a better citizen.

c. Bill$_i$ knows that PRO$_{i/j}$ becoming an expert in a foreign language is difficult.

d. PRO$_i$ Maintaining a large family was no easy task to him$_i$.

In (4) each of the gerundival clauses is used as a subject of the matrix or embedded clause. In (4a) PRO is controlled by an arbitrary reference, like PRO of (1b). In (4b) PRO may be dependent either on the object NP *me* or on an arbitrary pronoun *one* depending on a context for its interpretation. In (4c) PRO, which is a subject of the embedded subject clause, may be controlled either by the subject of the matrix clause *Bill*, or by an arbitrary reference. In (4d) PRO is taken to refer to the NP *him*, an object of the following preposition *to*. Like PRO in (3), PRO in (4) also comes before or after its controller regardless of a c-command relation between them.

Now we will discuss some examples whose complement nonfinite clauses come from an infinitival clause as in (5) and a gerundival clause as in (6):

(5) [My$_i$ job]$_j$ is PRO$_{i/*j}$ teaching English.
(6) [Her$_i$ only wish]$_j$ is PRO$_{i/*j}$ to travel all over the world.

The complement of sentence (5) is the gerundival clause, whose subject PRO is referentially dependent on the specifier of the subject NP *my job*. In the structures like (5) PRO is always controlled by a part of a subject, not by the whole subject.[5] In (6) the infinitival clause is used as a complement of the copula *be*. The non-overt argument subject of the clause is controlled by the specifier of the matrix subject, *her only wish*. It suggests that the non-overt argument of a nonfinite clause that functions as a complement of the copula *be* is referentially dependent on a part of the matrix subject for its interpretation.

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5) We propose one of the standards of dividing the -*ing* clause into a gerundival clause or a participial clause, when it is preceded by the copula *be* as illustrated in the following:
(i) [The students]$_i$ are PRO$_i$ playing football on the ground.
(ii) [My$_i$ hobby]$_j$ is PRO$_{i/*j}$ collecting stamps.
In the structure *S* + *be* + *C*, PRO can be referentially dependent on the whole of the matrix subject or a part of it. The former is referred to as a participial clause, whose nonfinite verb represents an activity in progress. The latter is referred to as a gerundival clause.

Next we turn to examples in which an infinitival clause or a gerundival clause functions as an object, as exemplified in (7) or (8), respectively:

(7) a. [The federal government]ᵢ decided PROᵢ to stop PROᵢ withholding highway money from states without helmet laws.
     b. Johnᵢ will leave it to himⱼ PRO*ᵢ/ⱼ to arrange the party.
(8) a. Billᵢ stopped PROᵢ smoking for the improvement of his health.
     b. [Barack Obama]ᵢ hold an eventⱼ in Indiana before PROᵢ/*ⱼ talking to voters in North Carolina. (The Associate Press. 2008-05-02)
     c. [The pain]ᵢ in myⱼ throat made PRO*ᵢ/ⱼ speaking difficult.

Sentence (7a) has two PROs. The former PRO, which is the subject of the infinitival clause, is controlled by the NP subject of the matrix, *the federal government*. The latter PRO is the subject of the gerundival clause, *withholding highway money from states without helmet laws*. It is controlled by the former PRO, which is referentially dependent on the matrix subject. In (7b), the sentence where the infinitival clause is extraposed, the NP *John* cannot control PRO in the nonfinite clause. Only the NP *him*, the object of the preposition, can function as a controller of PRO.

In (8) each of the gerundival clauses is used as an object of a verb or a preposition. In (8a) the verb *stop* has a gerundival clause as its object, a clause headed by the gerund of the verb *smoking*. The subject of this clause is PRO, which is interpreted as referentially dependent on *Bill*, the main clause subject. In (8b) the gerundival clause *talking to voters in North Carolina* is the object of the preposition *before*. The subject of the clause is PRO, which is controlled by *Barack Obama*, the subject of the matrix clause. Sentence (8c) takes the gerundival clause *speaking* for its object. The subject of the gerund is PRO, which is interpreted as referentially dependent on *my*, the specifier of the NP *my throat*.

2.1.2. Adverbial Clauses

In this section I will examine the occurrence and interpretation of PRO in a nonfinite adverbial clause, which comes from infinitival or participial clauses. Adverbial clauses have several semantic functions expressing time, purpose, cause, condition, result, etc. Based on them, let us first consider PRO in the following adverbial infinitival clauses:

(9) He_i went to [the United States]$_j$ $PRO_{i/*j/*k}$ to acquire [weapons and other machinery for the military]$_k$.

(10) [The netizen]$_i$ was surprised $PRO_{i/*j/*l/*k}$ to find [many people]$_j$ commenting about [his life]$_k$ in [blogs]$_l$.

(11) PRO_i To make the same mistake again, you_i will not be forgiven.

(12) a. $Mary_i$ drove all the way to $Maine_j$, $PRO_{i/*j/*k}$ to find that [her friends]$_k$ had moved to Florida.

b. $Bill_i$ is too polite PRO_i to ever say anything like that.

In the sentences in (9) through (12), an infinitival clause is used as an adverbial clause. In sentence (9), whose nonfinite clause expresses the adverbial relationship of purpose, only the NP *he* can control PRO. Other controllers are not available. In sentence (10), whose nonfinite clause may be interpreted as an adverbial relationship of reason, only the NP *the netizen* can be a controller for PRO. The other arguments cannot be available for the interpretation of PRO. In (11) the infinitival clause expresses condition. PRO of the clause is taken to be controlled by the matrix subject *you*. In sentences (12a) and (12b), in which the infinitival clause expresses the outcome and the degree, respectively, PRO allows a control of only the matrix subject, which is realized as *Mary* in (12a) and *Bill* in (12b).

Next, let us consider PRO of adverbial participial clauses given in the following:

(13) PRO_i Walking along the street, $people_i$ put their eyes straight ahead.

(14) a. He_i sat in silence, PRO_i stroking his beard.

b. [The natives]$_i$ came to the shore, PRO_i waving a flag of peace.

(15) PRO_i Fearing the loneliness of old age, he_i wanted to re-establish

contact with his son.

(16) [The drunken man]$_i$ fell, PRO$_i$ striking his head against the door
     and PRO$_i$ cutting it.

In (13) and (14) each of the nonfinite clauses expresses an adverbial
relation of time. In particular, the participial clauses of (14) indicate the
simultaneity of the situations with the matrix clause. PRO of these
nonfinite clauses is controlled by the subject of the matrix clause. In
sentence (15), in which the participial clause expresses reason, PRO is
referentially dependent on the matrix subject. In (16) the participial
clause indicates the result of something expressed in the matrix clause.
PRO has the subject NP *the drunken man* as its referent.

2.2. PRO as Non-overt Clause in Nonfinite Clauses

2.2.1. Nominal Clauses

In the previous section we have considered the relation between PRO
and its NP controller in a nonfinite clause, which performs a
grammatical function such as a subject an object, or an adverb.
However, PRO is not always controlled only by its NP controller,
serving as a subject or an object, because a sentence does not require
only NPs as its subjects or objects. Let us consider the following:

(17) a. [That the Public Prosecutor issued a warrant for the arrest of
         about 20 people] would cause the resistance of the local people.
      b. [To watch TV for more than one hour a day] may be a
         waste of time.

The sentences in (17) have nominal clauses as their subjects, which are
realized by the finite clause in (17a) and by the nonfinite clause in
(17b). In addition, such types of subject can be replaced by the pronoun
it, given a proper context, as illustrated in (18):

(18) a. If the Public Prosecutor issued a warrant for the arrest of about

    20 people, it would cause the resistance of the local people.

    b. Although they tried [to solve the problem], it was found impossible.

The subject of the matrix clause in (18a) is realized by the pronoun *it*, which refers to the preceding subordinate clause. In (18b), the matrix subject, which is realized by the pronoun *it*, refers to the nonfinite clause embedded in the preceding subordinate clause. It shows that a nominal clause, whether finite or nonfinite, can be used as the subject of a finite clause and can be replaced by the pronoun *it* in finite clauses, given a proper context. The pronoun cannot occur in a subject position of nonfinite clauses which is not governed. In contrast, PRO can not be realized as a subject of finite clauses, as shown in the following:

(19) a. *If the Public Prosecutor issued a warrant for the arrest of about
       20 people, PRO would cause the resistance of the local people.
    b. *Although they tried [to solve the problem], PRO was found impossible.

In this respect, the pronoun *it* and PRO may in a complementary distribution concerning the finiteness of a clause. Nevertheless, we could infer that just as the former is dependent on the controller of NPs or clauses for its interpretation, the latter may also be controlled by clauses as well as by NPs, as dealt with in the previous section. We will first examine whether PRO, which occurs in a nominal nonfinite clause, can take a clause as its controller. Let us consider the following:

(20) a. [We$_i$ will all know that PRO$_{i/*j/k}$ to do such a thing will only
      cause trouble]$_j$.
    b. [He$_i$ realized that, [how much money he$_i$ made]$_j$, PRO$_{i/*j/*k}$
      maintaining a large family was no easy task]$_k$.
(21) a. [He$_i$ continues to tell customers$_j$ that [[a good way]$_k$ to test if
      [they$_j$ need a moisturizer]$_l$ is [PRO$_{*i/j/*k/*l/*m/*n/*o}$ to wait 20
      minutes after bathing]$_m$]$_n$]$_o$.
    b. [[He$_i$ wasn't sure [how [she$_j$ would feel about his$_i$ coming]$_k$]$_l$]$_m$
      because his$_i$ hobby is PRO$_{i/*j/*k/*l/*m/*n}$ collecting odd religious

experiences]$_n$.

(22) a. [She$_i$ fell in love with an American officer$_j$]$_k$ and decided PRO$_{i/*j/*k}$ to follow him to the U.S.

   b. In still other cases it's clear [that [the nursing homes]$_i$ aren't discriminating]$_j$ because they$_i$ have stopped PRO$_{i/*j}$ providing a particular service altogether. (Washington Post. 1999-06-07)

   c. He$_i$ spoke then about [poor preparation for postwar Iraq]$_j$, [a concern he$_i$ developed]$_k$ after PRO$_{i/*j/*k}$ listening to State Department officials. (Washington Post. 2006-12-03)

In (20a) the infinitival clause functions as a subject of the embedded clause. The non-overt argument PRO is controlled by the matrix subject co-indexed with i or the arbitrary pronoun co-indexed with k but not by the clause co-indexed with j. In (20b) the gerundival clause functions as an embedded subject. Three possible candidates for the interpretation of PRO could be given, as co-indexed. However, only the controller co-indexed with i could contribute to the interpretation of PRO. In (21a) the infinitival clause is used as a complement of the embedded clause. Its PRO is also referentially dependent on only one of several possible controllers, the NP co-indexed with j. The control of a clause is impossible. In (21b) the gerundival clause, which occurs in the reason clause, is a complement of the copula *be*. As co-indexed, PRO is controlled by the NP *he* or *his* but not by the clauses co-indexed with k, l, m or n. Likewise, the non-overt argument, which is in the infinitival clause of (22a) and the gerundival clause of (22b), is not controlled by the clause but by the NP. From the discussion in (20) through (22), we can conclude that PRO of a nominal nonfinite clause cannot take a clause as its controller.

2.2.2. Adverbial Clauses

Next let us turn to the possibility of adverbial nonfinite clauses whose subject is dependent on a clause for its interpretation. Let us first consider adverbial infinitival clauses, as exemplified in (23):

(23)   a. [He$_i$ worked hard]$_j$ PRO$_{i/*j}$ to support his family.

      b. [[Our guests]$_i$ are very surprised]$_j$ PRO$_{i/*j}$ to find that the majority of the students are of other ethnic origin.

      c. [He$_i$ will do anything]$_j$ PRO$_{i/*j}$ to have the chance to see her again.

      d. [He$_i$ awoke one morning]$_j$ PRO$_{i/*j}$ to find himself famous.

      e. [[The news]$_i$ is too good]$_j$ PRO$_{i/*j}$ to be true.

As shown in (23), the infinitival clauses perform several semantic functions such as purpose, reason, condition, result, degree, etc. PRO, which is a subject of the purpose clause in (23a), is understood as referring to the subject NP, but not to the clause *he worked hard*. The infinitive verb in the purpose clause has to take an NP with the feature [+animate] as its subject. Therefore, the clause that has the feature [-animate] cannot control PRO in the purpose clause. Likewise, the nonfinite clauses in (23b) through (23e) do not allow the clauses with the feature [-animate] to control PRO as well. This discussion tells us that PRO in adverbial infinitival clauses requires only NPs for its interpretation. Now let us turn to adverbial participial clauses, as illustrated in (24):

(24)   a. PRO$_{i/*j/*k}$ Walking along the street$_j$, he$_i$ met [a friend whom he had not seen for a long time]$_k$.

      b. [[The student]$_i$ went into his classroom]$_j$, PRO$_{i/*j}$ slamming the door shut.

      c. PRO$_{i/*j}$ Not knowing what PRO$_{i/*j}$ to do, [[the student]$_i$ asked for his advice]$_j$.

      d. PRO$_{i/*j/*k}$ Turning to the right, [you$_i$ will find [the hotel]$_j$ on the left]$_k$.

      e. [I$_i$ seldom see them]$_j$, PRO$_{i/*j}$ living next door.

      f. As you$_i$ enter a country, [$_{IP}$ [the inspector]$_j$ will simply wave [the passport]$_k$ across [an electronic reader]$_l$ and [your face]$_m$ will pop up on the computer screen]$_n$, PRO$_{*i/*j/*k/*l/*m/n}$ making possible an instant comparison with your passport photo.[6] (Chicago Tribune. 2004-02-01)

g.. [_{IP} [These satellites]_i have stronger batteries]_j, [PRO_{i/j} allowing them to continue collecting data and send it back even during eclipses when the Earth blocks sunlight from the solar collectors that power the instruments]. (USA TODAY. 2006-04-27)

Like adverbial infinitival clauses, the participial clauses in (24) can also express several semantic functions: the participial clause expresses time in (24a, b), reason in (24c), condition in (24d), concession in (24e), result in (24f, g), etc. As co-indexed in (24a) through (24e), PRO of each clause is referentially dependent on the NP, but does not allow the control of a clause. Detailed discussion could be provided in the same way given in (23). However, we are faced with the nonfinite clause different in the control mode from those dealt with so far. In (24f) the participial clause expresses a meaning of result. The non-overt element of the nonfinite clause, which appears in the final position of a sentence, does not refer back to an argument NP but to a preceding clause. PRO is not controlled by any of such NPs as *you, a country, the inspector, the passport, an electronic reader, your face* and *the computer screen.* In addition it is not controlled by an arbitrary pronoun, either. In (24g) the non-overt argument could be understood as referring to the matrix subject *these satellites* or the matrix clause *these satellites have stronger batteries*. Although both of the interpretation is grammatically acceptable, the contextual meaning allows only the clausal reference of PRO. Unlike other nonfinite clauses, result participial clauses allow PRO to refer back to clauses as well as NPs.

If we go into more detail, we may divide clauses into four types of clauses: nonfinite IP, finite IP, nonfinite CP and finite CP. The controllers of PRO in (24f) and (24g) both fall under a finite IP. A nonfinite IP can also be used as a controller of PRO, as illustrated in (25):

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6) The view on a controller of PRO in (24f) may vary from person to person. Some claim that it is the second conjunct of the preceding clauses. Others claim that it should include both the first and the second conjunct. I also prefer the latter view, because the action of the first and second conjunct constitutes an integrated event rather than a separated one.

(25) [[A story]ᵢ often told by [Senator Hillary Rodham Clinton]ⱼ
describes [an Ohio hospital]ₖ as [refusing to treat a woman and
her child]ₗ]ₘ, PRO*ᵢ/*ⱼ/*k/l/*m resulting in their deaths. (New York
Times. 2008-04-05)

In (25) the non-overt argument has a lot of candidates for its controller
- *a story, Senator Hillary Rodham Clinton, an Ohio hospital, refusing
to treat a woman and her child,* and *a story often told by Senator
Hillary Rodham Clinton describes an Ohio hospital as refusing to treat
a woman and her child.* However, only one candidate is permitted in the
sentence - the nonfinite IP *refusing to treat a woman and her child.* In
addition, a CP controller is also allowed, as illustrated in (26):

(26) [[This meant]ᵢ to [Mr. Reagan as president]ⱼ [that [a U.S. military
buildup and SDI]ₖ would place[severe strain]ₗ on [the Soviet economic
and political system]ₘ]ₙ]ₒ, PRO*ᵢ/*ⱼ/*k/*l/*m/n/*o making possible both
genuine reductions in nuclear weapons and the potential unraveling of
the Soviet Union. (The Washington Times. 2005-03-01)

In (26) the non-overt argument of the result participial clause may
have a lot of candidates for its controller, as co-indexed as *i, j, k, l, m,
n,* and *o.* Out of these candidates, only one is possible - the CP *that a
U.S. military buildup and SDI would place severe strain on the Soviet
economic and political system.* This analysis might, however, lead us to
a hasty conclusion that PRO of result participial clauses is always
dependent on the controller of clauses for its interpretation. It is wrong,
as evidenced by the following:

(27) [It was reportedly from there [that [heᵢ was detained in August
2006]ⱼ, and [[his arrest]ⱼ prompted [a police search of several
homes in Britain]ₖ]ₘ]ₙ]ₒ, PRO resulting in the arrests of 24
people. (New York Times. 2007-12-17)

In (27) the non-overt argument may be referentially dependent on

several possible controllers for its interpretation - *he, his arrest, a police search of several homes in Britain, he was detained in August 2006, his arrest prompted a police search of several homes in Britain, that he was detained in August 2006, and his arrest prompted a police search of several homes in Britain* and *It was reportedly from there that he was detained in August 2006, and his arrest prompted a police search of several homes in Britain.* However, the contextual meaning requires the interpretation of PRO to be dependent on only the NP co-indexed as k - *a police search of several homes in Britain.*

The examples in (24e, f) through (27) show that there is a strong relationship of cause and effect between matrix and result participial clauses. However, sentences in a somewhat vague causal relation between two clauses also show that PRO is controlled by a clause. Let us consider the following:

(28) a. [They$_i$ told [U.S. officials]$_j$ that [Iran$_k$ is beginning to test [a more elaborate cascade of centrifuges]$_l$]$_m$]$_n$, PRO$_{*i/*j/*k/*l/m/*n}$ indicating that it is further along than previously believed. (Washington Post. 2006-04-08)

b. [Shoppers$_i$ also said more frequently than last year that [they$_i$ would be putting off spending until later in the season]$_j$]$_k$, PRO$_{*i/j/*k}$ suggesting that consumers are tightening their wallets this year more so than last year. (Chicago Tribune. 2007-11-03)

c. [Streets$_i$ around the hotel will be blocked off]$_j$, PRO$_{*i/j}$ meaning that traffic in parts of the city will be snarled for days. (USA Today. 2008-01-06)

As discussed in (24f, g) through (27), the non-overt arguments in (28) are all controlled by the preceding clause: PRO in (28a) by the clause bracketed with *m*, PRO in (28b) by the clause bracketed with *j*, and PRO in (28c) by the clause bracketed with *j*. The nonfinite clauses in (24f, g) through (27) represent the outcome of the preceding clausal controller. However, those in (28) may express a weak outcome of the preceding clausal controller or tell more about the clausal controller. In this article I

classify such type of nonfinite clause into a result clause, as well.

Interestingly enough, an infinitival clause also expresses the meaning of result in relation to the matrix clause. However, its PRO does not allow a clause as its controller, as illustrated in (29):

(29)   a. [He$_i$ finally won [his lawsuit]$_j$]$_k$, only PRO$_{i/*j/*k}$ to find that his lawyer would get most of the money.

   b. [He$_i$ awoke one morning]$_j$ PRO$_{i/*j}$ to find himself famous.

Unlike the result participial clauses in (24f, g) through (28), the result infinitival clauses in (29) allow only the NP co-indexed with i to control PRO. I claim that it comes from the lexical difference between verbs of the two nonfinite clauses. More specifically, the infinitive verb in the result clause takes an object as its subject or does not contain the feature of intention. In contrast, the verb of a participle in the result clause has activity or state as its subject. Consequently, the result infinitival and participial clause are structurally in complementary distribution. Let us consider the following:

(30)   a. [He$_i$ awoke one morning]$_j$ PRO$_{i/*j}$ to find himself famous. (= 29b)

   b. [He$_i$ awoke one morning]$_j$, PRO$_{*i/*j}$ finding himself famous.

(31)   a. [Streets$_i$ around the hotel will be blocked off]$_j$, PRO$_{*i/j}$ meaning that traffic in parts of the city will be snarled for days. (= 28c)

   b. [Streets$_i$ around the hotel will be blocked off]$_j$, PRO$_{*i/*j}$ to mean that traffic in parts of the city will be snarled for days.

In (30) there may be possible four examples on the basis of co-indexation. What is grammatical is only one sentence, in which PRO is a subject of the infinitival clause and refers back to the matrix subject *he*. What is grammatical in (31) is the sentence in which PRO is a subject of the participial clause and refers back to the preceding clause.

On the basis of the discussion so far, result participial clauses allow PRO to refer back to clauses as well as NPs, unlike other nonfinite clauses.

2.3. Summary

So far we have dealt in detail with the interpretation of PRO based on grammatical and semantic functions of nonfinite clauses. When it is referentially dependent on NPs, PRO can occur in every nonfinite clause. When it is controlled by a clause, however, its occurrence is restrictively possible. That is, it is limited to a result participial clause.

Farkas (1988:28) suggests that the controller choice is directly connected to the lexical meaning of the matrix verb. However, our discussion has shown that, in addition to the lexical meaning of the matrix verb, the lexical meaning of the embedded verb and the structural relation between matrix and embedded clauses contribute to the controller choice of PRO.

3. Directionality between Controller and Controllee

Addressing the relation between PRO and its controller on c-command, some literatures (Williams (1980), Chierchia (1983, 1984) and Hornstein (1999), to cite only a few) depend on data where a controller and PRO are locally restricted so that the former can c-command the latter. We have, however, seen above that the interpretational reference of PRO does not always depend on its forward nearest NP. That is, the claim that PRO should be c-commanded by its controller could not provide a satisfactory explanation. To enhance an explanatory power, I will consider the interpretation of PRO on the linear order rather than on the c-command requirement between PRO and its controller.

As mentioned above, PRO may be controlled by a controller preceding it or following it, just as a pronoun may refer to a textual antecedent preceding it or following it. I will refer to the former as a left-to-right control and to the latter as a right-to-left control, in this article for expository convenience. In what follows I will focus on the linear order between PRO and its controller to find that the directionality of the order is different, depending on whether PRO is controlled by NPs or clauses.

3.1. NP Control and Directionality

As shown in Section 2, PRO may precede or follow its controller, when it is controlled by its NP controller, i.e. it allows both a left-to-right control and a right-to-left control, as illustrated in the following:

(32) PRO$_i$ To behave himself$_i$ in public would help Bill$_i$. (= 3a).

(33) [My$_i$ job]$_j$ is PRO$_{i/*j}$ teaching English. (= 5)

(34) Bill$_i$ stopped PRO$_i$ smoking for the improvement of his health. (=8a)

(35) PRO$_i$ Fearing the loneliness of old age, he$_i$ wanted to re-establish contact with his son. (= 15)

The examples in (32-35) show that the bidirectional control, in which PRO may precede or follow its controller, is possible when it is referentially dependent. What should be noted here is that a bidirectional control can be ambiguously interpreted.

One interpretation is that a bidirectional control can occur within a sentence where an NP controls PRO, i.e. a specific sentence allows both a left-to-right control and a right-to-left control, as in the following:

(36) It would help Bill$_i$ PRO$_i$ to behave himself$_i$ in public.

(37) He$_i$ wanted to re-establish contact with his son, PRO$_i$ fearing the loneliness of old age.

Sentence (36), which is formed by the extraposition of the subject in right-to-left controlled sentence (32), shows a left-to-right control. Sentence (37) is formed by reversing the matrix and subordinate clauses in (35). Consequently, a pair of (32) and (36) and another pair of (35) and (37) show that a bidirectional control within a specific sentence is possible when the sentence allows an extraposition or a change of the positions of the nonfinite clause and its controlling clause.

Another interpretation is that a bidirectional control can occur in sentences where an NP controls PRO, as shown in (32) through (35). It

does not mean, however, that a specific sentence always allows a bidirectional control. Let us consider (38):

(38)   a. *PRO$_i$ smoking for the improvement of his health stopped Bill$_i$.
　　　b. *PRO$_i$ smoking stopped Bill$_i$ for the improvement of his health.

Examples (38a, b) are formed by the change of the subject and the object in (34) but are not grammatical due to structural or semantic constraints. The verb *stop* does not take a nonfinite clause but an object with the feature [+animate], as its subject when it means *to finish the motion or progress of.*

　　In this article a bidirectional control refers to the second type of interpretation. Therefore, PRO allows a bidirectional control when it is referentially dependent on NPs, as illustrated in (32) through (35).

3.2. Clause Control and Directionality

　　So far we have discussed the directionality of an NP control. Now let us turn to that of a clause control. As mentioned in Section 2.2, a clause control of PRO is not allowed by anything but a result participial clause. Therefore, putting other nonfinite clauses aside, we will focus on a sentence where PRO is controlled by a clause. Let us consider the following:

(39)   a. A story often told by Senator Hillary Rodham Clinton
　　　　 describes an Ohio hospital as [refusing to treat a woman
　　　　 and her child]$_i$, PRO$_i$ resulting in their deaths. (= 25)
　　　b. *PRO$_i$ Resulting in their deaths, a story often told by Senator
　　　　 Hillary Rodham Clinton describes an Ohio hospital as
　　　　 [refusing to treat a woman and her child]$_i$.

Unlike nonfinite clauses expressing purpose or condition, the result clause introduced by the *-ing* participle does not allow the initial position. It must always follow the controlling clause. It shows that

PRO allows only a unidirectional control, more specifically left-to-right control, when it is referentially dependent on a clause.

A question arises why a result participial clause must come after its controlling clause. Quirk et al (1985:1108-1109) mentions a little about the position of a result clause without detailed account, writing that finite clauses of result are introduced by the subordinators *so that, such that, and so*, and *so*, and that they can only appear sentence-finally. Let us consider the following:

(40) a. We paid him immediately, so that he left contented. (Quirk 1985:1108)
b. We paid him immediately, so he left contented.
c. We paid him immediately, and so he left contented.
(41) a. *So that he left contented, we paid him immediately.
b. *So he left contented, we paid him immediately.
c. *And so he left contented, we paid him immediately.

The examples in (40) and (41) show that the initial position of the finite clause of result makes them ungrammatical. They can be expressed by reversing the matrix and subordinate clauses and by using a subordinator such as *because*. Let us consider the following:

(42) a. He left contented because we paid him immediately.
b. *It$_i$ results in their deaths because a story often told by Senator Hillary Rodham Clinton describes an Ohio hospital as [refusing to treat a woman and her child]$_i$.
c. Refusing to treat a woman and her child results in their deaths because a story often told by Senator Hillary Rodham Clinton describes an Ohio hospital as such.

The sentence in (42a) is grammatical although the relation of its subordination has changed. Sentence (42b), in which the subject *it* refers to the *-ing* clause *refusing to treat a woman and her child*, is obtained by reversing the matrix and subordinate clause in sentence

(39b) and regarded as ungrammatical. It may lead us to a hasty conclusion that, unlike finite clauses of result, their nonfinite counterparts do not seem to allow the change of the relation of subordination. I claim that the ungrammaticality of (42b) is not due to the finiteness of result clauses but to the pronoun *it* which is understood as referring to the clause *refusing to treat a woman and her child*. It can be evidenced by the grammaticality of sentence (42c), in which the proform *such* follows its antecedent clause contrary to (42b). Moreover, it can be strengthened by Ross (1967) and Lakoff (1970). They state that a right-to-left pronominalization is impossible but possible in certain situations like the following:

(43) a. Although Sid asserted [that Max left], I didn't believe it.
    (Lakoff 1970:147)
  b. Although Sid asserted it, I didn't believe [that Max left].
  c. I didn't believe [that Max left], although Sid asserted it.
  d. *I didn't believe it, although Sid asserted [that Max left].

As seen from sentences (43a) and (43b), both left-to-right and right-to-left pronominalization is possible when the subordinate clause precedes the matrix. The examples in (43c) and (43d) show that right-to-left pronominalization is possible but its left-to-right counterpart is not possible when the matrix clause precedes the subordinate clause. The ungrammaticality of (43d) contributes to accounting for the ungrammaticality of (42b). With respect to the position, therefore, a result nonfinite clause also acts in the same way as its finite counterpart.

  On the basis of our discussion so far, we can give an answer to the above question, why a result participial clause must come after its controlling clause. It is a structural constraint. Like a result finite clause, its nonfinite counterpart should be preceded by its clause controller when PRO is referentially dependent on a clause. Therefore, PRO of a result participial clause allows only a unidirectional left-to-right control.

4. Conclusion

We have so far discussed referential dependability between PRO and its controller on the basis of types of arguments and nonfinite clauses. We could schematize it like the following:

Type of Argument	Infinitive				Gerund			Participle
	Sub	Comp	Obj	Adv	Sub	Comp	Obj	Adv
Arbitrary	O	O	O	O	O	O	O	O
NP	O	O	O	O	O	O	O	O
Clause	X	X	X	X	X	X	X	O

(sub: subject, obj: object, comp: complement, adv: adverbial)

As shown in the above table, the occurrence of a clause as a controller of PRO is restricted only to participial clauses, more specifically, result participial ones. It is owing to the semantic property of verbs and the syntactic property between clauses that PRO is restrictively controlled by a clause for its interpretation.

We have discussed the difference between NP controllers and clause controllers concerning their positions. The former controllers usually come before or after nonfinite clauses, although it is not always possible. They allow a bidirectional control, a left-to-right control and a right-to-left control, specifically, when the sentence allows an extraposition or a change of the positions of the nonfinite clause and its controlling clause. However, the clause controllers must precede their controlled clauses because of a structural constraint. They allow only a unidirectional left-to-right control.

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Jeong, In-Sik
Department of English
Seoul Digital University
634-10, Shinsa-dong, Gangnam-gu
Seoul 135-895, Rep. of Korea
Phone: 82-2-2128-3017
e-mail: isjeong@sdu.ac.kr; isjeong@gmail.com